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Applying behavioural insights to
property flood resilience

FRS17191

Flood and Coastal Erosion Risk Management Research and Development Programme

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Professor Doug Wilson
Director, Research, Analysis and Evaluation

Executive summary

Property Flood Resilience (PFR) measures have been shown to provide a cost-effective route for many households and businesses looking to reduce both the risk of flooding occurring and the damage that ensues when water does enter a property. The uptake of these measures, however, is still low among individuals and businesses.

This two-part report summarises findings from the behavioural sciences exploring how behavioural insights can be applied to the field of PFR. It reviews the current state of knowledge and summarises evidence from both flooding and hazards literature.

Part 1 – Evidence on flood preparedness behaviours (steps 1 to 6)

The review of existing evidence follows the following six steps in a customer's journey:

Step one: I know flooding might impact me

The first step towards installing PFR is having an awareness of the level of risk you face. Research shows that people can:

- Struggle with probabilistic risk information
- Draw on emotional cues as a substitute for scientific assessments of risk
- Respond to floods differently – affected by past experiences, depictions of floods in the media and narratives specific to their culture/community
- Underestimate the scale of an event when they are not feeling fearful or distressed about it
- Mistrust individuals/institutions communicating risk information and this affects how effectively the messages are received
- Show a tendency to adopt the beliefs/attitudes/actions of their peers, hence social networks can be an effective routes for sharing messages

Step two: I feel able to take action, and feel responsible for taking an action

People's ability to take action will be influenced by many factors such as:

- Extent to which they feel able or not able to something which can lead to action or disengagement
- Extent to which they feel it is their responsibility to act
- Whether they consider it too difficult or costly to take action
- Their past experience of flooding
- Whether they see others taking action (this can encourage action)
- Seeing bad news stories about failed resilience measures can decrease likelihood of action

Step three: I am able to assess and access available options

Once a person knows they are at risk and they feel they can and should act they then need to assess the pros and cons of different options which are often complex. This could be made easier by:

- Having approved PFR surveyors
- Reducing the number of options
- Standardising the presentation of the pros/cons and costs/benefits
- Putting in place default mechanisms such (e.g. industry standards, building regulations, and resilient reinstatement for insurance claimants)
- Providing decision aids such comparison tools and websites, decision trees, Kitemarks or categorical labels (such as traffic lights and letter grades)

Step four: I adopt resilience measures

Once a person has identified the best option(s) for them, the next stage is to adopt the measure(s). The following barriers can affect uptake of PFR:

- A low income can act as a barrier to installing PFR measures
- The need to commit upfront expenses for a long-term and uncertain benefit
- The risk that measures could affect the sale of a property or reduce its value
- Small points of hassle or inconvenience in the adoption process can reduce the likelihood or pace of adopting PFR

There are ways to address these barriers such as:

- Encouraging people to install PFR after a flood, or prior to renovation or sale
- Making the process of applying for financial support accessible and straightforward
- Providing long-term, low-interest loans combined with risk-based insurance premiums
- Providing flood protection certificates for properties with PFR

Step five: I regularly check whether I am sufficiently protected

After PFR measures have been installed, they may not be needed to be used for a number of years. To ensure they work when needed they need testing, maintenance and in some cases replacement/repair. Maintenance of PFR could be prompted by:

- Deadlines or reminders
- Independent annual testing and inspections (similar to an MOT)
- Signing up to annual maintenance checks
- Tying maintenance check to other actions (e.g. clearing drainage points)

Step six: I take action in critical moments

The final step is the actions needed during a flood so that people are ready to use their PFR measures correctly in response to advice from authorities or their flood plans. However, people's actions are rarely optimal during a flood due to time pressures, stress, anxiety and uncertainty. This can mean that:

- Typically the first response to a disaster warnings tends to be denial, no one wants the danger to be real, so initially there is no incentive to react
- Following an initial phase of denial, people tend to seek confirmation of a threat before taking any action often looking to peer to know how to act so as not to be seen to be acting in a way that is rash or disproportionate

Helping people receive, understand and trust flood warnings is vital in helping them take action. The following are examples of how this can be achieved:

- Credible messengers within communities can help improve trust in public messages, also seeing others act can be a prompt to act ourselves
- Personalising communications can help people understand risks, this should include providing clear instructions with actionable steps
- Pre-prepared flood plan are important, they give a clear set of instructions to follow at a time when people may be finding it hard to think clearly.

Part 2 – Evidence gaps and future research needed

In the second part of this report identifies gaps in the evidence and outlines possible research strategies for filling them to encourage uptake and effective use of PFR measures.

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1 Introduction

1.1 Introducing property flood resilience

Flooding is the most common natural source of damage to properties in the UK (Bonfield 2016), and the individual, social and economic costs associated with it are significant (Bonfield 2016). Led by action from the Environment Agency (and the respective agencies in Northern Ireland, Scotland and Wales) and flood risk management authorities (RMAs), national and local governments have taken a range of actions to reduce both the risk of properties flooding and the scale of the potential damage when flooding does occur. However, national and local schemes can never completely remove the risk of flooding and, as the climate and natural environment change, many more properties are likely to become at risk.

This means that, over time, more emphasis has been placed on the role that households and businesses themselves could play in taking action to mitigate the impacts of flooding. This includes taking up insurance that covers flooding, and protecting properties through property flood resilience (PFR) measures. While the provision and uptake of appropriate insurance is important, this report focuses on the potential role of PFR.

This appetite to consider the role of PFR is unsurprising; a number of reviews of previous flood events (Pitt 2008) and other research show that PFR measures can be effective at reducing risk and damage, and show that packages of PFR measures could provide cost-effective protection for a wide range of residential and commercial properties across the UK (Lamond et al. 2018, Oakley 2018). Box 1 summarises the two types of PFR options available. For a more comprehensive review see Dhonau et al. 2018 and Lamond et al. 2018.

Box 1. Property flood resilience

There are two basic types of property flood resilience:

- **Resistance measures** – Which aim to stop water getting into a property. Examples include water-resistant doors, windows and walls, built-in pumps, flood gates, and covers for vents and air bricks
- **Resilience measures** – Which aim to reduce the damage caused once flood water has entered a property. Examples include wall, flooring and kitchen and bathroom fittings that are water-compatible, raised electric sockets and meters, plinths for raising white goods, and removable internal doors

Overall, the evidence also shows that, despite high costs sometimes, PFR measures are cost-effective. For example, a comparison of the damage caused by two similar floods in Cologne found that, thanks to property-level flood protection measures, costs dropped from €65 billion in 1993 to €30 billion in 1995 (Fink et al. 1996). A report on the flood recovery schemes in England found that for every £1 spent on property-level protection measures, about £5 could be saved in future flood damage costs (Merret 2012). A recent evidence review concluded that studies “...generally agree that the benefits of installing appropriate measures can outweigh the costs for a subset of properties at risk of regular flooding” (Lamond et al. 2018).

1.2 Uptake of property flood resilience

Despite the benefits of PFR measures, and grant schemes that subsidise their installation, uptake in the UK remains low (Harries 2008 and 2009). While there is no systematic collection of data on the uptake of PFR measures, there is a range of survey evidence to demonstrate it. A survey among at-risk people in England in 2013, for example, found that 21% of respondents had bought flood protection equipment (Langley and Silman 2014). Another suggested that around 27% of households and businesses that had previously experienced flooding had taken up protection measures, while for those without previous experience, the figure was only 6% (Thurston et al. 2008). Another estimate from 2008 found that, overall, only 16% of households and 32% of small businesses in areas at significant risk of flooding had taken any practical steps to reduce their exposure to risk (Thurston et al. 2008). Evidence from other countries suggests there is a similar situation elsewhere in the world (Bubeck et al. 2012, Lamond and Proverbs 2009).

Interventions to improve uptake have often been based, at least implicitly, on the protection motivation theory (Bubeck et al. 2012). A simple reading of this theory suggests that, to take action, people need to understand the risk and costs of flooding and to believe that they are able, and can afford, to act to protect their properties (Fisher 2015, Joseph et al. 2015a, Joseph et al. 2015b, Harries 2001 and Harries 2012). While some small positive impacts have been seen, approaches based on this understanding – including to communicate flood risks and provide grants – have failed to produce transformational results in the extent to which they encourage the uptake of PFR measures (Lamond et al. 2017, Fisher, 2015). A recent report from Defra summarised that: "...despite efforts by multiple agencies, the tendency of households or small businesses at risk to adopt measures to protect their property from flooding is generally low" (Lamond et al. 2017).

Box 2. Insurance to mitigate flooding impacts

The role that insurance can play in mitigating the financial impact of flooding is clear. Over the last 10 years, an average of 19,000 UK households per year have made flood-related insurance claims (Oakley 2018), and the 2007 floods led to 43,000 flood-related domestic insurance claims (Flood Re 2018). For domestic properties, flood cover is typically included as part of the standard terms of the household insurance, and this has helped to improve the affordability and availability of insurance (and, in turn, uptake). Individuals who own their residence with a mortgage are also typically required to buy household insurance as part of the terms of their mortgage, which means that uptake among a large part of the domestic market is already very high. Affordability and availability of household insurance for properties at high flood risk have also been increased by the recent introduction of Flood Re, which provides a re-insurance facility to the insurance sector. This enables it to reduce the premiums charged to households with a high flood risk.

With this already high uptake of insurance in mind, this report focuses on understanding the barriers and routes to increasing the uptake of PFR.

Yet it is also clear that insurance uptake is not universally high. The uptake of contents insurance among the social and private rent sectors, and lower-income households, for example, is relatively low. Research also suggests significant under-insurance in small businesses (Harries et al. 2018).

Increasing the uptake of property insurance that includes flood cover, for both renters and businesses, is still a desirable route through which flood resilience can be boosted. For these groups, the research and the consumer journey presented in this report could also be used to understand their decisions over whether to buy insurance.

1.3 Behavioural science and property flood resilience

By putting the focus on PFR measures, the burden of implementation lies more with individuals. The challenge is then ultimately one of a behavioural issue, with policies and campaigns needing to be designed with a sophisticated and realistic understanding of human behaviour. This is the motivation behind the Environment Agency commissioning work to understand more about the behavioural science of what motivates people living and working in areas of medium to high flood risk to adapt their properties to make them more resilient.

The discipline of behavioural economics has emerged rapidly over the last couple of decades. Alongside the established fields of cognitive and social psychology, it gives a wealth of insight into what factors drive our behaviour and shape our decision making. These academic disciplines explore the forces, both internal (psychological) and external (contextual), that shape our perceptions, decisions and behaviour.

A number of broad conclusions emerge. Principally, these fields of study reveal the importance of non-conscious as well as conscious factors in our decision making. The former include the profound influences of emotions, intuition, heuristics (mental shortcuts or rules of thumb) and cognitive biases (predictable deviations from pure economic 'rationality' in our decisions). This body of work also highlights several psychological barriers to taking action. These include procrastination and hassle, a tendency to discount uncertain events in the future relative to the upfront costs of taking action, a tendency to deny and avoid discomforting information about risk, and low self-efficacy (that we can do something worthwhile) or low responsibility (that we should be expected to). This research also sheds light on how we are influenced by our environment. This includes our social environment – we adopt the norms of our peers and form beliefs in line with our cultures and social identities. It also includes our physical environment, as we tend to go with what is easy, available and salient.

These insights, and behavioural research drawn from a variety of contexts, can be used to gain a much deeper understanding of decisions by households and businesses on whether to take up PFR measures. For example, research on financial decision making can tell us a lot about the financial risk and trade-offs people look at when considering flood resilience investments; and research on the uptake of energy-efficiency retrofits can tell us a lot about the importance of hassle, uncertainty, procrastination and other biases in making home improvements that have upfront costs and uncertain future benefits.

To some extent, recent research has already begun to take account of these issues. The impacts of social norms and emotions, for example, have begun to be seen in research of households' understanding of risk, and their readiness to install PFR measures. However, research has tended to focus on the individual aspects of a decision-making journey, and particularly on the extent to which people understand risk. This understanding of risk is but one step in a customer journey towards taking action (indeed, there is good reason to critique whether a true understanding of risk is even needed). Research has also focused almost exclusively on household decision making, rather than also considering the actions of businesses.

There is thus a significant gap in the current knowledge of how insights from behavioural science can be applied to household decisions and actions against flood risk. The same is also true for business decisions, where the context is clearly different, although it is likely that the underlying behavioural, emotional and psychological factors are similar.

1.4 Purpose of this report

This report, and the research that has underpinned it, attempts to characterise, and begin to fill, that knowledge gap. The first step is to review the state of knowledge and then to identify what we do not yet know. While behavioural science is increasingly being applied to other contexts – in particular, public health, consumer decision making and international development – there has been limited work in applying these ideas to flood resilience behaviours. There is still much evidence we can learn from though.

The Behavioural Insights Team and WPI Economics have been commissioned by the Environment Agency to address the following research questions:

- What does the existing literature say about the current approaches taken by a range of RMAs and non-governmental organisations (NGOs) in their attempts to support the uptake of PFR, in both households and businesses?
- Why might some conventional approaches be unsuccessful?
- What lessons might we learn from the wider literature on natural hazard preparedness – fire and earthquake resilience, for example?
- What lessons might we learn from foundational literature in behavioural science, and research from more distant but related fields, such as financial decision making, and pro-environmental behaviours?
- What are the gaps in this evidence base with respect to flood resilience behaviours? This is important because (a) our current understanding of barriers and motivators for adoption is incomplete, and (b) while evidence from other contexts may provide a rich stock of ideas yet to be fully exploited in the PFR context, behavioural responses are context-dependent, meaning well-evidenced interventions from other contexts will need to be tested in a flood resilience context
- How might these gaps be filled through additional qualitative and quantitative research? This includes further exploratory research aiming to understand the barriers and drivers of PFR behaviours, as well as experimental research testing behavioural interventions in this context

This report sets the context, reviews the available evidence, identifies the gaps in our knowledge, and outlines a set of possible research activities to address the identified research gaps in the future.

This review aims to be informative, but is not a systematic or exhaustive review. We prioritise evidence that we judge to have particular relevance to the flooding context and that is likely to have been previously under-explored. Ultimately, our aim has been to produce a document that is useful in providing new ideas and in shaping the approach taken by RMAs, NGOs, trades, businesses and community groups.

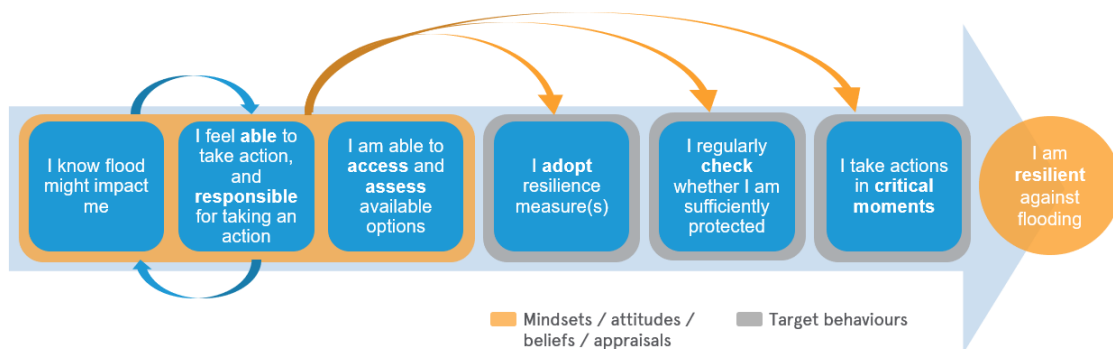
1.5 Structure of this report

This report has two Parts to it:

- **Part 1** – Cover the evidence on flood preparedness behaviours focussing on 6 steps on a customer journey:
 - **Chapter 2.** Step 1 – I know flooding might impact me
 - **Chapter 3.** Step 2 – I felt able to take action and feel responsible
 - **Chapter 4.** Step 3 – I am able to access and assess available options
 - **Chapter 5.** Step 4 – I adopt resilience measures

- **Chapter 6.** Step 5 – I regularly check whether I am sufficiently protected
- **Chapter 7.** Step 6 – I take action in critical moments
- **Chapter 8.** Part 1 Conclusions
- **Part 2** – Identifies the evidence gaps and potential future research needed for filling them:
 - **Chapter 9.** Identifying evidence gaps and developing a research programme
 - **Chapter 10.** Part 2 Conclusions and Next steps

In steps 1 to 6, we review the existing evidence on flood preparedness behaviours, each of these chapters covers one of the six steps in a simple theory of change (Oakley 2018) or customer journey, presented in the following diagram.



The diagram does not reflect the precise decision-making journey for all individuals or businesses, and nor does it intend to. Rather, it provides a simple framework within which we can capture the key issues. It approximates an intuitive, quasi-rational decision-making process that would lead someone from a position of ignorance towards a decision to adopt property flood resilience (PFR), regularly maintain it, and act appropriately during a flood. In particular, we wish to draw attention to a number of details and caveats to this model.

- The three behaviours (adoption, maintenance and taking action during a flood) are quite distinct outcomes or endpoints. This is reflected in the model, with the first three steps applying to each behaviour (albeit with differing detail)
- Much of the literature on behavioural science shows this linear model to be simplistic or incomplete. It is not strictly necessary, for example, that someone understands (or is even aware of) flood risk in order to take action – other influencing factors may shortcut this logical route (peer influence and social norms, for instance, can cause us to act in the absence of personal awareness or knowledge)

The order of these steps is open to some debate, and they interact with each other. For instance, we have implied that a basic acknowledgement of flood risk is a precursor to feeling able to take action, and to feeling responsible for doing so (that is, without any acknowledgement of flood risk, feelings of self-efficacy or responsibility are meaningless). It is also true that without any acknowledgement or responsibility, or with a complete lack of empowerment or self-efficacy, we are psychologically motivated to ignore or deny the risk. As such, the first two steps are highly interactive. Likewise, a feeling of being able

to take action and mitigate the risk depends to some extent on an awareness of the available options (thus interacting with step three)

- The process of assessing options and making a decision is most relevant where people are expected to make a proactive choice to adopt PFR. It is equally possible that PFR will be adopted by default (for example, if legislated through building regulations or provided as standard during reinstatement after flooding), or that the decision might largely be outsourced to an expert. In other words, there are different ways of progressing through these steps, with the psychological processes within each being more or less relevant depending on the mechanisms and processes created by the PFR industry

With these caveats stated, we believe the model still provides a useful and coarsely correct theory of change that allows us to (a) examine the behavioural factors at play within each step, and (b) develop clear and testable hypotheses for what might nudge individuals and businesses towards becoming flood resilient. This customer journey therefore serves as a roadmap for the reader as we progress through the following chapters. In each case, we review the evidence from three key areas of research:

- literature specific to flood resilience
- literature concerning other hazards such as fires and earthquakes
- research from the wider behavioural sciences that is considered relevant, including cognitive and social psychology and behavioural economics

The focus of this research is the flood resilience of both households and small businesses. From the start of this research, however, it has been apparent that the existing literature on businesses' responses to hazards is relatively poorly developed (and so is an important area for future research). That said, from a behavioural perspective, the factors that influence people's behaviours are to a large extent the same for households and small businesses, given the common landscape of cognitive and behavioural factors. This means that, in the following chapters, we generalise findings to apply to both households and small businesses. There are a few aspects specific to a business context, and we highlight them as such.

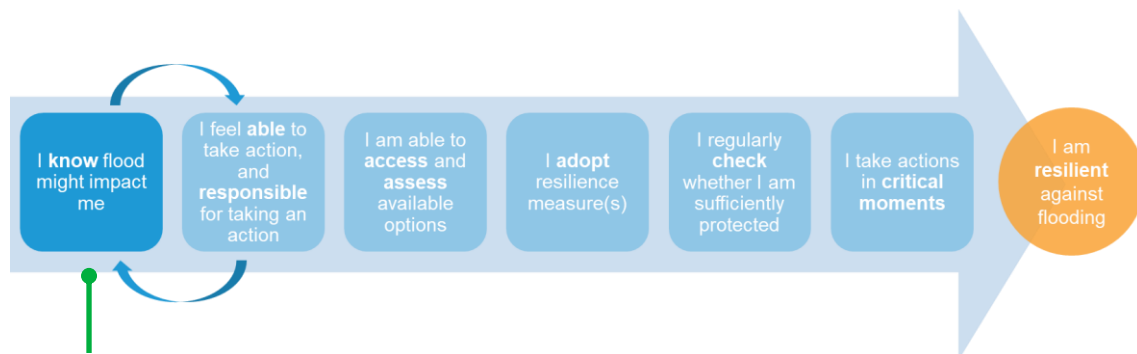
Each of these 6 steps are now described in detail in the following chapters. At the start of each chapter we set out what the flood hazard literature and behavioural science literature says about each step.

Part 1 – Evidence on flood preparedness behaviours



**Property flood resilience measures in operation Worcester during 2012 Floods
(Source: Environment Agency)**

2 Step one – I know flooding might impact me



The flood and hazards literature says

- Awareness of personal flood risk is low, and 67% have never checked their risk level
- Acknowledgement that the local area is at risk is higher (45%) than acknowledgement of one's own property being at risk (7%)
- Protection motivation theory, dominant in the hazard literature, suggests we rationally appraise the likelihood of a risk and the severity of an outcome
- More recent research on cognitive biases shows our perception of probability is skewed, leading to localised optimism (believing we are less at risk than other people)
- Recent research also demonstrates that it is incredibly difficult to communicate risk effectively and, even where this is done effectively, it could be counterproductive
- In this respect, research has shown that understanding emotions is key – for example, a better knowledge of flood risk can lead to a feeling of dread, which, in turn, could lead to increased risk perception. Emotions may, however, also lead to people ignoring the issue completely
- Overall, this suggests that attempting to educate people about their level of quantifiable risk is unlikely to be the most effective strategy for influencing their awareness and perception of flood risk

The wider behavioural science says

- The importance of the availability heuristic in risk perception is validated by the wider behavioural science literature. The heuristic is in turn influenced by the salience of information, and the level of exposure to information. That is, we perceive risks as greater the more we are exposed to information about them, and the more salient and memorable that information is – since both of these factors increase the ease of recall, or cognitive availability
- Similarly, the importance of emotion (or the affect heuristic) in risk perception is validated by wider behavioural science. Fear is not the only important emotion though – disgust for example (as used on cigarette packet warnings) also plays a role
- However, negative emotions and fear can also have the opposite effect, leading to the avoidance of information and the denial of risk, particularly if we feel there is little we can do about the risk
- The current state of arousal (raised versus relaxed emotional state) influences the immediate perception of risk

- We also use social cues to perceive risk. For example, if neighbours or peers appear to take a risk seriously, so will we. Similarly, the identity of the person or organisation conveying the risk is important – are they credible, trustworthy and relevant or knowledgeable about our situation?

2.1 Introduction

Conventional wisdom suggests the first step towards installing PFR is an awareness of the level of risk that one faces. This makes intuitive sense: if people do not feel at risk of flooding then there is little need for them to consider any action either to prevent it or to mitigate the potential impacts. This perspective is most commonly formalised in protection motivation theory (PMT), which is often used to explain individuals' propensity to protect themselves against hazards (Rogers 1975 and 1983).

The first stage of PMT is a threat appraisal, where individuals evaluate both the probability that their home or business will be flooded in the near future (perceived vulnerability) and the potential consequences (costs) of a flood (perceived severity) (Bubeck et al. 2012). For action to be taken, both the perceived vulnerability and the perceived severity must be relatively high.

Under this approach, the failure of individuals to protect their own properties can, at least in part, be attributed to people not understanding either the risk itself or the potential consequences (Kellens 2011). With this in mind, there are two clear questions: firstly, to what extent do people appreciate the risk they face from flooding or other hazards and the impacts these events may cause; and, secondly, what does this say about how information on flood risk and impact could be used to improve the uptake of PFR?

On the first of these questions, evidence from the UK demonstrates a poor awareness of flood risk. For example:

- a survey of people at risk of flooding found over half (54%) did not believe they were at risk of flooding (Langley and Silman 2014)
- among those who had been flooded in the past 12 months, 29% said they did not believe they were at risk of flooding prior to the event (Langley and Silman 2014).
- a survey of households in the UK by the 'Know Your Flood Risk' campaign found that 67% had never checked the flood risk level of their home. Only 20% of respondents had checked the flood risk of their home before they moved into it, and only 11% checked once they had moved (Know Your Flood Risk 2015)
- research by the Environment Agency has found that even people at risk tend to underestimate it, with only 45% feeling that their local area was at risk, and only 7% feeling that their own property was at risk (Know Your Flood Risk 2015)
- such findings have been replicated in other countries, and across other hazards (Renn, 2008)

Given these findings, and the importance given by PMT to the role played by the understanding of flood risk, it is no surprise that there is significant research into how to best communicate flood (and, more generally, hazard) risk information. Helping people to understand probabilistic information has proven challenging. Yet as this research has progressed, it has become clear that a poor understanding of probabilistic risk is

not the main influence on people's calculations of risk (Sjöberg 2000). Indeed, while cognitive biases in probability judgement are important, and included in our discussion below, recent research demonstrates that the very idea of the calculation of risk is misleading. People do not evaluate risk through a judgement of the likelihood and potential impact of a hazard. Instead, the social sciences stress that risk perception is multifaceted and complex, involving not just information processing but beliefs and emotions (Slovic et al. 1987). Because of this, attempting to educate people about their level of quantifiable risk is unlikely to be the most effective strategy for influencing their awareness and perception of flood risk (HM Government 2016). This chapter provides detail to underpin that conclusion, drawing from research on hazard perception in general, specific studies of flood risk perceptions, and evidence from wider behavioural sciences.

2.2 Biases in probability judgements

One strand of research focuses on the way that people understand probabilities and the information presented to them about hazard risk. It explores the ways in which our evaluation of riskiness deviates from a purely probabilistic or rational statistical view. A consistent finding of this literature relates to our tendency to see ourselves as being less at risk than others. For example, a representative study of the Swedish population found that people perceived risks as higher in general than for themselves personally, while the risks for family members were evaluated as higher than for personal risk, but lower than general risk. This finding was true across all hazards and has been labelled risk denial (Sjöberg 2000). Risk denial reflects our tendency to shut out uncomfortable truths and to distort reality to serve our own mental wellbeing. In this context, risk denial contributes to the phenomenon of optimism bias: the tendency for people to think that they are more likely to experience positive events and are less at risk of experiencing negative events than most other people.

This bias is evidenced in the flooding context. For example, the Environment Agency has reported that even in areas where nearly half the population are aware of local flood risks, only 7% feel their own property is at risk (Environment, Food and Rural Affairs Committee – EFRA – 2016). Research suggests that the level of risk denial (the difference between perceived general risk and perceived personal risk) is strongly correlated with the degree of control people feel they have over the hazard – in other words, the degree they believe they can protect themselves from it (Sjöberg 2000). This evidences a strong interaction between risk perception and the second step in our customer journey, perceived self-efficacy. Evidence shows that the more control people feel they have in relation to a risk, the lower they perceive that risk to be. (Our fear of driving, for instance, is typically lower than our fear of flying – falsely so, according to the death statistics – partly because we are in control of the car, but not the plane.) The less we feel we are able to address a risk, the stronger the psychological motivation to deny that risk (since worrying about something we can do nothing to avoid brings only psychological cost). These psychological processes operate in the same direction – a strong sense of control may diminish our risk perception, and a complete lack of control may lead us towards denial and therefore also may diminish our risk awareness. There is little evidence accounting for which circumstances would drive one process or the other.

A second focus of the literature on cognitive biases regarding risk perception relates to the salience of different presentations, or framings of risk. For example, some evidence suggests that people judge risks as higher when these are presented as a frequency of impact (1 in 1,000 for example) rather than as a probability (0.001 for example) (Siegrist 1997). However, evidence from the UK suggests that frequency is still not readily understood. For example, a recent report by EFRA concluded that “Current methods of describing flood risk using the ‘one in x year’ event formulation are

confusing. It is hard to interpret from this information the risk of flooding for any particular home or community at any particular time: individuals may not therefore appreciate that they need to take steps to reduce their own risk” (EFRA 2016).

A lack of understanding of flood risk probabilities was also highlighted in qualitative research with at-risk groups by the Environment Agency. One participant in the research stated, for example, that they found the description of ‘one in 100 years’ to be misleading. They explained “...we haven’t had anything for years, then we had three years on the trot”. Some participants also questioned whether flood information should be framed in terms of probabilities at all, and stated that flooding should rather be treated as a ‘when, not if’ question – and focus on what people should do about it (Fisher 2015). Another recent report concluded that there was no perfect solution to flood risk presentation, but a consensus among those giving evidence to the committee was a preference for a simpler approach to risk levels, such as a traffic light system, which communicates the fact that there is a level of risk, without specifying precisely what that risk is (EFRA 2016).

Other studies have looked at how people’s judgements of risk are affected by the inclusion of a time frame. For example, risk perception was found to increase when information about a potentially fatal hazard was presented as affecting ‘one resident in x years’ instead of a ‘1 in x chance’ of affecting an individual (Weinstein et al. 1996). Moreover, research has shown that stretching the time horizon over which risk is calculated, and presenting cumulative probabilities can improve perceptions of the risk. Presenting the risk of a serious car accident as 0.33 over 50 years, for example, rather than 0.00001 per trip makes people more willing to wear a seatbelt (Slovic and Lichtenstein 1977). Properties in the US considered at high risk of flooding are those within regions that have a one in 100 years risk of flooding. This translates as a flood risk of 1% annually, or around 26% over 30 years. Experimental research has shown that significantly more people are willing to buy flood insurance if the risk is presented in the latter format (Chaudhry et al. 2017). The Federal Emergency Management Agency, the US agency responsible for flood warnings, has started to communicate flood risk in this manner (Kunreuther 2017).

Box 3. Are cognitive biases and heuristics irrational?

Research by behavioural economists on judgement and decision making has been described in terms of rational versus irrational behaviour. This comes from the fact that the point of reference for this research has often been a notion of economic rationality. This is a formal model of human behaviour that, in simple terms, means we make judgements by weighing the pros and cons, and choose the option that is most likely to maximise our benefits. Deviations from this model have been described as cognitive biases. Critics have suggested this framing is derogatory, however, by implying that decisions that are not strictly economically rational are inferior or suboptimal. In some cases, this may be true – we do often make decisions that, even on our own terms, are not in our best interests and are not logical. It is also clear, though, that we make decisions that are driven by many factors not captured by the narrow economic model, and labelling these as irrational or suboptimal is unhelpful.

Here we describe cognitive biases using the conventional language from this field of study. We stress that the majority of our cognitive biases and heuristics are evolved traits that have arisen for good reason. These mental shortcuts help us to make good decisions most of the time with minimal thought or effort: this is why they have persisted in the evolution of the human mind. However, they do sometimes trip us up, either as a consequence of prioritising efficiency and disaster-avoidance over accuracy or optimization of decision making, or because the setting in which the shortcuts evolved is no longer applicable to the world we live in today. Regardless of whether these patterns of decision making and behaviour are rational or irrational, the evidence shows that they do exist and that they reliably veer our actions towards certain predictable outcomes. We predictably veer towards the familiar and the status quo (Kahneman et al. 1991); we feel losses more severely than equivalent gains (Kahneman et al. 1991); we are highly

averse to risks (Kahneman and Tversky 1979); we often blindly follow the crowd and adopt the norms of our peers (Cialdini and Goldstein 2004); and we instinctively adopt a wide range of simple mental shortcuts like 'choose the middle option' or 'rule out the options I've not heard of' (Gigerenzer and Gaissmaier 2011). We must take these findings into account when designing flood resilience policies/services that aim to encourage certain choices.

A clear conclusion from the previous section is that human brains are not naturally geared towards probabilistic thinking. While much research has sought to find better framings for explaining probabilistic risk to overcome our apparent mathematical shortcomings, there is good evidence from related research to suggest this is the wrong approach. Contrary to a probabilistic model, the relationship between the expected damage (fatalities or financial losses for example) and risk perception is often relatively weak (Rohrmann and Renn 2000 and Slovic 1987). In explaining this, studies across multiple hazard types have found that emotions often play a stronger role in determining risk perceptions than an understanding of probability.

In many respects, this is unsurprising; having evolved to be highly efficient decision makers, we draw on many cognitive shortcuts, or heuristics, to form judgements in place of more onerous logical calculation. One ubiquitous mental shortcut is the affect heuristic: instinctively, our emotions are substitutes for deliberation (Slovic et al. 2007). This has been shown to lead to people ascribing large benefits and low risks to things they feel favourable towards, and low benefits and high risks to things they feel negative about (Slovic et al. 2004). Strength of emotion has also been shown to impact on probability judgements, with people tending to overestimate the likelihood of threats that inspire strong negative emotions, and to underestimate the likelihood of events that do not (Rottenstreich and Hsee 2001).

Specific research into hazards and risk has shown that hazards with potentially catastrophic consequences – that is, those with very high potential losses or fatalities – are perceived as more threatening than hazards that are more likely to occur but that have only medium consequences (Renn 2008). This is a deeply ingrained aspect of our decision making in all kinds of situation, and is perfectly sensible from an evolutionary perspective: we can cope with small-impact negative events, but absolute disasters are often life-ending. We therefore prioritise the mitigation of the latter, even if probabilistically they are less severe. This is a good example of how a so-called cognitive bias, or irrationality, can be labelled as such only when benchmarked against strict economic rationality, rather than the realities of life.

More generally, this skews our perception of risk towards giving more concern to events that inspire feelings of dread (Slovic 1987). Again, the comparison between fear of flying and fear of driving is a good example. The strength of emotional feeling associated with the horrific experience of a plane crash overrides common knowledge that many more people die in car accidents than in plane crashes (Renn 2008).

Evidence of flood risk perception appears to confirm these general findings, with numerous studies finding a link between fear of flooding and a perception of high risk. A study in Japan attempted to find variables that influenced how prepared residents of a previously flooded area were for a future flood. It found that there was no link between preparedness and anticipation (the perceived likelihood) of future floods, but that residents' levels of fear of floods determined how prepared they were (Takao et al. 2004). Research among Alpine communities at risk of flooding and landslides in Italy also found that feelings of worry were associated with risk preparedness, while there was no significant relationship between likelihood perception and preparedness (Miceli et al. 2008). A study in Poland found that fear of flooding was positively related to buying flood insurance, but that knowledge of flooding was not (Zaleskiewicz et al. 2002). Overall, psychometric studies of the properties of hazards suggest that if people

do not feel negative enough about the consequences of a flood, they are unlikely to perceive it as risky enough to take up resilience measures.

This evidence on emotion suggests that risk communication could be improved through appealing to emotional reactions to floods, perhaps focusing on the severity of impacts rather than the probability of occurrence. Indeed, there is evidence from the hazard literature that providing information about the severity of a hazard's consequences leads people to seek further information about that hazard (Drabek 1996). While the evidence is limited for flood communications, there is some research suggesting that the presentation of emotion-laden images of flood damage contributes to perceptions of higher risk among participants (Terpstra 2011, Keller et al. 2006, Siegrist and Gutscher 2006). A study in Sweden found that emotionally laden communications could have an effect on people who had previously not been directly impacted by flooding. Reminding Swedish people about the 2004 Boxing Day tsunami in south-east Asia resulted in more pessimistic perceptions of the future in terms of similar risks (Västfjäll et al. 2008).

Although fear arousal is advocated in the literature as a way of increasing risk perception (Witte 1992), such suggestions raise potentially challenging issues for risk communications. Most obviously there are ethical questions about the extent to which communications should aim to inspire fear within the target audience. There are also questions about effectiveness, as fear can be paralysing, causing denial, or motivated avoidance ('head in the sand' responses) (Renn 2008).

The research is clear that strong negative emotions are motivating towards action only if we feel we are actually empowered to do something. That is, there is a clear interaction between threat appraisal and coping appraisal, or self-efficacy (the latter is picked up later in the second step of our customer journey).

More specifically related to flooding, qualitative research in England has found that the desire to feel secure in the home (or business) can act as a deterrent to flood protection behaviour – people are reluctant to engage with information or actions that contradict their feeling of security (Harries 2008, 2012). Follow-up research has found that anticipated emotions are important and that instead of emphasising fear, messages that stress the positive emotional benefits of resilience measures could help to improve uptake (Harries 2012). This echoes recent research on climate change denial and action that suggests conventional messages rooted in negative emotions (particularly guilt about not acting, or fear of the consequences of climate change) can exacerbate inaction, while positive emotions (such as pride about acting, or the feeling that you can make a difference) can be more motivating (Schneider et al. 2017).

Box 4. The role of affect in avoiding risk information

The importance of affect in shaping our decisions is a common finding throughout the wider behavioural sciences (Finucane et al. 2000). It is a common approach (and an intuitively logical one) for information and advertising campaigns to harness negative emotions, for instance by using graphic images on cigarette packets or messages of guilt and fear in environmental campaigns (Witte and Allen 2000, Shelton and Rogers 1981). These campaigns may be successful based on at least one metric – campaigns based on fear or disgust are more likely to be shared on social media (Dobele et al. 2007). Negative elements from mass media can influence people's perceptions of the real world: heavy television viewers perceive the real world as more violent and dangerous than light television viewers (Ridout et al. 2008).

It is important, however, to ensure that emotions-based campaigns do not backfire by producing defensive or avoidance responses. Information avoidance has been found to be a common response to unpleasant truths in many contexts. For instance, one study found between 85% and 90% of people claimed they would not want to know about a variety of upcoming negative events (Golman et al. 2017). Other studies have shown that some cancer patients avoid

information about the state or prognosis of the disease to retain a hope of recovery, and some actively avoid medical tests that would diagnose a disease (Golman et al. 2017). The more threatening the information, the more we may try to avoid it (Ganguly and Tasoff 2017). This may seem counterintuitive, since ignorance inhibits our ability to do anything about the threat. However, if a threat (whether impending climate change, a terminal illness or financial strife) feels out of our control, we adopt these psychological defence mechanisms to avoid the negative psychological consequence of ineffectual anxiety and fear.

Successful solutions tend to fall into two categories. First, we can make the message less threatening. It would be wrong to state that fear-based or threatening language is always ineffective. But where it is demonstrably so, switching to a more positive, beneficial aspect of the issue may work. A recent trial found, for instance, that a more helpful framing of language in letters from banks threatening the risk of repossession increases the number of customers making contact by over 35% (The Behavioural Insights Team 2017a). Second, we can make it easier to take action and to resolve the threat, since it is the combination of negative emotion and powerlessness that tends to cause avoidance. This might involve removing practical or bureaucratic barriers, reducing costs, offering expert support onto which we can partially offload our anxiety, simplifying the actions to be taken or encouraging a small first step.

The avoidance of information is one specific case of a broader psychological phenomenon termed confirmation bias – we tend to seek out, interpret and remember information that confirms our prior assumptions and worldview, and that caters to our ego or our emotive needs. Similarly, we tend to ignore, discount or forget information that contradicts our existing beliefs or creates psychological discomfort (Lord et al. 1979). Confirmation bias is not just a characteristic of people with a strong agenda, but is common in us all. Our political views will influence our interpretation of the news, our like or dislike for an acquaintance will frame their actions in a positive or negative light, and we play down or conveniently put aside ethical issues (such as sweatshop labour when buying clothes, or animal welfare while eating meat). This pervasive tendency poses a significant barrier to authorities trying to engage the public on issues like flooding – if the public's starting point is that the risk is low and that the issue is not their problem. These are beliefs we are motivated to preserve, given the discomfort associated with accepting risk and the cost associated with accepting responsibility.

Research shows that a narrative that attempts to bridge the differences between an individual's existing beliefs and a new piece of evidence can increase the likelihood of acceptance (Graves 2015). We tend to think in narratives more than in facts of logic, and to judge incoming information on the extent to which it 'makes sense' and 'fits' with our existing story (Graves 2015). Telling someone that their property is at risk, when they have not had any issues in the past, does not fit well with their existing viewpoint. Instead, explaining that their property is now at greater risk than it was previously, because of a shifting climate or changes in the local environment, offers a bridge between the old beliefs and the new. In building this narrative, individual anecdotes and case studies (Stewart and Chambless 2010) – particularly from people 'like us' with whom we identify – are inherently story-driven, and harness the identifiable victim effect. Story-driven tactics have been found to be more compelling than statistical evidence alone.

2.3 Experience of past floods

The experience of past hazards has been shown to be a key determinant of risk perception in studies across a variety of countries, including in the UK, and different hazards, from bushfires to earthquakes (Bubeck et al. 2018, 2017, Wachinger et al. 2013, Kung and Chen 2012, Burningham et al. 2008, Gow et al. 2008, Viscusi and Zeckhauser 2006). Experience of flooding and risk perceptions have been shown to be linked in Canada (Thistlethwaite et al. 2018), Switzerland (Siegrist and Gutscher 2006) and the UK (Harries 2011). Indeed, a 2013 survey of people at risk of flooding in England found that over two-thirds (69%) of respondents who were victims of flooding in the last 12 months believed themselves to be at risk, compared with less than half (45%) of respondents overall (Langley and Silman 2014). Experience of flooding has also been found to be a factor in households taking up preventive measures. A study in Germany found experience of previous floods was a strong motivator for people to

install flood mitigation measures in their properties, while in Poland previous experience of flooding was linked to the uptake of insurance (Kreibich et al. 2005, Zaleskiewicz et al. 2002). Similar evidence has been found for households at risk of coastal flooding in Belgium, Germany and Japan (Osberghaus, 2017, 2015, Kellens et al. 2011, Zhai et al. 2006).

Not all of the evidence points in this direction with experience of flooding. Some points to people needing to experience a number of floods before accepting that they are at risk and taking action (Harries 2013). A rebound effect has also been found in some cases, in which previous experience leads to assessments of lower risk (Botzen et al. 2009a, 2009b, Peacock et al. 2005). A key variable that seems to explain these contradictory findings is the severity of the previous experience: if it is not severe, it may lead to communities becoming complacent to the risks of hazards (Cutter et al. 2008). A severe flood that causes significant damage is likely to lead to a perception of greater risk, yet if a flood is completely devastating, it could lead to a sense of helplessness and disengagement from flood risk and the motivation to take protective action (Wilson 1990). A study of residents in Japan found people's preparedness for flooding was not based simply on experience but on the extent of damage experienced in previous floods (Takao et al. 2004). Similar findings have been reported in Scotland and for small businesses (Harries et al. 2018, Owusu et al. 2015).

The tentative conclusion that the severity of previous experience is important leads to questions about what actually links previous experience to risk perception. Once again, the answer appears to be related to emotions and the complex ways in which positive and negative emotions motivate us to take action, but also motivate us towards denial or helplessness as a way of avoiding the psychological consequence of that emotion. It is often our previous experience that determines our emotional associations with flooding. Evidence from Switzerland, for example, suggests that people without flood experience significantly underestimate the negative emotional consequences of flood damage (Siegrist and Gutscher 2006). Experience of previous floods has been found to be a driver of worry about future floods, and the magnitude of losses in previous floods has an impact on the extent of that worry (Lechowska 2018). Given the role that emotions have been found to play in risk perception, it is likely that they represent a significant portion of the impact of experience. Indeed, one study concludes that "...previous experiences fuel the affective route with emotions" (Terpstra 2011).

Box 5. Hot-cold empathy gaps, and identifiable victims

When we are in a 'cold' emotional state, we often fail to understand the preferences and behaviours of people in aroused emotional states (including those of our future selves), and vice versa (Loewenstein 2005). In the context of flooding, this means that, day to day, when we are not particularly fearful or distressed about a flood event, we find it difficult to appreciate or appropriately weight the magnitude of the negative experience of flooding. Thus we do not give enough weight to the severity of the risk.

The literature in psychology has found a variety of effective methods for increasing empathy that might help people in cold states to understand the negative emotions that they, and others, would feel during and immediately after a flood. Relevant methods include experience-based interventions that offer people the opportunity to take another person's perspective; asking people to imagine themselves in another person's position; explicitly instructing people to consider how another person feels; and using audio and visual narratives to show another person's perspective (Weisz and Zaki 2017).

We also tend to empathise more with a relatable and identifiable individual than with statistical victims, referred to as the 'identifiable victim effect'. This is commonly used in the charity sector: research shows we are more likely to donate to a charity highlighting the plight of an individual rather than the statistics on poverty conditions (Small et al. 2007). Our level of empathy for people in floods, and therefore the gravity with which we consider flooding risks, could be increased by highlighting the impacts on identifiable victims (particularly those 'just like us'), rather than highlighting large-scale statistical impacts.

Our past experience shapes not just our emotional associations with flooding, but also our perception of flooding likelihood. Again, we are not good at probabilistic calculations. The affect heuristic (emotion) is one of our hard-wired mental shortcuts. Another is the availability heuristic: we crudely judge likelihood based on the ease of recalling examples (Keller et al. 2006). Risks that are commonly discussed or prevalent in popular culture and media (such as terrorist attacks) are perceived as more likely than those that are not discussed (such as death from falling from bed), simply because we have many more salient examples in our memory. In this sense, previous experience of flooding may serve as a reminder of the risk. Moreover, as the memory fades and becomes less salient, so does the perception of risk. Evidence suggests the feeling of being safe from flooding can re-emerge quickly, typically within two years (Wood et al. 2012). The 2013 survey of at-risk people in England, for example, found that those who had been flooded in the last 12 months were more likely to have taken preventive action against future floods than those who had experienced flooding more than a year previously (Langley and Silman 2014). Other research has also found that long periods without flooding reduce risk awareness among people who had nonetheless experienced flooding previously (Burn 1999). More frequent floods are likely to ensure that the perceived risk remains high (Wilson 1990).

It is not only our personal experience of past events that impacts the availability of memories or examples. More salient issues, or those with wider coverage in the media or popular culture, are also more readily recalled and therefore perceived as more common and likely. There is some evidence that news about flooding can increase perceptions of a hazard among people who lack direct experience of it, by providing a kind of indirect experience (Siegrist and Gutscher 2006). Media stories about recent flooding have been found to be effective in stimulating memories of previous flooding and therefore provoking perceptions of higher risk. Episodes of flooding could therefore be seen as a window of opportunity for raising awareness about their risks (Felgentreff 2003). However, other findings suggest that the media primarily affects risk perception via availability, and it is more effective at raising general risk perceptions rather than personal risk perceptions, which are not necessarily the same thing (Wahlberg and Sjoberg 2000). It has also been suggested that including in risk communications first-hand accounts of people who have experienced flooding can help to raise risk awareness (Keller et al. 2006).

Box 6. The availability heuristic

There is a variety of ways to increase the presentation of risks such as flooding, or to make it more salient to people. Mass media is one channel. For instance, people exposed to mass media advertising messages about AIDS were significantly more likely to consider themselves at higher risk of acquiring HIV and to believe in the severity of AIDS (Agha 2003). Likewise, in the 18 months following the September 11 attacks on the World Trade Center in 2001, there was a correlation between the number of terrorism stories in news broadcasts and the public's ranking of terrorism as America's most important problem (Ridout et al. 2008, Norris et al. 2003).

Governments can think beyond mass media to creatively increase people's exposure to the consequences of risks. For instance, researchers have suggested that parking officers use large, bright orange tickets that read VIOLATION on the driver's side window, where they are clearly visible to other drivers passing by (Jolls 2004). Graphic images on cigarette packets are also an example of making risks salient (Lupton 2014) – the use of disgust harnesses the affect heuristic, but also grabs our attention, and makes the message memorable. It is also possible, though, to be saturated by and overexposed to such messages – so the benefits must be weighed against our tendency to adapt and to become desensitised to risks. In the context of flooding, current risk perceptions are seemingly so poor that the risk of oversaturation with flood risk messaging is likely to be minor, but there are also ethical considerations to take into account before using these sorts of intervention.

2.4 Trust in flood risk information

The source of information on risk is also central to understanding individuals' perceptions of risk and the action they take. In particular, the level of trust in the individuals or institutions communicating the risk seems to make a difference to how effective the messages are (Heitz et al. 2009).

A number of recent reports in this area have suggested that social networks are one of the most effective routes through which risk information can be communicated, and that they are often more effective than official advice (Harvatt et al. 2011). Further, some evidence suggests that media stories are considered more important in raising awareness of flooding than other channels such as information campaigns (Wachinger et al. 2013).

Research in the UK from Defra found that most people cited the emergency services, friends, figures in the local community and voluntary organisations as the most trusted sources of information about flood risk. Local authorities and the Environment Agency elicited more mixed responses, due to concerns about previously inaccurate or poorly timed communications. Insurance companies were seen as particularly untrustworthy (Fisher 2015).

Overall, while the need for trust in the source of information seems obvious (Wachinger et al. 2013), the evidence over the most effective source of information is mixed and strongly reliant on local contexts and experiences.

Box 7. Messenger effects

We give different weight to information depending on who is communicating it. The most effective messenger is context- and audience-specific (Moser 2010), though the literature suggests a common theme of multiple dimensions to perceived credibility and trustworthiness (Pornpitakpan 2004). There are various types of messenger we might draw on, as follows.

Experts

A number of studies – particularly in the fields of health research and health education, but also more broadly – have shown that messages from perceived experts are powerful (Chauhan and Mason 2008, Heath and Heath 2007, Wilson and Sherrell 1993), particularly in situations of uncertainty (Petty and Briñol 2010), because when we have little first-hand information to go on, we are more likely to rely on others. It is important to recognise that expertise in the flooding context is not just about someone's credentials. Distant or aloof expertise can be unwelcome and viewed cynically. It is also about the credibility of the knowledge with respect to our own local area and situation. It is also important to note that experts are not the most trusted or most appropriate source with every audience or message (Moser 2010).

Familiar messengers

We often use familiarity as a rule of thumb for credibility or legitimacy. For example, amateur traders tend to favour the stocks of companies they have heard of, and we tend to favour brands that are familiar to us. As with most mental shortcuts, this has a certain logic to it: familiar brands are more likely to be established, legitimate and successful. All of these characteristics influence the credence we give to a particular messenger. Research from the Behavioural Insights Team has found that consumers are more likely to respond to energy supplier-branded letters than to Ofgem-branded letters alerting them to cheaper energy offers, partly due to the lack of brand recognition of the government regulator (Tyers 2017). Celebrity endorsements can also be effective on social media, both because of familiarity but also because their endorsement simply increases exposure to the message (and getting people to listen is the first necessary step). Studies have shown that Twitter users are more likely to retweet content promoting immunisation when it has been posted originally by a celebrity (Alatas et al. 2019).

Similar messengers

We trust information that comes from people like us, and are more likely to adopt the opinions, beliefs and behaviours of people we identify with (Dolan et al. 2010, Moser 2010). One study varied both the quality of a written argument and whether the messenger was from the reader's country or from another country. The quality of the argument affected the opinion of people who thought the message came from someone similar to them, but messages from the dissimilar person were rejected regardless of quality (Esposito et al. 2013). We similarly trust information that comes from our friends. Online messages about consumer products are viewed as more credible when they are posted by those we perceive to have a close social relationship with us (Pan and Chiou 2011). On social media, recommendations for news stories from friends improve levels of trust in the particular media outlet, and also make people want to follow more news from it in the future (Turcotte et al. 2015).

Multiple messengers

People give more consideration to a message when there is consensus around it and when it is presented consistently across different situations (Kelley 1967). People feel more persuaded when arguments are presented consistently by multiple messengers (Harkins and Petty 1981). The majority voice is often most influential, but not always. A coherent and consistent minority voice can also be compelling, particularly of course if that minority is one we identify with.

Converted communicators

Messengers who have previously been won over by the arguments they present are more effective at persuading others. Study participants rated anti-alcohol communications delivered by former alcoholics as more credible than the same communications delivered by lifelong teetotallers (Levine and Valle 1975). Similarly, community organisers who themselves owned solar panels recruited 63% more households to install them than those who did not themselves own solar panels (Kraft-Todd et al. 2018).

Government messengers

The government is often, though not always, perceived negatively, particularly in a business context, but also among many individuals. In qualitative research by The Behavioural Insights Team on research and development investment among small and medium-sized enterprises, the government's credibility as a messenger for information on innovation was undermined by a lack of trust among some businesses. Businesses instead valued such advice from experienced individuals (The Behavioural Insights Team 2018a). This problem may apply to advice from government broadly, including advice about flood mitigation measures. That said, while the perceived credibility of expertise may be low, trust in the government may be higher compared with commercial organisations with potential profit motives.

2.5 Trust in flood management institutions

There may be a detrimental side to good levels of trust. Trust has been shown to be a key variable in the extent to which people rely on the authorities to protect them from flood risk (Winnubst 2011). Research suggests that trust in flood management institutions is negatively associated with risk perception; if people trust authorities and regulators to manage hazards effectively, they perceive the risks to be lower (Wachinger et al. 2013). A clear example emerges in research that shows that people who live near structural flood defences believe themselves to be immune from flood risk (Bradford et al. 2012). Empirical research has found trust to be negatively related to mitigation actions in a variety of contexts such as the purchase of insurance among Dutch coastal communities (Terpstra 2011), action among residents in a river basin in Taiwan (Hung 2009), and the uptake of damage-limitation measures among urban flood-prone residents in Germany (Grothmann and Reusswig 2006).

Trust in institutions has been theorised to act in a similar way to experience and the emotion heuristic. In uncertain situations, trust in institutions permits people to simplify

complex decision-making processes and essentially to switch off from thinking about risk (Terpstra 2011).

Trust has also been hypothesised as a key variable in explaining international differences in flood risk awareness (Löfstedt 2005). In the Yangtze delta in China, for example, floods are seen as relatively rare but potentially catastrophic risks that evoke feelings of dread, whereas in the Netherlands, people are comparatively fearless about flood risks (Kellens et al. 2013). Differences in risk perception have also been highlighted in a comparative study between China and the US (Ge et al. 2011). What is key here is that trust is not entirely related to institutional performance. Instead, drivers of trust vary from place to place according to social norms as well as the way that institutions and the public relate to one another (Löfstedt 2005). It is therefore vital that local levels of trust in institutions are understood when designing risk communications.

2.6 Demographic factors

Beyond experience, emotions and trust, research is much more inconclusive on whether individual factors influence risk perception. Some research has found that older people tend to have lower risk perception, and that women tend to have higher risk perception – but other studies have found no relation (Wachinger et al. 2013). There is similarly inconclusive evidence on the effect of education level and income, and home ownership (Kellens et al. 2013), although a 2013 survey in England found that people with children and those with higher social grades were more likely to consider themselves at risk (Langley and Silman 2014).

Research into individual characteristics and their relation to risk perception is the weakest part of the literature and it is difficult to draw strong conclusions or implications. There may be confounding factors. It might be the case, for example, that differences between groups are simply a reflection of their differing propensity to have experienced floods. Home ownership, for example, becomes a predictor of perceiving higher flood risk only after homeowners experience a flood (Wachinger et al. 2013). This research may also be picking up effects from people's confidence in how to deal with risks, as much as from their assessment of risk in the first place.

2.7 Social influence

Our social environment is a source of information, and we are influenced by the beliefs and opinions of those around us. This is known as informational social influence, or social proof (Deutsch and Gerard 1955) – and the effects can be profound. Though there is no research on the social dimensions of risk perception in the context of flooding, the psychological phenomena involved are well established and evidenced in virtually every aspect of life (including in risk perception more broadly). If our peers, neighbours or the society at large appear to be taking the risk of flooding seriously, it is more likely that we will adopt and internalise that normative viewpoint. This raises an important point: targeting individuals in an attempt to change their minds will have less impact so long as the normative belief remains as it is. As such, broader efforts to change normative views across society may also be necessary.

Box 8. Social proof

The tendency to adopt and internalise the normative beliefs and attitudes of our peers and reference groups – social proof – operates on all manner of beliefs, attitudes, emotions and behaviours. For example, fear and panic, emotions highlighted in the flood literature as drivers of higher risk perception, have been found to be socially 'contagious'. This can sometimes manifest dangerously, such as in stampedes, and can spread rapidly, even when there is no

clear cause (Helbing et al. 2000). More broadly, the things we fear or perceive as risky are partially determined by our culture and the norms of our society.

Through the same mechanisms, seeing other people not react to a threat deflates our own perception of risk. In one classic psychological study, undergraduate students found themselves in a smoke-filled room, either alone or with others (Latane and Darley 1968). When in the room with two actors who did not react to the smoke, only 10% of study subjects reported the smoke, whereas 75% of subjects did so when in the room alone. This has relevance to the perception of flood risk: it is very difficult to take the risk of flooding seriously if all our neighbours appear to be giving it no credence. Promoting the desirable social norm, for example highlighting that in fact our neighbours are taking the risk seriously, is therefore likely to be a powerful intervention. This echoes much evidence from The Behavioural Insights Team and others in which social norms messages have been used as an effective intervention. Adding the line “9 out of 10 people pay their tax on time” to letters sent to late payers, for example, brought forward £200 million in tax revenue (The Behavioural Insights Team 2012). The effect of this type of intervention has been replicated in dozens of studies across different contexts.

Clearly, it is not possible to build a campaign around such messages if they are not true. A number of similar tactics can be used in such cases, though. Highlighting the worst-performing minority is an example that allows us to craft a message of social comparison. Telling high-prescribing GPs that 80% of their local peers prescribed fewer antibiotics per head than them has led to a reduction in prescription rates (Hallsworth et al. 2016). We can also highlight absolute numbers when they do not represent a majority (“thousands of homeowners in a similar situation to yours are taking the risk of flooding seriously”) and recent evidence suggests dynamic norms – highlighting the growing prevalence of a behaviour (“more and more people...”) – can also be effective (Sparkman and Walton 2017).

2.8 Business-specific dimensions of risk perception

All of the above factors will be relevant to the decisions, judgements and perceptions of small and medium-sized enterprises – after all, small businesses are run by humans with the same cognitive architecture as anyone else. A number of factors are specific to businesses, though, due to the different mechanisms through which they make decisions, and the differing consequences they may face. We highlight a few important factors here.

In addition to the forms of social influence outlined in the previous section, businesses may also fall prey to groupthink – a phenomenon through which the social dynamics of a group distort the decision made, compared with the one that the individuals of that group would have made (Harries et al. 2018, Janis 1971). Specifically, dominant voices often overrule, while more timid members fail to voice their views; and the desire to reach a consensus may override the desire to reach the best decision. Among homogenous groups, the extremity of views can often be increased, as peers reinforce each other’s views. Among divided groups, each faction may strengthen their views as a way of differentiating themselves from their opponents, or to exaggerate their negotiating position. All of these factors may influence perceptions of risk and decisions to take action against flooding, particularly where investment is needed to do so.

Optimism bias was identified earlier as a reason that people underestimate their own level of risk from flooding and hazards. Research suggests optimism bias tends to be localised, reducing the perception that we ourselves are at risk, even if we acknowledge that others or society as a whole are at risk.

Strategies that ask people to think more deeply and methodically about a topic appear to reduce optimism bias. In an experimental study, participants who formed implementation intentions (strategic ‘if, then’ plans for achieving a goal) about where and when they would complete an assignment were able to more accurately predict their rates of goal completion, since this process forces us to acknowledge the various

risks and issues that can arise (Koole and van't Spijker 2000). Asking people to consider their own situation in comparison with that of others may also help to reduce optimism bias. When students were exposed to lists that other students had made of their own advantages, they rated their own chances to be above average for positive events less highly (Weinstein 1980). In the flooding context, we might aim to engage people in a thought process along the lines of: 'It's happened to these other people. What makes you think it wouldn't happen to you?'

The tendency to overestimate our abilities and the accuracy of our judgements is similar to optimism bias. One of the effects of this overconfidence is that we tend to play down the role of chance in future events, believing we have greater control over outcomes than we really do. In most companies, the ability to project great confidence is what gets rewarded (Lovallo and Sibony 2010) and so business leaders tend to be naturally more overconfident than average (Lee et al. 2015). It has been shown that many business managers have false perceptions about how their company is performing compared with those of their peers, and their assessment of the company's management practices is often very optimistic (Sadun et al. 2017). This may be a personality trait that subtly influences their beliefs and motivations about mitigating risks generally, or their view that in the event of a flood, there is little they could do to contain the commercial damage or recover effectively.

2.9 Summary of findings

The first step towards installing PFR is having an awareness of the level of risk that you face. Research suggests we rationally appraise the likelihood and severity which in turn informs our response to that risk (the limitations of which were described earlier in the chapter). The literature also shows that the common understanding of hazard risk is relatively poor, we often struggle with probabilistic risk information.

Research highlights the importance of emotions in our perception of and response to risk. We draw on simple emotional cues as a substitute for a more deliberative assessments, fear and other emotions are not driven by a knowledge of flooding statistics. How people respond to a flood is affected by personal and cultural factors, such as past experience, depiction of flooding in the media, and specific narratives of a given culture or community. Research shows a gap between our 'hot' and 'cold' states, we tend to underestimate the magnitude of a negative event when we are not, at that moment, fearful or distressed about it.

Another common finding is that the level of trust in the individuals or institutions communicating the risk makes a difference to how effective the messages are. Informal social networks can be more effective than official advice due to a tendency to adopt and internalise the beliefs, attitudes and actions of our peers.

3 Step two - I feel able to take action, and feel responsible for taking action



The flood and hazards literature says

- Protection motivation theory suggests that if people do not feel able to take action against a threat, then a perception of high risk can easily translate into denial or avoidance
- Research across different hazards has generally found that coping appraisal – feeling able to take action – is a better predictor of people taking up protective measures than risk perception
- This suggests that communication efforts should be more heavily weighted towards increasing people’s coping appraisal, rather than improving their perception of risk
- Social influences from friends and neighbours have a strong impact on coping appraisal: If people see others taking action, they are more likely to believe that they can do so themselves
- Social influence can also work negatively, though – for example, through spreading anecdotes about flood protection measures’ ineffectiveness
- A common finding in the hazard literature is that people who believe that they are not responsible for protection tend not to act – ‘Why should I pay to protect my property? What is our government doing?’
- In turn, when authorities do take action, this reinforces the belief and people are less likely to undertake individual measures. Part of this effect is a kind of moral hazard (see 3.1.5 for more details on moral hazard)

The wider behavioural science says

- The social drivers of coping appraisal, and views of responsibility are validated by the wider behavioural science literature. People internalise the values of people around them and align their actions with the values and behavioural norms of their social networks
- The wider behavioural literature supports the finding that government action can be a disincentive to individuals taking responsibility. However, there are behavioural strategies to leverage government action to encourage complementary individual actions

- People need specific, achievable and approachable steps to feel that they can effectively mitigate flood risks. Otherwise, they are likely to avoid or deny them
- The wider behavioural literature finds that people are likely to underestimate the efficacy of measures that lower risk or make people more knowledgeable about the situation but do not eliminate the risk of flood damage.

3.1 Introduction

We can see from step one that having some awareness of the risk – though not in a conventional probabilistic sense – is a key part of the journey towards taking up flood resilience measures. However, a number of studies examining the relationship between risk perception and the adoption of flood resilience measures have found only a very weak or absent relationship between the two (Bubeck et al. 2012). Similar results have been found in research among small businesses, which shows no relationship between managing directors having a crisis management plan and their perceptions of threat levels (Herbane 2013). This has been described as the risk perception paradox: even when people feel themselves to be at high risk, they still do not take action.

Clearly, risk perception is not the only prerequisite to taking action. Two other factors are critical. First, a recognition that flood risk is something that you can do something about. As already discussed, if we lack the belief that we can meaningfully make a difference, we will tend not to act, and may disengage from the risk altogether. Second, we must acknowledge that we have some responsibility for taking action. Flood risk management strategies increasingly require individual households to take up flood resilience measures, yet people are unlikely to do so if they do not feel that this is, or should be, their role. Without this feeling of responsibility, it is likely that improving risk perception will lead to over-reliance on public flood protection, and to non-protective responses such as avoidance or denial. We now address these two factors in turn.

3.2 Coping appraisal: I am able to take action

The protection motivation theory (PMT) model introduced in the previous chapter states that while threat appraisal (the perception of risk and consequences) is an important first step in motivating people to act, how they react to this risk perception is crucial. Coping appraisal is this reaction; put simply, it is an individual's assessment of their ability to act to reduce risk. According to the PMT model, if people have a high threat appraisal but a low coping appraisal, they will not be motivated to take up protective measures and will display non-protective responses, such as wishful thinking, avoidance or denial, which do not reduce the risk itself, but may be helpful in reducing negative emotions (Bubeck et al. 2013).

Coping appraisal is made up of the following three elements.

- Response efficacy describes whether an individual considers that there are options available that will reduce their risk. For people to demonstrate response efficacy, they need to be aware that there are measures they could take that could improve the resilience of their property or business – and they need to believe that these measures would be effective
- Self-efficacy indicates whether an individual feels able to implement a particular measure. Self-efficacy is therefore a belief that people must hold before they can take the next step of the journey

- Response cost refers to the costs that individuals associate with action, both monetary and non-monetary, such as time and emotional costs (Bubeck et al. 2013)

In comparison with the large literature on risk perception and flooding, there are relatively few studies that focus on coping appraisal. Most evidence underpinning PMT has come from research into health threats and shows that coping appraisal has a greater predictive effect on protective behaviour than threat appraisal (Milne et al. 2000). Similar findings have been seen in the context of other hazards, such as farmers in Sri Lanka at risk of drought related to climate change (Truelove et al. 2015).

There is little direct evidence on the level of coping appraisal held by at-risk households or small businesses. Some research has asked general questions about people's level of confidence. A study of at-risk people in England in 2013 found, for example, that 70% agreed that they had a good understanding of how to protect their home (Langley and Silman 2014).

Evidence from one study in Germany also showed that, together, threat appraisal and coping appraisal determined people's flood mitigation behaviour, but that coping appraisal had a greater influence on behaviour than threat appraisal. This study also found that non-protective behaviour, such as denial, was correlated negatively with coping appraisal (Grothmann and Reusswig 2006). A study in the Netherlands found that response efficacy – the belief that resilience measures are effective – influences people's intentions to take up precautionary measures, but self-efficacy – the belief that 'I can take action' – does not (Zaalberg et al. 2009). Yet a study of households in three flood-prone regions of France found that those households who felt able to take protective action were much more likely to do so than those, even within the same communities, who lacked this confidence (Poussin et al. 2014). Another study of flood-affected residents in Germany showed that belief in the effectiveness of preventive measures was a more important predictor of uptake than the perception of flood risk (Kriebich et al. 2005), as did research on the preparedness for flooding among coastal communities in Denmark and Germany (Koerth et al. 2013).

Other studies that did not directly focus on PMT have shown that variables such as feelings of hopelessness are correlated with a lack of preventive action (Siegrist and Gutscher 2006).

While the limited evidence suggests that coping appraisal is important for the uptake of flood resilience measures, we do not know, unlike for risk perception, a great deal about what factors influence coping appraisal. It is only in the last few years that researchers have begun focusing on coping appraisal in detail. From the research that does exist, it appears that socio-economic and demographic factors may play a greater role in coping appraisal than in risk perception. Socially vulnerable groups, for example, are likely to have relatively low coping appraisal (Bubeck et al. 2018), potentially in part because they more commonly lack the resources to dedicate to protective action. This is significant as these groups are often disproportionately at risk of flooding (Sayers et al. 2016). Research into flood-affected households in Austria has found that self-efficacy is lower among women and among people whose objective risk is higher, while it is higher among those with higher incomes (Babcicky and Seebauer 2017).

A recent study of flood-affected households in France and Germany is the only research on flooding to investigate coping appraisal and its components in detail. The research broke down coping appraisal into its three constituent parts and also compared structural and non-structural resilience measures as well as insurance purchase. As other studies suggest, an assortment of socio-economic factors were found to be significant drivers of different aspects of coping appraisal, although the overall impact of these factors was very small (Bubeck et al. 2018). In Germany, older people were more likely to have lower response efficacy for structural measures, while

income was positively associated with response efficacy for non-structural measures, and home ownership was related to high response efficacy for insurance. In France, women have higher response efficacy for non-structural measures than men, but there were no significant effects for income or home ownership. In terms of self-efficacy, a higher income was found to be a significant predictor across all measures in Germany and for structural measures in France. Home ownership was significant in self-efficacy of structural measures in Germany, but not in France. Education was positively associated with self-efficacy in terms of insurance in Germany, as was age, but it was negatively associated with the self-efficacy of structural measures in France. The results for response cost were similarly varied (Bubeck et al. 2018).

Some studies have suggested that, as with flood risk perception, experience plays a part in coping appraisal, although again results are mixed. If someone has experience of a past flood where resilience measures have reduced damage, they are likely to believe that they could do so again. Evidence from a study in Germany has found this to be the case, with people who had experience of previous flooding being more likely to understand the benefits of resilience measures (Kreibich et al. 2005). Similar evidence has been found in relation to hurricanes (Norris et al. 1999), although other research has highlighted that the positive effects of hurricane experience on self-efficacy may relate only to evacuation experience, and that when considering property damage or emotional impact, past experience serves to reduce self-efficacy (Demuth et al. 2016). Similarly, the recent study in France and Germany did not find a positive relationship between experience and coping appraisal (Bubeck et al. 2018).

More conclusively, in both France and Germany, the social environment – that is, a belief in what neighbours, family and friends will do – was a much more significant influence on all measures of coping appraisal than socio-economic factors (Babcicky and Seebauer 2017). This matches previous research into the uptake of flood mitigation measures, which found that the belief that friends, family members or neighbours have taken up mitigation measures has a strong positive influence on the number of measures households take up (Bubeck et al. 2018). In Austria, similar research found social capital (feelings of support, trust and social cohesion) was associated with higher self-efficacy (Babcicky and Seebauer 2017).

These findings resonate with research on other hazards that highlights the role of social norms in protective behaviour. Social norms have been found to be important in enabling communities' adaptation to climate change, for example, in a number of contexts (Adger 2003). The earthquake literature shows that individuals are more likely to prepare for disasters if their neighbours, friends and families take similar action (Mileti and Darlington 1997, Mileti and Fitzpatrick 1992). Research in Australia found that uptake of insurance was unrelated to perceptions of the likelihood of flooding, and strongly correlated to the belief in social norms related to holding flood insurance (Lo 2013). Research has also found that in communities at risk of flooding and earthquakes, discussions with friends and neighbours are one of the most important factors determining the uptake of insurance (Kunreuther et al. 1978).

Social cohesion and social capital have been seen more broadly as important in helping communities to adapt to living with hazards (Kunreuther et al. 1978). For example, in the US, a sense of place and community engagement in resource planning has been shown to lead to community cohesion and preparedness for wildfires (Bihari and Ryan 2012). A study of a community in China that saw flooding as inevitable and was sceptical of flood protection systems found that social networks enabled it to plan adaptations to living with flooding (Wong and Zhao 2001). A study of coffee farmers in Mexico found that those who felt that climate risks were extremely high were not motivated to take action as they believed it was futile. But when information about possible adaptation measures was provided by a source within the group, they were more motivated to act (Frank et al. 2011).

Social norms can also negatively affect people's propensity to act: if a number of neighbours decide not to buy insurance, and word spreads, this can lead to an information cascade (Banerjee 1992). Indeed, a recent report from the UK has highlighted that anecdotal evidence of failed flood resilience measures – and a lack of successful examples of flood resilience measures – could negatively impact confidence in the measures (Lamond et al. 2017). Further, it has been suggested that in some communities at risk of flooding, individuals installing resilience measures may threaten a key element of social identity. One qualitative study into this subject found examples of such an effect: “the participants of one focus group labelled anyone who took long-term flood protection measures as ‘nuts’ and as having ‘more money than sense’. In another case, a householder's decision to install a door-board when his neighbours had not done so caused him to be accused of conjuring up an ‘apocalyptic image’ of the future and of threatening the cohesion of the local community” (Harries 2011).

3.3 Lessons for information provision

The aforementioned study in France and Germany on coping appraisal found that information about resilience options, as well as about flood risk, was positively associated with aspects of coping appraisal (Bubeck et al. 2018). The authors therefore conclude that communications should aim to improve coping appraisal through increasing self-efficacy (belief in one's ability to install resilience measures) and response-efficacy (belief in the effectiveness of resilience measures). Given that the conventional approach is to focus communications on risk perception rather than on coping appraisal – despite the evidence that the latter is likely to be more of a limiting factor – this is an important conclusion, and a strong recommendation to re-gear communications to this effect. This matches the conclusions from a number of other studies, that flood risk communication is insufficient unless it also specifies the potential measures that can be taken (Poussin et al. 2014, Bubeck et al. 2013). Indeed, some suggest that communications should explicitly attempt to reinforce coping appraisal through messages emphasising sentiments such as ‘yes, you can do it’ and ‘yes, it works’ (Kievik and Gutteling 2011). The findings about the importance of social norms suggest that communications should also aim to make flood resilience measures ‘normal’ within communities (Harries 2012).

Box 9. Low-cost hypothesis and certainty effects

Low-cost hypothesis

As established in step one, strong negative emotions such as fear can increase our sense of risk and push us to take action, but can also be debilitating. Research suggests the outcome will depend largely on the effort, cost or utility associated with acting. If action is low cost (easy, cheap, non-threatening to the psyche, and non-diminishing of other motivations such as enjoyment), we will take it. If action is costly (difficult, not known about, expensive or unappealing), we are less likely to take it – and instead more likely to resolve the fear and anxiety through denial, information avoidance or rationalisation (Diekmann and Preisendörfer 2003). Property flood resilience is often costly (or at least perceived to be), in various senses of the word.

It is therefore important when communicating risk that we pair it with strategies that can easily be taken up, ensuring a useful response to that risk, and a feeling of empowerment rather than disengagement or helplessness. In addition to removing practical barriers (discussed further in later steps), we can communicate specific and achievable steps that people can take to mitigate the risk. According to Pratkanis and Aronson (2001), fear persuasion is especially effective under the following circumstances: “(1) it scares the hell out of people, (2) it offers a specific recommendation for overcoming the fear-arousing threat, (3) the recommended action is perceived as effective for reducing the threat, and (4) the message recipient believes that he or she can perform the recommended action”. These concepts are illustrated well by The

Behavioural Insights Team's work (unpublished data) seeking to encourage bank customers in mortgage arrears to contact their bank. Letters to customers that took an aggressive approach caused distress, denial and fewer people to call their banks. Rewriting the letters to maintain a sense of the severity of risk, but combining it with a friendly tone, specific actions to take, and an emphasis on the help available to resolve the problem, caused significantly more customers to contact the bank. The objective was to empower customers to resolve the issue, rather than to threaten them, and to ensure that the action they needed to take (speaking to the bank) was neither anxiety-inducing nor difficult, all without diminishing the legitimate risk of what might happen if they did not act. New York City's [FloodHelpNY](#) webpage incorporates this insight by immediately following warnings about a website user's flood risk with "What you can do": a section that provides simple steps and indicates the number of minutes needed for each.

Simplified communications with clear actions also work for businesses. In one trial, The Behavioural Insights Team (2017b) tried to encourage businesses to seek information about a new apprenticeship levy that would be affecting them. A simplified letter that chunked the next steps into two clear items of action (and also leveraged social norms and loss aversion) led to a significant increase in click-through rates to the apprenticeship levy website.

Certainty effects

An important dimension of self-efficacy (feeling like our actions will make a difference) is having faith that the flood resilience measures will truly protect our building. However, many flood resilience measures lower, but do not eliminate, the risk of damage to property. People have strong preferences for zero risk: they are willing to pay more to reduce a risk from 5% to 0% than to reduce it from 25% to 20% (Kahneman and Tversky 1979). This is a reasonable preference, given the added peace of mind that comes with zero risk, but it does lead us to put less value on resilience measures that do not fully eliminate risk. This may in turn reduce people's perception of their abilities to reduce negative outcomes.

Introducing more certainty into flood resilience measures could help to combat this effect. This can take the form of guarantees or a Kitemark equivalent, or expert advice on the suitability of certain products for individual homes.

3.4 Responsibility for taking action

The second factor discussed in this chapter is the belief that we, as individuals, are responsible for taking action.

A number of studies have shown that there is a common belief that authorities have the primary responsibility for flood protection and therefore that residents do not (Bichard and Kazmierczak 2012, Terpstra and Gutteling 2008). A survey of homeowners in risky areas in England and Wales found that few believed protection was an individual responsibility – most people thought the authorities were responsible (Bichard and Kazmierczak 2012). A survey in 2015 in England found that, while 55% of respondents thought that homeowners were responsible for protecting their homes against flooding, the same proportion believed the local council was responsible, and 57% thought the Environment Agency was responsible (Davies 2015).

Research with households affected by the 2007 floods in England echoes these findings. One respondent suggested, for example: "...why should I pay to protect my property? What is our government doing? It is the job of my local authority to make sure that the drainage was clear of debris – if this had been done, we would not have suffered what we suffered in 2007" (Joseph et al. 2015a).

Another study, from those affected by the 2007 floods in Scotland, found that 58% of respondents thought that the responsibility for property flood protection should lie with local authorities, while a third thought it should lie with the Scottish Government, and only 8% thought it should lie with individuals. Other research suggests, though, that individuals do appreciate that at least some of the responsibility lies with them. A survey of at-risk people in England in 2013, for example, found that 60% of people

acknowledged that preparing for flooding was their responsibility (Langley and Silman 2014).

Similar themes are found in other countries. One study of coastal communities in the Netherlands found that 70% of residents thought of the government as being primarily responsible for flood protection, although around half saw disaster preparedness as a joint responsibility (Terpstra and Gutteling 2008). This study also found that the effectiveness of emotionally laden risk communication varies according to whether people feel responsible for addressing or mitigating the risk. Those who do not feel responsible for flood risk are more likely to disengage from emotionally laden messages (Terpstra and Gutteling 2008). Clearly, the local context makes a difference: flood defence has been a major area of government policy for hundreds of years in the Netherlands (Terpstra and Gutteling 2008). Other studies have concluded that households tend not to be very well informed about the roles and responsibilities of public authorities (O'Sullivan et al. 2012).

There is evidence that a lack of personal responsibility for hazard protection could be a barrier to people taking protective action (Lindell and Hwang 2008). In literature on disaster preparedness it has been found that at an individual level: people who perceive their responsibility to be higher are more likely to take preventive action (Lindell and Perry 1992). This effect has been less clear-cut in the flooding literature, with two studies not finding a link between a lack of uptake of resilience measures and statements expressing no responsibility (Harries 2011, Terpstra and Gutteling 2008).

3.5 Moral hazard

While positive relationships between individual responsibility and the uptake of measures are rare in the flooding literature, some links have been found between feeling that flood protection is the government's responsibility and a lack of individual action. There is also an element of moral hazard here; a regular finding from the hazard literature is that the availability of insurance encourages people to increase their exposure to hazards (Cutter and Emrich 2006). The research that does exist on the links between responsibility and flood resilience uptake suggests a similar effect. For example, research on flooding in England found that over a quarter of people agreed with the statement, "My home is covered by insurance, so I don't need to worry [about taking resilience measures]". These respondents were less than half as likely as other householders to have taken resilience measures (Harries 2011).

Examples from elsewhere repeatedly show similar findings. A study in the Netherlands demonstrated that the perceived responsibility of the government made homeowners less willing to buy sandbags to protect their properties (Botzen et al. 2009b). In Germany, researchers found that reliance on public flood protection was an important factor in explaining a lack of flood mitigation behaviour (Grothmann and Reusswig 2006). Indeed, "the view that 'only the authorities' can manage flood risk and there is nothing they can do and/or should do, to improve their resilience" has been identified by Defra as one of the main barriers to people installing resilience measures (Bonfield 2016). Researchers have found that the French disaster recovery scheme, CAT-NAT (for 'Système Catastrophes Naturelles' or Natural Disaster Scheme), although often cited as a model of good practice in terms of its comprehensive recovery activities, acts as a disincentive for individuals to take up preventive measures (Larrue et al. 2016).

This reliance on authorities relates to past experience and to trust: negative emotions related to previous experiences reduce trust in authorities and public measures, while positive emotions increase it (Wachinger et al. 2013). Research on individuals' sense of responsibility for preventive actions strongly links this to trust in the effectiveness of public flood protection (Birkholz et al. 2014). Evidence suggests that trust in public

flood protection is negatively associated with the uptake of resilience measures and insurance (Terpstra 2011).

These findings echo those of the last section, which demonstrated that flood risk perception was often negatively correlated with trust in public authorities. One review of the literature concluded that the role of authorities was a key barrier in the uptake of private resilience measures (Bubeck et al. 2012). As perceptions of flood responsibility are likely to be bound up in social norms in a similar way to coping appraisal, one conclusion from this literature is that communications should aim to normalise the idea of joint responsibility between individuals and the authorities. Some have argued that engaging local communities in active participation in local flood resilience decisions can help to shift perspectives about the division of responsibility and can help residents to gain the crucial experience that appears to be valuable in motivating preparation for future floods (Lara et al. 2010).

Box 10. Social dimensions of responsibility

Social norms

A belief that we have personal responsibility is, just like any belief or opinion, influenced by the beliefs and opinions of those around us (an example of social proof, discussed in step one). In the context of flooding, the dismissal of personal responsibility is perceived as normal in the UK. Importantly, however, our perception of what is normal is often biased, and so dispelling this misconception can be a powerful intervention. Providing accurate information to college students on the average drinking behaviour of their peers, for example, has been shown to reduce their consumption, because they had previously overestimated how common it was to drink excessively (Dotson et al. 2015). The Behavioural Insights Team has used similar social norms messages to influence behaviour in a wide variety of settings (Hallsworth et al. 2016). In the context of flooding, campaigns and interventions aiming to increase the perceived normality of taking individual action may therefore help to shift the normative perception of where responsibility lies.

Businesses are not immune to social norms either. The Behavioural Insights Team tested different versions of communication to encourage businesses in Denver in the US to file their tax returns and pay their taxes online through a business tax portal. A message highlighting that the majority of their peers had an online tax account was 67% more effective in encouraging businesses to pay their taxes online than messaging to persuade people to switch from paper-based correspondence for green reasons (The Behavioural Insights Team 2016).

An important distinction is that norms may be descriptive (what people actually do or believe), or injunctive (the common expectation or understanding of what we ought to do). The above examples use descriptive norms, but highlighting the injunctive norm can also change behaviour because we are driven to fit in and comply with social expectations regardless of our own personal beliefs. For example, when people are given information about how their energy consumption compares with that of their neighbours (a common social norms intervention to reduce consumption), researchers have found that the second-order beliefs (believing that your neighbours believed it was important to reduce energy consumption) were more important than whether you yourself believed it to be important (Jachimowicz et al. 2018a and b).

Reciprocity, and the tragedy of the commons

Where collective benefits depend on individual contributions, there is a risk of a tragedy of the commons. Put simply, this is asking why a significant personal expense should be taken on when others do not bother and will get free protection from the government at taxpayers' expense. Though we might all be better off if everyone did their bit, the individual is incentivised to have a free ride. This problem is particularly acute where multiple households must adopt flood resilience measures for any of them to be protected, such as in terraced housing.

The tragedy of the commons has traditionally been solved through regulation (in the case of flooding, this would require changing building regulations or legislating for certain property flood resilience measures), or taxation (taxing people who choose not to protect their buildings, in

order to pay for the clean-up, relieving the burden from those who do choose to protect their property). There is also a number of behavioural solutions, though. We have evolved a tendency for conditional cooperation, or reciprocity, for example: a keen sense of fairness, an aversion to freeloading, and a powerful urge to reciprocate deeds done to us in order to save face and meet social expectations. We will therefore be more willing to take responsibility (and thus contribute to the collective good) if others also are doing so, or are explicitly doing something for us (Keser and van Winden 2000, Ostrom 2000).

Reciprocity can be leveraged in a number of ways. Social norms messages (discussed above) can harness it since they may highlight the contributions to the public benefit that others are making (with messages such as, 'Most hotel guests reuse their towel' – found to be significantly more effective than conventional eco messaging). More directly, we can craft messages that allude to the fact that others are doing something that benefits us, and so we ought to reciprocate. 'If you needed an organ, would you take one? If so, please help others,' for example, has increased the number of people registering to be organ donors (The Behavioural Insights Team 2013a). It is also possible to evoke reciprocity directly through giving gifts or unconditional incentives. Giving investment bankers a packet of sweets before asking them to consider donating a day's salary to charity has more than doubled the number of donations (The Behavioural Insights Team 2013b). In the context of flooding, we might consider either highlighting that others are doing their bit, or that the government is already spending resources to protect our homes, thus evoking the reciprocal acknowledgement that we ought to take on a share of the responsibility in return. These kinds of intervention tend to be most effective when there is a degree of social accountability, where we are not acting in anonymity – personalising correspondence can help to achieve this.

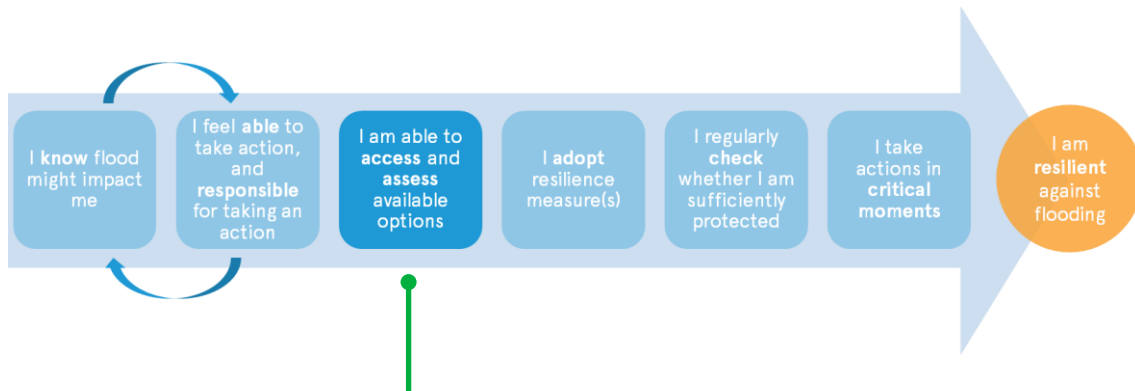
3.6 Summary of findings

People's ability to take action will be influenced by the extent to which they feel able to act and whether they feel it is their responsibility to act. If people do not feel able to do something about a risk, they will tend to disengage or wilfully avoid the issue and thus diminish their perception of that risk. A person's propensity to act will depend largely on the effort, cost or utility associated with taking that action – if action is difficult or costly, they are more likely to resolve their concerns by shutting them out (denial or motivated avoidance) than by acting on them.

People are more likely to take action if they have past experience of flooding or they see others taking action. Social influences can also be negative, anecdotes shared between individuals about failed flood resilience measures could affect confidence in measures.

In addition to the need to feel we can act is the need to feel we should act. A number of studies have found that many people do not think it is their responsibility to protect themselves against hazards which results in a lower uptake of PFR. There is less evidence on what we can do about this, and this remains one of the principle research gaps.

4 Step three - I am able to assess and access available options



The flood and hazards literature says

- There are several obstacles that make assessing flood protection options difficult, including a lack of expertise in evaluating options, and difficulties in calculating costs and benefits
- There is a vast range of potential options for flood protection – resistance measures that keep water out of a property, resilience measures that prevent damage from flood water that has entered a property, and insurance, which provides financial compensation for flood damage
- Flood protection requires a package of measures, but there are no one-size-fits-all packages. Professional advice is needed to recommend the best options
- Costs are difficult to evaluate as they vary according to the individual property, and quality is hard to judge as there is a lack of common standards, especially for resilience measures
- It is also difficult to fully appreciate the potential benefits of flood protection measures as many of them are less obvious or immediate – such as reducing physical or mental ill health after a flood. Research has consistently shown that people’s valuations of flood protection measures are significantly below the actual costs

The wider behavioural science says

- We make better choices when we are presented with only highly relevant information about different options. The information presented should also be simplified when possible
- Fewer options make it easier for us to engage and to make a choice
- Options should be presented alongside one another in a standardised format
- Product endorsements are effective, but the most trusted source for the endorsements depends on highly specific contextual factors

4.1 Introduction

The journey so far has demonstrated that people first need to have some meaningful awareness that they are at risk, need to feel able to do something about it, and need to feel responsible for doing something about it. The third step in the journey is assessing and accessing the available options.

A wide range of PFR measures is available, and installing a combination of resistance and resilience measures is likely to be needed to fit the needs of a particular property. Table 1 illustrates a number of potential options in the case of a domestic household.

| Resilient measures | Resistant measures |
|--|--|
| <p>Electricals</p> <ul style="list-style-type: none"> • Separate electrical circuit for upper and lower floors • Raised electrical sockets • Valuable items on high shelves, wall mounted TV <p>Kitchen</p> <ul style="list-style-type: none"> • Kitchen units on legs, concealed by removable kickboards • Fridge and white goods on raised plinth <p>Property design</p> <ul style="list-style-type: none"> • Tiled floors, with waterproof adhesive and grout • Closed-cell type insulation • Boiler moved to upper floor • Lightweight doors with rising butt hinges • Resilient plaster OR plasterboard laid horizontally • Easily accessible storage for flood barriers and blocks • Permeable paving surface <p>Sentimental and important items kept upstairs</p> | <ul style="list-style-type: none"> • Flood resistant front door • Pump to remove water • Flood barriers can protect garage but move vehicles to higher ground if possible • Service vent covers and seals, and automatic airbricks • Non-return valve in sewer pipe |

Table 1. Examples of household resistance and resilience measures. Source: Adapted from Mary Dhonau Associates (Dhonau et al. 2018)

There are three possible courses of action in making optimal choices for flood resilience. First, individuals and small businesses could make themselves aware of and understand the available options, able to compare their advantages and disadvantages individually and in combination. Second, they could outsource this complexity to an expert, putting their faith in an approved surveyor to make the decision for them. Third, there could be some default mechanism through which the individual does not need to make a proactive decision at all, for instance during the reinstatement process after flooding, or through altered building regulations. From a behavioural perspective, the latter two options are likely to be preferable – as outlined in this chapter, the complexity and uncertainty associated with choosing PFR measures is a major barrier to uptake. Indeed, over a quarter of respondents to a survey agreed with the statement, ‘I don’t think I’d be able to choose the right way to protect my home’ (Harries 2013). We therefore strongly recommend that the use of default mechanisms or turnkey solutions that need no further input and are driven by expert decision making, is explored. In this chapter, though, we focus mainly on the steps needed (and barriers to) more deliberate consumer choice (with or without a degree of expert advice being sought by the

consumer), since this is currently the predominant route through which householders and small businesses would be expected to adopt PFR.

4.2 The range of options is large and trade-offs are complex

As Table 1 illustrates, there is a wide range of potential resilience and resistance options available to property owners and small businesses. A recent review that focused solely on resilience measures found 139 different options, of which 104 directly applied to the building fabric and 35 were related to contents and strategies (Lamond et al. 2016). One homeowners' guide for people at risk of flooding lists 12 resistance product types and, for each type, 71 possible products or suppliers (Dhonau et al. 2018).

Dhonau et al (2018) highlighted that the best options for a particular household varied according to a range of factors: "The most appropriate measures for any individual property depend upon a combination of factors including: type of building and construction; age of building (and any constraints such as listed status); condition of building including pre-existing dampness; preferences, resources and capacities of the building occupants; support available to implement measures (such as flood warning time); and the characteristics of flood itself (including expected flood type(s) and their interaction, annual probability, flow velocity, duration, speed of onset and depth)" (Dhonau et al. 2018). Further considerations, such as the capacity of the occupants of the property to implement measures, and the skill and experience of available contractors, add further complexity to the choice. Because of these factors, there is no universal basic package of measures that could simplify the choice.

To help navigate this complexity, the National Flood Forum provides the 'property protection advisor', an online tool that allows people to input details about their property and receive an estimation of the kind of resistance and resilience measures they would need, along with an estimation of the cost of each measure plus a range for the total costs. Such a tool can provide only a relatively basic estimation, though.

It is likely that each property will need to be inspected by an independent flood risk assessor before making any decisions. This will establish the nature of the flooding threat, the potential vulnerabilities of the building and the specific protection measures that might be required. Together with a post-construction survey to confirm installation and quality, such surveys were estimated in 2015 to cost between £280 and £525 per residential property and over £630 per commercial property. Factors such as the size of the property and the experience of the staff may vary the costs (Environment Agency 2015). These costs may present a barrier to consumers who want to understand their options. Depending on the area in which the property is based, and when the survey is needed, grant funding may be available to help with this. Support was available to cover survey costs for households and businesses affected by flooding between April 2013 and March 2014 in the UK (Department for Communities and Local Government 2014). But financial support is not standardly available to everyone who may benefit from a survey to explore the potential to increase the resilience of their property.

Box 11. Cognitive load and choice overload

Cognitive load

Cognitive load refers to the amount of mental effort being used. Our capacity to perform mental work is a limited resource that can be taken up by planning, remembering, calculating, worrying, self-control, and so on (Fiske and Taylor 1991). Decisions that are more complex, or being

made at moments of stress or with other issues on our mind, tend to be suboptimal or avoided altogether (Loewenstein et al. 2014).

There are several strategies to reduce the cognitive load of choosing the optimal flood resilience measure, and thus to improve decisions. Given our tendency to put-off complex or time-consuming tasks of life admin, particularly non-urgent ones, it is vital that consumers' decisions can be made as simply and quickly as possible.

- **Standardising** the presentation of the costs and benefits of various options improves consumer comprehension and eases comparisons between products. Standardising privacy policies, for example, along the lines of a common 'nutrition label', has been shown in research to significantly improve consumer comprehension (Competition and Consumer Authority 2018, Kelley et al. 2010). The tariff comparison rate is a similar decision aid, reducing several dimensions of energy tariff pricing into a single metric, helping consumers to make a rapid comparison between options
- **Presenting only the most relevant information** reduces information overload by limiting the number of dimensions we must compare products on. For example, The Behavioural Insights Team and Money Advice Service found that the comprehension of financial terms and conditions improved when the information was summarised into six key facts (The Behavioural Insights Team 2018b)
- **Categorical labels**, such as stars and letter grades, leads to better comprehension than using continuous scales to present information (Loewenstein et al. 2014). The A–G energy performance certificate for properties in the UK, for instance, is simpler to comprehend than the numerical scale beneath it. Systems such as traffic light colours to display nutrition information on food packaging similarly make rapid judgement and cross-product comparisons easier
- **Kitemark-type** stamps of approval from consumer or government organisations can make it easier for consumers to identify which products are recommended. Experimental studies support this finding, showing that such marks are more effective than complex labels at helping consumers to choose between products, although they are not always as effective as simple categorical labels (Cecchini and Warin 2016, Ducrot et al. 2015)
- **Default options** given to consumers increase the number of people who settle on these (Jachimowicz et al. 2018a and b). Often we do not want to engage in a decision, and would prefer a trusted authority to make the decision for us. When coming from a trusted entity, defaults act as strong recommendations, as well as greatly simplifying the decision-making process. Defaults about specific measures or products can be personalised to reflect individual differences, and tailored to a consumer's needs (Goldstein et al. 2008). Companies can take age and income into account when defaulting new employees into retirement plans, for example.

Choice overload

Having too many options can make decisions more difficult. This is most likely to be true when consumers are faced with time constraints, complex choices, or lack expertise (Chernev et al. 2015) – all of these factors are likely to apply to the majority of homeowners and businesses who ought to consider flood mitigation measures. Even with good intentions to adopt flood resilience measures, we are more inclined to backtrack and do nothing when researching the available products if overwhelmed by the amount of choice and the technical nature of the products, or there is a high chance of making a wrong choice (fear of regret).

The behavioural science literature has identified a number of ways to reduce choice overload:

- **Reducing the number of options** encourages people to make a decision, and can also lead to better decisions (Johnson et al. 2013), since it is easier to identify the best option from a limited choice. This is illustrated by the example of the Swedish Government's effort to offer more choice on pension products – it backfired, by causing fewer savers to make a choice (Czech 2016). Sophisticated comparison websites are able to reduce the available options, to display only those suitable for the individual's circumstance, removing the risk of being overwhelmed, and cutting the fear of making a wrong choice. In a flood resilience context, New York City's FloodHelpNY platform reduces the complexity surrounding flood insurance by giving homeowners a short list of actions they can take based on their home address (IDEO 2016)

- **Preselecting the options** offered acts as a default while maintaining the consumer's ability to view and choose other options. This can be effective because, as with defaults explained above, we tend to perceive them as implicit recommendations or 'safe' options – assuming that they come from a trusted source

4.3 Complexities in calculating costs of measures

Besides the sheer quantity of the options for property-level flood protection, consumers also face complexities in attempting to calculate potential costs. The first problem is that costs can vary enormously between measures. Estimates for the costs of packages of measures applied to scenario properties range from between £2,500 and £16,500 for resistance measures, and from negligible costs to £35,000 for resilience measures (Oakley 2018). An evaluation of the UK's property-level flood protection scheme found that the total cost varied from £618 to £6,736 (Merrett 2012). As these broad ranges indicate, meaningful estimates for costs are hard to get before a survey of the needs of a particular property is done. Even once it is, individual measures can vary in cost. For example, according to the calculations used by the National Flood Forum's 'property protection advisor', replacement automatic flood doors can range in price from £1,000 to £2,000, while a sump pump can cost between £1,000 and £3,000.

An important element to the calculation of costs is the situation a property is in when the measures are to be installed. The above estimates are for works done to upgrade a property. Flood protection measures, particularly those that affect the structure of a property, are instead most likely to be installed during reinstatement after a previous flood, or during a period of renovation (Oakley 2018). This means that estimations of costs need to be compared with those of installing the equivalent non-protective product. This can significantly reduce the marginal costs of installing flood protection measures. One recent report calculated the costs of some low-cost packages of resilience measures. These totals varied from £7,420 to £12,540, but once the equivalent costs for non-resilient measures were taken into account, the additional costs for resilient repair were reduced to a range from £1,890 to £4,770 (Lamond et al. 2016). This suggests that the presentation of the potential monetary costs of installing flood protection may constitute a barrier to uptake, as the quoted price is often significantly higher than the relative extra amount over the price of standard products.

4.4 Complexities in calculating potential benefits

As well as the large number of options and varied costs, another problem is that the potential benefits of flood protection measures are difficult to calculate. This is because much of the potential benefit of protection measures comes in reducing – rather than eliminating – the damage from flooding. Furthermore, the potential benefits of installing protective measures will vary enormously for different properties, based on location, structure and layout for example (Joseph et al. 2015b). The ways in which residents use properties will also make a large difference. A common piece of advice for flood resilience is to move valuable and important belongings to upper floors, but for people with mobility issues, the ability to prevent water from entering the ground floor is of greater benefit than to people who can more easily move upstairs (Mawhinney 2016).

Another challenge to understanding the potential benefits is the sheer range of costs that floods cause to households. These include a range of intangible and indirect costs; Table 2 gives some examples of these. These costs are not only difficult to assign a value to, but it is also difficult to predict their impact. How much leave from work is likely to be needed after a flood? For how long will alternative accommodation be needed?

The potential health costs of flooding – physical and mental – are well documented. Research into these has estimated that the average costs of GP care, plus other medical and productivity costs, were £970 per household over four months (Jeremy Benn Associates 2013). Clearly, though, such costs are difficult to anticipate and to estimate. Nor are they fixed, such as in the case of the costs to mental health after flooding, which evidence suggests are related to the length of time it takes to get back into a property (Lamond 2014, Stanke et al. 2012, Defra 2004). For small businesses, the time it takes to return to normal operation is a crucial factor in the overall costs of a flood (Li et al. 2015). Once again, the fact that flood protection measures are likely to be able to only reduce, rather than eliminate, these costs means that the value of doing so is harder for people to evaluate.

Some benefits of flood protection products may also be shared between different properties. This is clearly the case for measures that reduce the structural damage of flood water to terraced housing (Oakley 2018). There may also be positive side-effects of flood protective products that are not normally considered, such as savings on utility bills through making properties more energy efficient (Lamond et al. 2016).

| Indirect costs | Intangible costs |
|---|---|
| <ul style="list-style-type: none"> ▪ Telephone expenses ▪ Extra expenses on food ▪ Unpaid leave ▪ Costs of absence from work ▪ Extra travelling expenses ▪ Emergency services cost ▪ Alternative accommodation | <ul style="list-style-type: none"> ▪ Ill health ▪ Mental stress ▪ Pain and suffering ▪ Fear of further flooding ▪ Concern about inconvenience to family members and others ▪ Loss of items of sentimental value (e.g. photos, diaries) |

Table 2. Examples of the less obvious costs of household flooding. Source: Adapted from Oakley (2018)

Research attempting to evaluate how people value these benefits has asked people who have experienced flooding how much they would be willing to pay to avoid the costs of another flood. The most comprehensive approach to this has found that people who had experienced the serious floods of 2007 were willing to pay an average of £653 per household per year to avoid all of the costs associated with flooding (Joseph et al. 2015b). Another survey in England and Wales found that people who had previously experienced flooding were willing to pay an average of £200 per year to avoid the health impacts of flooding, while those who had no experience but were at risk of flooding were prepared to pay £150 per year (Defra 2004). However, a similar survey in Salford, but asking specifically about flood protection measures, found the average response was a willingness to pay only £100 (Bichard and Kazmierczak 2012).

The complexities associated with weighing up potential flood resilience options are considerable, ranging from needing a bespoke package of measures for a particular property, to difficulties in establishing both the costs and the potential benefits of such measures. These problems have been highlighted in the literature, and point to the importance of expert advice and support (Lamond et al. 2017).

4.5 Trust in surveyors, trades and products

When considering a surveyor, cost is not the only barrier to action, as a range of small-scale research has suggested that even after advice from a surveyor, households can

be left unsure of, or sceptical about, the efficacy of potential protection measures (Lamond et al. 2017). There is a number of possible reasons for this. A recent evaluation has highlighted that the independence of surveyors from suppliers is crucial in building trust in recommendations (Merret 2012). While independence is important, challenges in ensuring the knowledge and necessary flood-related expertise of surveyors have consistently been highlighted as a barrier to both building trust in the sector and effectively applying resilience measures (Harries 2009). One study summarised that there are "...major gaps in evidence, and in communication and sharing of available evidence, reducing the confidence in implementation of measures within relevant trades and professionals, as well as by owners and occupiers directly" (Lamond et al. 2017).

A factor that has been identified as a significant driver of these challenges is the lack of a clear set of standards for resilience measures, which means that surveyors and insurers as well as property owners may struggle to understand the efficacy of fitting differing options (Bonfield 2016). While there are Kitemarks to indicate that products have been tested, a recent Defra report highlighted that there were complexities relating to materials and installation procedures that could lead to errors in installation if not done by experts (Lamond et al. 2017). In particular, there are no currently accepted standards to indicate that particular materials are suitable for flood resilience.

This is further complicated by some individual low-cost resilience measures needing to use standard construction materials in a different way to normal. Water-resistant boards designed for bathroom walls, for example, may need to be applied throughout a property. While standards exist for the normal use of such materials, they do not exist for wider applications. Standards must therefore be evaluated on a case-by-case basis, which can cause confusion and errors even for professionals (Lamond et al. 2017). Some case study research has shown that government backing can increase confidence in the choice of measures (Defra 2014). This is a live issue being progressed by the industry and government.

Box 12: Messenger credibility

The trustworthiness and perceived expertise or credibility of the messenger are critical: if information on different products is not trusted or perceived as credible, we are less likely to make a decision to invest in property flood resilience, particularly if our starting point is uncertainty and unfamiliarity about the products and the benefits they provide.

We attribute different levels of trust and credibility to different messengers, as noted in step one. Endorsements from experts, familiar organisations and our own social networks impact the level of trust that consumers have in a product, although the most trusted messenger depends on the context (Elshout et al. 2016, Moser 2010). The use of Kitemark-type labels that are recognisable and standardised provides a degree of familiarity and credibility. These may be most effective when recognisably government-administered, though other organisations such as Which? have also been able to develop recognisable and trustworthy brands.

Expertise is not merely about credentials, and we may give more weight to personal experience from a trusted peer. Our friends and peers who have experienced a product are among the most powerful messengers. This is why 'refer a friend' schemes are such common and effective marketing tools, and also why customer review websites are often the primary resource for many consumers struggling to make a decision to buy. In the flooding context, if these peer-to-peer recommendations do not exist, there may be merit in creating them.

4.6 Summary of findings

Once someone knows they are at risk, and feels they can and should do something about it, they also need to be able to assess and access available options. A wide

range of PFR options are available, and consumers are expected to weigh up their pros and cons.

Behavioural science research shows that the complexity of decisions is a major barrier because the choices are complex and sometimes there are too many options. The complexity of decision making could be reduced by putting faith in an approved surveyor to make the decision for them or putting in place default mechanisms to remove the need for individuals to make a decision (e.g. industry standards, building regulations, resilient reinstatement for insurance claimants). PFR choices could be made easier by:

- Reducing the number of options
- Standardising the presentation of the pros and cons and costs and benefits
- Providing decision aids (e.g. comparison tools and websites, decision trees, Kitemark or categorical labels (such as traffic lights and letter grades))

5 Step four - I adopt resilience measures



The flood and hazards literature says

- Recent evidence suggests that only around 20% of households at risk of flooding have bought flood protection equipment. Estimates for small businesses are higher but are still less than a third
- High upfront costs may be a barrier to uptake. Evidence is inconsistent but suggests that higher income is positively related to higher uptake
- It may also be the case that people are unwilling to trade high short-term costs for uncertain (and intangible) long-term benefits
- The literature emphasises the importance of timing: a key window of opportunity to install disruptive resilience measures is immediately after a flood, when properties need repairs anyway
- But this is also a stressful and traumatic time, when people's priority is to get back into their property as fast as possible

The wider behavioural science says

- Absolute costs prevent us from buying items even when we recognise their value
- We consider an item's aesthetics when choosing whether to buy it. Ugly or unusual aesthetics can be overcome, however, when the item signals positive virtues
- Even when we recognise the benefits of taking action, we are less likely to do so if it is not easy and convenient
- We prioritise current costs over future benefits, making it difficult for us to spend money now to reduce flood damage in the future
- Without clear goals, and plans to achieve goals, we are likely to procrastinate
- We seek the approval of people in our social networks, so we are motivated to act when we believe others are watching
- Installing flood protection measures presents its own risks that need to be mitigated and minimised to encourage uptake

5.1 Introduction

Once a homeowner or a small business has identified the best option for them – whether through independent research or the use of an expert surveyor – the next stage is to make the decision to adopt the measures, and to follow through on that decision. According to a narrow rational account of economic behaviour, this step is straightforward: with the options having been assessed and trade-offs identified, the only remaining consideration is whether the benefits outweigh the costs. If they do, we adopt; if not, we do not. Through this lens, we might encourage uptake by reducing the costs or increasing the benefits of adoption. This extends to financial costs and benefits, but also time and effort, disruption and other non-financial dimensions such as aesthetic appeal. These are clearly important considerations. The wider behavioural science reveals a long list of additional barriers to taking action: we often act against our own best intentions, we procrastinate, and we often make biased decisions that go against our own best interests. In this chapter, we explore several of the most relevant factors that influence our adoption of PFR measures.

5.2 Affordability

As discussed in the previous chapter, the costs for packages of flood protection can be relatively high, which could present a serious barrier to their uptake, especially given the over-representation of vulnerable households in flood risk areas in the UK (Sayers et al. 2016). Research is mixed on the impact of income on the uptake of protection measures. Studies from Canada (Thistlethwaite et al. 2018) and Germany (Grothmann and Reusswig 2006) have shown that income correlates with installing mitigating measures. Other studies have found that there is no difference between the demand for hazard mitigation measures and income in the Netherlands (Botzen et al. 2009a) or the US (Lindell and Hwang 2008). Although the evidence is inconsistent, it could be interpreted as indicating that, while low income does not inhibit the understanding of the need to install protective measures, it may present a serious barrier to actually doing so.

This makes financial support an important part of attempts to promote the uptake of PFR measures. In the UK, this has focused on grants, which have been used to help property owners to afford protection. Schemes have tended to be launched in response to recent flooding, and vary a great deal in terms of the type and amount of support given. In England, the only support available is for households or businesses that have been victims of recent flooding. Up to £5,000 per property is available here to help pay for the installation of protection measures, but this is available only for repair works to properties flooded in December 2015 (BRE Trust, 2015a). Similar schemes also exist for properties affected by the winter 2013-14 floods (Department for Communities and Local Government 2014) and the November 2019 floods (Defra, 2019). Small amounts of money are also available to support businesses affected by these floods. In Scotland, households have been able to apply for grants of up to £1,500, and small business owners up to £3,000, for assistance in recovering from flooding in December 2015 and January 2016 (BRE Trust, 2015b).

While such schemes are a good way for the government to target limited funding at the time when it may be most effective, it does not assist households or small businesses seeking to proactively install protection measures. An exception is the homeowner flood grant in Northern Ireland, which makes up to £10,000 available for privately owned properties that have recently flooded or that are located in a known flood area (BRE Trust, 2009). As well as these national schemes, some local authorities provide council tax and business rates relief to aid recovery from episodes of flooding, while a

range of charities also provides support and funding. For such support to be accessible, it needs to be clearly signposted and relatively straightforward to apply for.

Overall, the evidence on applications to and the effectiveness of the UK's various forms of grant scheme is scant. What evidence there is suggests that grants and financial support in the UK do not meet these criteria. Particular concerns have been that, while money is provided from central government, it is distributed locally, and the criteria and eligibility regulations often vary from place to place. This adds complexity and makes it harder for people (including professionals as well as homeowners and businesses) to understand and access the scheme. One study focused specifically on evaluating a grant scheme suggested that people find it difficult to access information about potential support, and, where support is available, they find the application process confusing and arduous (Harries 2009).

High costs may also pose another barrier for consumers, even if they can afford them. Some of the most consistent findings from behavioural research are that people tend to value the present over the future, and tend to see losses as more significant than gains. Together these theories suggest that people are unlikely to trade a loss today for a payoff in the future (Kunreuther 1996). For example, it has been claimed that the usual framing of insurance may discourage uptake because it trades a loss of premiums in the present for an uncertain future gain (Slovic et al. 2004). The high upfront costs for flood protection measures may mirror this situation and be a barrier to uptake.

Connecticut's 'Shore Up CT' programme, which helps residential and business property owners to install protection measures by giving them 15-year loans at a relatively low interest rate, is an attempt to tackle this problem. These loans help property owners to spread the cost of the measures over a 15-year period, and the low interest rates are an incentive – because risk-priced insurance premiums will reward the installation of protection measures. The overall monthly costs could be lower than if the protection measures had not been taken up (Kunreuther 2017).

The attraction for homeowners of incentives for flood protection installation being built into insurance has been confirmed through research in the Netherlands (Botzen et al. 2009b), and has been proposed as a potential solution to problems of affordability and 'present bias' (Surminski and Eldridge 2017). However, while there are some exceptions, the current UK insurance market does not typically provide premiums to take account of whether or not flood resilience measures have been installed. This has been acknowledged by the industry, and various strands of work are under way to understand how this might be tackled and the impact it might have on the uptake of PFR measures (Flood Re 2018).

People have also been shown to be concerned about the longer-term financial implications of the installation of both resilience and resistance measures. Evidence from England demonstrates that people are wary of installing protection measures because, for example, of the signal they might send to prospective buyers (Harries 2008). Another concern is that the installation of protection measures will lead to higher insurance premiums (Harries 2008).

5.3 Non-monetary costs

Besides the monetary costs of installing flood protection measures, there are other costs that can be a barrier to uptake. Some of these are common to any construction work, including the time that installation takes and the disruption to everyday life during installation. It is likely that these issues are heightened among flooded households, who naturally want to be able to reinstate and return to their property as quickly as possible (Oakley 2018). Indeed, research has shown that the perception that a

measure will take a long time to install is negatively related to its installation (Poussin et al. 2014), and given the complex range of products and choices involved in adopting resilient repair, it is likely that this approach will be viewed as more time consuming.

Another significant issue that has been raised in the literature is that flood measures are often visible, and people do not like the aesthetics of them (Lamond et al. 2017). As well as aesthetics, the potential emotional costs of installing protection measures also present a barrier. As discussed in previous sections, some people face significant emotional barriers to taking up flood measures. These could relate to an unwillingness to see the home as being under threat (see Step one) or relate to challenges to a group identity if local social norms are set against flood protection measures (see Step two). Even once a decision has been made to consider installing protective measures, both of these elements may impose emotional costs, which people include when weighing up the costs and benefits (Harries 2011, 2008). This can be particularly true for resilience measures, which by their very nature acknowledge the likelihood of flood water entering a property. Resistance measures may be visible externally and so may be more of a challenge to social norms (Lo 2013).

Box 13. Aesthetics

Aesthetics may prevent people from choosing resilience measures they consider unsightly. In the wider behavioural science literature, this has been documented as a barrier to another type of life-saving home modification: the type designed to improve older people's safety and quality of life. Home modifications reduce dependency, increase daily activities and even reduce mortality among frail older adults (Stark et al. 2009). Despite these significant benefits, many older people resist home modifications and assistive technologies because they have an industrial appearance, including "ugly metal finishes and bulky, awkward shapes" (Bakker 1999).

In some contexts, conventionally unappealing aesthetics have become a benefit through being signals of virtue, such as with some early electric cars (the Toyota Prius, for example, has been called "one of the ugliest new cars money can buy"; Stevenson 2018). This ugliness allows owners to signal their green credentials conspicuously, and one study found that US consumers would pay up to \$4,200 for the green signal associated with Toyota Priuses (Delgado et al. 2015). There is a similar effect with many homeowners and neighbourhood associations viewing solar panels as a threat to neighbourhood aesthetics (Rule 2010). In certain areas in California, homebuyers pay a premium for solar panels above their true value, likely to be due, at least in part, to the pride in producing green electricity (Dastrup et al. 2012). This begs the question of whether there are any similar benefits to PFR measures that have unconventional aesthetics – such as raised electrical sockets or noticeable door seals. This is doubtful – there is little virtue to signal (being flood resilient is not a moral stance in the same way as being environmentally conscious), and there is little social kudos to gain. A more relevant lesson therefore might come from Tesla. In opposition to the likes of the Toyota Prius, Tesla sells electric cars, not on a message of conspicuous environmentalism, but rather by making cars that are conventionally desirable – showing high status, being fast and luxurious – and just happening to be green. The lesson is that we should not be naive in expecting people to compromise their aesthetic values, and should instead ensure the market is able to provide PFR measures that are at least as appealing, if not more so, than non-resilient products. Examples might include concrete flooring that can be both flood resilient and aesthetically desirable. Indeed, improving the aesthetic of our homes is a strong motivator that could be harnessed. After the stress of a flood, having parts of the home renovated and (partially or fully) covered by an insurer is likely to be a silver lining to an otherwise distressing experience. The desire to opt for products and finishes that we actually like, rather than unsightly products that simply add to the ongoing negative experience, will be strong.

5.4 The importance of timing

One issue that is important and has been identified in numerous reports is that timing and, in particular, the presence of windows of opportunity, is a crucial factor in enabling people to make decisions on protection measures (Oakley 2018). The most obvious

window of opportunity for the installation of flood protection measures is immediately after a flood. There is a number of reasons for this. First, as discussed in step one, people's awareness of the risks they face, and motivation to install protection measures, is likely to peak immediately after a flood. Second, as discussed in step three, flood protection measures will be at their most cost-effective immediately after a flood, because structural repairs and reinstatement – not to mention the disruption of construction work – happen at these times anyway. Yet, working against the opportunity is the existence of other pressures at this time. Flooding is a stressful and traumatic experience, and a priority for affected households is to complete flood repairs as quickly as possible. This means that there may be a reluctance to take up measures that delay (or are perceived to delay) reinstatement and the return to the home (Oakley 2018). Given the relatively complex and lengthy process of identifying and evaluating appropriate protection measures, there is clearly a barrier to installation immediately after a flood.

This attitude is not limited to homeowners: it is important for the survival of small businesses that the recovery time is as short as possible, a priority typically shared by professionals, including building trades and surveyors. Following the 2015 flooding, agencies and professionals were found to doubt the desirability of delaying repairs in order to build in resilience measures (Lamond et al. 2016). This quest to be quick among professionals has meant that previously installed resilience measures may not be recognised and may be discarded and replaced (Lamond et al. 2016).

Having repair and reinstatement plans in place, before flooding occurs, has been suggested as a way of avoiding some of the stress that can act as a barrier to uptake immediately post-flood (Lamond et al. 2016). The wider behavioural science reinforces this view. Research on implementation intentions (pre-set 'if, then' plans) shows that having plans that are set during periods of calm, which can then be drawn on during a period of difficulty, is more effective than making decisions during the difficult moment (Gollwitzer and Sheeran 2006).

A further problem relates to insurance companies. Resilient reinstatement can cost significantly more than standard post-flood reinstatement. Estimates vary, but one study of resilient reinstatement in England found that it was between 23% and 58% more expensive, depending on the house type, and 34% more expensive on average (Joseph et al. 2011). Other estimates are around 40% (Surminski and Eldridge 2017). Research has revealed that knowledge of resilience measures among insurers is not widespread, while a survey of insurance brokers revealed that over half said the insurers on their panel would reject claims that involved resilient repairs at higher cost. Over 30% said they would even reject claims that involved cost-neutral resilient repairs (Lamond et al. 2016). Indeed, even the insurance industry itself highlights that resilient repairs are considered an investment in the property that would not normally be funded (Association of British Insurers, 2019).

While the time immediately post-flood seems optimal for installing protection measures, overcoming the obvious emotional and time barriers could be difficult. There are other windows of opportunity though. Insurance renewal, for example, has been highlighted as a time, particularly for businesses, to take advantage of protection measures (Lamond et al. 2016). It should also be pointed out, however, that the focus on single windows of opportunity should not obscure the fact that the ongoing installation of less intrusive protection measures is also important and encouraged (Lamond et al. 2016).

5.5 Making the decision

There are several additional psychological factors that, while not being explored in the flooding literature, have good evidence for many other consumer decisions. These can broadly be clustered as biases and heuristics in decision making. Referring back to

Box 3, such cognitive biases should not be considered irrational, or to imply inferior judgement, and the evidence shows that they certainly do exist. We reliably draw on a number of common heuristics (mental shortcuts) in forming our decisions, and myriad cognitive biases predictably veer our decisions towards certain outcomes. Among many other consequences, these cognitive processes cause us to prioritise near-term costs and benefits over those in the future (present bias), lead us more strongly towards inaction and leave us susceptible to influence from our peers.

Box 14. Biases and heuristics influencing decisions to adopt

Present bias

Present bias is our tendency to ascribe more value to immediate rewards and costs than to those in the future (Loewenstein 2005). As a deeply evolved trait, this is intuitively logical where the future is uncertain, but also leads us towards suboptimal decisions where the temptation for immediate gratification or convenience overrules wiser long-term goals.

One method to combat present bias is to make the ‘future self’ more salient. People who saw digitally generated images of their future selves chose to accept later monetary rewards over immediate ones (Hershfield et al. 2011). One study found that a message asking email recipients to “Picture who you will spend time with in retirement” caused more recipients to engage with retirement planning tools than other behaviourally informed messages (The Behavioural Insights Team 2018c). When the retailer John Lewis modified price labels on home appliances to also show the lifetime running cost, customers bought more energy-efficient washer-dryers. These tended to be significantly more costly upfront, but saved money in the long run (Department of Energy and Climate Change 2014).

Another strategy is to move costs into the future and benefits into the present. One method of doing this is to ask people to commit in advance to costs in the future (at the time of committing, the cost is further into the future). Asking people to commit to a future salary savings programme increases uptake compared with asking them to start saving now (Thaler and Benartzi 2004). Subsidy and repayment schemes can also help to delay costs (Meier and Sprenger 2010), as with the UK’s Green Deal. Similar schemes could exist for flood resilience measures. For example, it might be possible to provide low-interest loans to new homeowners (coinciding with the benefit of a timely moment), paid back through a mortgage add-on.

Status quo bias

For many people, doing nothing is the status quo. It is well documented that people prefer to maintain their status quo, even when there is seemingly an economic benefit to making a change (Kahneman et al. 1991). There are various reasons for this, including laziness (and the fact that friction costs discourage us to take action). We also tend to view the status quo as a safe option (since it has worked fine so far), and deviate from it only when there is a clear need. This is related to, and exacerbated by, risk and ambiguity aversion (described below), and might be colloquially described by the heuristic of ‘if it isn’t broken, don’t fix it’. In the flooding context, unless there is a known imminent flood or past experience of one, the need is rarely pressing, and thus it is always easy and consequence-free in the short term to do nothing. Our innate loss aversion (a greater sensitivity to losses than to equivalent gains) also contributes to the status quo bias, since we tend to be more sensitive to the potential downsides of change than to the upsides.

Status quo bias can be leveraged by changing the default such that inactive consumers receive some benefit automatically and must proactively opt out if they wish to. While it may not be possible to automatically default properties into receiving property flood resilience measures, there may be certain steps that can be defaulted (such as receiving a home survey in certain situations, or receiving an application form for a grant). Examples of defaults that have been particularly successful in life-changing decisions include: more than 90% of eligible workers in the UK stick with the default pension scheme they are automatically enrolled into (Choi et al. 2004); and 77% of seriously ill patients accepted a comfort-oriented end-of-life care regime when it was the default option, while only 43% of patients with a different default option accepted it (Halpern et al. 2013).

When defaults are impractical or unethical, an alternative approach to combat status quo bias is to prompt consumers with active choice. This is where there are no defaults, but consumers are required to make a choice between several options, one of which may be inaction – but they must actively indicate this choice (Carroll et al. 2009). Forcing people to select an option increased the numbers getting a flu vaccination, for example (Keller et al. 2011).

Social influence

The actions and opinions of our peers influence our decision making: if other people have chosen to protect their homes, we are more likely to do so, as we infer that it is a sensible and normal thing to do. One study with particular relevance to the flooding context showed that the more that houses around us have rooftop solar panels, the more likely we are to buy them ourselves (Graziano and Gillingham 2015). Moreover, it matters if the solar panels are visible from the street or not, showing that norms are effective only when observable. Flood resilience measures are likely to be far less visible than solar panels, meaning this norming effect may be underexploited. Highlighting the prevalence of adoption (with social norms messages) may therefore be advantageous. There might also be benefits to making it more obvious when a home has had flood resilience measures fitted – a temporary sign left outside by the installers, for example.

Risk and ambiguity aversion

For some people, installing flood resilience measures may seem risky: they could cause damage to their house or waste money if they choose the wrong measure, have it incorrectly installed, or be overcharged by an unscrupulous supplier. The benefits of property flood resilience measures are also hard to measure. We are generally averse to risky and ambiguous outcomes (Ellsberg 1961), so the prospect of spending significant sums of money on ambiguous benefits (and possible detriments) may be unappealing.

Prospect theory provides a sophisticated account of our risk preferences under uncertain gains and losses. With gains, we are on average risk-averse, so would prefer to take a guaranteed £50 over a 50% chance of £100. Conversely though, we tend to become risk-seeking when dealing with certain losses versus probabilistic ones. This suggests we might rather take the low risk of financial damage due to a flood than the guaranteed loss spent on flood resilient measures. Note, however, that this is a simplistic account. The reverse often seems to be true when the guaranteed gain or loss is trivial and the probabilistic gain or loss is large but subject to long odds. For example, we might prefer the lottery ticket (probabilistic gain) rather than keep the £2, and we might prefer to buy insurance (small guaranteed loss) over the long odds of being financially harmed. Clearly, our preference for risks depends both on whether they are with respect to a gain or loss, and the relationship between the likelihood and the size of windfall or damage.

When dealing with decisions that grapple with risk and uncertainty, we are more likely to act when messages emphasise the benefits or gains, and to de-emphasise the risks or losses of activities with uncertain outcomes. One seminal study showed that when medical treatments are framed in terms of survival rates rather than death rates, doctors are more likely to recommend them (McNeil et al. 1982). Credible advice about making a decision may also reduce the effects of risk aversion (Druckman 2001).

We may also be more likely to take a chance on technology that we consider risky if we feel less committed to the decision. For instance, mortgages and other leased products tend to be more expensive the shorter the period is, showing we are willing to pay a premium for less commitment (Shih and Chou 2011). Returns periods and other forms of consumer protection also increase consumer confidence in buying, and thus lead to higher sales. Though it may not be possible to return certain flood resilience measures, the key insight is that consumers are more willing to invest where there is some perceived safety net or guarantee against regretting the decision. Across various industries, different mechanisms achieve this aim, including Kitemarks and recognised quality standards, money-back guarantees and warranties, and 'no-win no-fee' arrangements.

5.6 Acting on the decision

Once a decision is made, and intentions formed, there are still practical and psychological barriers to acting on those intentions. We therefore often observe an intention–action gap. Again, these issues are not addressed by the flooding literature, but are well evidenced in other applications of behavioural science.

Box 15. Additional factors that inhibit or encourage action

Friction costs

Friction costs are small points of hassle or inconvenience that may seem trivial but are often found to have a disproportionate impact. Taking up flood resilience and resistance measures can be a process rife with friction and hassle. In many cases, people have to take an initiative to coordinate the installation of flood protection measures, as well as to disrupt their routines and their homes to do so. Furthermore, as seen earlier, the process to obtain grant funding to pay for new measures can be cumbersome, which adds additional layers of friction to the adoption process. Even something as simple as booking a home survey can be effortful. Research shows that small frictions like having to wait on hold during a phone call, or needing to be at home during working hours, can be disproportionately debilitating to action, particularly where there is little urgency to get the job done. Removing just a single mouse-click from a tax payment process (by sending people directly to a form, rather than to a further webpage hosting that form) has been found to increase on-time payments by 22% (The Behavioural Insights Team 2014).

Friction costs are also relevant in business settings. Based on qualitative research, smaller businesses are more likely to have a low awareness of government schemes or to find them difficult to navigate. Small firms are more likely to be put off by friction costs from applying for schemes than firms with more than 50 employees (The Behavioural Insights Team 2018a).

Removing friction costs can therefore have impact. Research on the adoption of loft insulation has shown that offering a loft-clearance service with the installation triples the number of people buying the insulation, even though customers have to pay significantly more for the service (Department of Energy & Climate Change 2013). (Note, though, that uptake was still very low.)

Reducing the number of small steps needed in taking up flood protection measures may have a disproportionate effect on outcomes. This is true even for big life decisions. Research showed, for instance, that students were eight percentage points less likely to attend university when they had to complete empty rather than pre-filled application forms (Bettinger et al. 2012).

Friction costs can be minimised by intervening at timely moments. The flooding literature is clear that timely moments are important. People are likely to be more receptive to installing property flood resilience measures when installation is most convenient, such as when moving house or when renovation works are happening anyway. This is partly because the hassle is temporarily lessened, but also because these moments present natural breaks in our ongoing habits. For example, the U.S. city of Portland bike share program had higher uptake among people moving into neighbourhoods with existing bike stations than people living in neighbourhoods where new bike stations were installed. For businesses, timely moments will be different, possibly related to strategic planning or budgeting, or off-peak seasons.

Procrastination

Short of responding to an ongoing or imminent flood with a last-minute mitigation action, there are often no clear decision points for when flood resilience and resistance measures need to be installed. More immediate and necessary demands on our time, attention and money will therefore naturally take priority. Our tendency to procrastinate is related to ‘present bias’ – we prioritise the immediate gratification of doing something more fun, and ignore the long-term detriment of failing to take action. Simply never ‘getting around to it’ is therefore likely to be a major barrier to the adoption of flood resilience measures, even among people who have good intentions.

There is a variety of ways to address this procrastination such as:

- **Artificial deadlines**, such as when applying for grant money or receiving a free property survey, work because they create a specific decision point, addressing the problem of a lack of urgency. Participants in a lab study were more intrinsically motivated to complete a task when they had to finish it within a certain time limit (Amabile et al. 1976). The New York City Office of Recovery and Resiliency found in a randomised controlled trial that households who had not yet completed a flood survey were 15.5 times more likely to do so if they received a 'last chance' letter instead of the typical letter (Behavioral Evidence Hub, 2016). Among other behaviourally informed changes, the letter had FINAL NOTICE printed on its envelope and began with, "This is your last chance – you must respond within one week!" Deadlines can be effective also because they harness the scarcity effect: if a precious resource (such as grant money) is running out or limited to a certain number of applicants, it becomes more attractive, partly because it signals the preciousness and value of that resource, and partly because it implies that others are using it up (a form of social proof).
- **Prompts and reminders** have also proven successful to help people overcome inaction. Reminders in SMS text messages have been shown to enhance healthy behaviours, from smoking cessation to adherence to medication (Orr and King 2015) and in personal finance, people who received reminders were 3% more likely to achieve their savings goals (Karlán et al. 2010). Reminders coming from one's own social network can be particularly effective. A study of 1,800 students across 9 further education colleges in the UK found that texting students' friends and family, to encourage them to prompt and support the student, has improved class attendance by 5%, and achievement by 27% (The Behavioural Insights Team, 2017c). Reminders have proven to be effective in a business context, too. SMS messages sent to businesses in Costa Rica to remind them that they had not yet filed their tax returns significantly increased compliance rates (Brockmeyer et al. 2016).
- **Implementation intentions** ('if, then' plans to put intentions into action) have been an effective strategy for helping people to complete their goals in a variety of contexts (Gollwitzer and Sheeran 2006). Implementation intention strategies include breaking large goals down into actionable plans and planning for how to cope with potential barriers, so that a strategy is developed before the barriers emerge (Gollwitzer and Sheeran 2006). Plan-making interventions do not need to be intensive to be effective; encouraging employees to simply write down the time and date of their appointment increased vaccination rates by 4.2 percentage points (Milkman et al. 2011), and prompting women to decide where and when they would examine their breasts a month later increased the likelihood that they would do the self-examination (Orbell et al. 1997).
- **Checklists** are also an effective way to help people to break large goals down into smaller, more manageable steps. Sending drivers a checklist of steps to complete their licence renewals online led to an increase in these renewals (The Behavioural Insights Team 2016). Checklists can be combined with the goal gradient hypothesis to motivate people to achieve their goals more quickly. This hypothesis (also known as the endowed progress bias) describes our tendency to be motivated by a sense of progress towards a goal (Kivetz et al. 2006). For example, customers who received a 12-stamp coffee-shop loyalty card with two stamps pre-filled completed the card faster than people who received a blank 10-stamp card (Kivetz et al. 2006). Similarly, where the adoption of flood resilience measures relies on a multi-step process, highlighting to homeowners (after a home survey, for instance) that they have already progressed part way along the journey may boost their motivation to continue.
- **Starting small** – a foot-in-the-door effect – is another similar strategy to spur action and commitment (Freedman and Fraser 1966). By first complying with a small request or action, we are more likely to later comply with a larger request – we try to remain consistent with our past behaviour. This tendency has also been observed among businesses in a hazard preparedness context. One study found that businesses that had already done more to protect themselves before an earthquake were more likely to take extra measures after the event (Tierney and Dahlhamer 1997).
- **Appealing to ego** – or making people feel special or privy to an exclusive opportunity – has been shown to improve people's engagement with, and uptake of, services (The Behavioural Insights Team 2016). For example, postcards with the message "you've been selected to receive a free large item removal" resulted in 146% more residents scheduling a large item collection than postcards that highlighted the costs to the city of improperly dumped items (The Behavioural Insights Team, unpublished data). Interestingly, the approach also seems

to work for businesses. The Behavioural Insights Team and HM Revenue & Customs tested the idea in a trial that aimed to increase the uptake of business growth vouchers among small and medium-sized enterprises. An email version indicating that the businesses had been 'chosen' to receive the information was significantly more effective in encouraging small and medium-sized enterprises to visit growth vouchers websites (The Behavioural Insights Team 2015). Similar messaging could help to increase applications for grants, or participation in community-wide efforts.

5.7 Summary of findings

Once a homeowner or small business has identified the best option for them, the next stage is to make the decision to adopt the measure(s), but there are psychological and practical barriers which can prevent this action.

A low income can act as a barrier to installing PFR measures. This is particularly relevant because vulnerable households are over-represented in areas at risk of flooding in the UK. Financial support (e.g. grants) could help promote the uptake of PFR measures; to be accessible, they need to be clearly signposted and straightforward to apply for. The need to commit upfront expense for a long-term and uncertain benefit can also deter action. Long-term, low-interest loans are effective if combined with risk-based insurance premiums (insurance saving can outweigh cost of servicing the loan).

Evidence from the UK shows that aesthetics also matter. PFR might act as a signal to prospective homebuyers and, as such, reduce the value of the property. Timing is also a crucial factor in enabling people to make decisions on PFR measures. Immediately post-flood is the optimum window of opportunity to install PFR measures. Other windows of opportunity such as the renovation or sale of a property by introducing flood protection certificates could be one way to encourage action.

Friction costs (small points of hassle or inconvenience) can lead to a tendency to procrastinate non-urgent actions where no natural deadlines exist and the motivation to do start works is weak. Removing these friction costs, by imposing deadlines or harnessing timely moments when action is easier, are ways of overcoming these barriers.

6 Step five - I regularly check whether I am sufficiently protected



The flood and hazards literature says

- Flood protection measures need periodic testing and maintenance
- It is also important that residents are trained in how to deploy temporary measures – and that this training is updated regularly; especially important when new residents move in
- Recent research has found that while most flood protection measures are successful, when they are not, it is because of a defect or not being successfully deployed
- Research highlights the importance of ongoing engagement with flood risk – it cannot be forgotten about after installing flood protection measures
- The importance of trigger points that lead to testing, maintenance and training has been highlighted – such as community-wide maintenance contracts or an MOT-style annual system of testing, inspection and certification

The wider behavioural science says

- Habit formation is important for encouraging recurring behaviours. Habits can be formed intentionally or based on our environment
- Information about the maintenance and use of flood protection measures should be easy to understand and memorable
- We are incentivised to avoid a loss in the value of equipment we already own. Making the value of existing flood protection measures visible could help to activate this loss aversion
- We are incentivised by monetary rewards, but they can backfire by replacing the intrinsic reward of doing the right thing. In contrast, non-monetary rewards can help to strengthen existing intrinsic rewards

6.1 Introduction

After flood protection measures have been installed, they may not be needed for a number of years. Yet, to ensure that they will function effectively when called on, they

will need periodic testing and maintenance. Over time, products may deteriorate and need updating, such as in the case of worn seals (Defra 2014). This means that people need to understand how the products should be stored when not used, how they should be maintained, and whether any extra equipment is needed to make them fully functional (Defra 2014). Such knowledge is particularly important when new owners take over a property, as they may be much less familiar with living in a flood-risk area, and unaware of measures already installed, or unable to operate them. Yet a recent review of the installation of resilience measures in the UK found a number of problems related to how protection products are maintained and kept effective (Lamond et al. 2016).

This clearly has implications for how effective products will be when they are used in episodes of flooding. A case study of the 2012 floods found, for example, that in one village, “instances of poor product storage and maintenance” were causes of problems in the functioning of protection measures (Defra 2014).

In principle, this suggests that an approach like protection motivation theory should also be applied to the ongoing decisions people make in engaging with, maintaining and storing protection measures. Little attempt has been made though to formalise the theory behind the need for ongoing engagement – and direct evidence on these issues is scant. What little evidence there is will now be summarised.

6.2 Lack of engagement

An evaluation of the property-level protection scheme that ran between 2007 and 2012 – providing support to over 2,000 households in installing flood protection measures in 100 different areas the UK – found that there was a lack of engagement of some property owners with information about how to use their resilience products (Defra 2014). The evaluation highlighted that it was important that people were aware of their responsibility for the use and upkeep of their own products (Defra 2014).

Similarly, a review of the property-level protection grant scheme found that the gains residents had experienced from the installation of protection measures were vulnerable if products were not properly maintained. The review highlighted that the level of engagement needed for ongoing monitoring and maintenance was significant, and raised concerns that it could be undermined if an absence of flood events led to a loss of interest in flood protection.

Other research has suggested that threat appraisal applied to flooding is lower in households that have installed resilience measures (Poussin et al. 2014). To some extent, this reaction is logical, as households with resilience measures are likely to judge the potential damage and costs of flooding to be lower. However, it does imply a drop-off in people’s engagement in the threat of flooding. This suggests a need to consider theories such as protection motivation theory in the context of ongoing engagement.

Local flood risk management agencies and support groups have demonstrated an important role in terms of how to encourage ongoing engagement (Harries 2009). In particular, an evaluation of property-level protection schemes noted that community engagement was easiest when coordinated through local flood groups (Defra 2014). Indeed, the National Flood Forum recommends that the testing and maintenance of measures could be undertaken as part of a regular, community-wide exercise (National Flood Forum, no date, a).

Box 16. Cognitive load and loss aversion

There are many further factors contributing to a lack of engagement, and much common ground with the issues discussed in the previous steps. For instance, the status quo bias, and our tendency to disengage from information are both relevant to ongoing maintenance. Two further factors are worth revisiting: cognitive load and loss aversion.

Cognitive load

The complexity of deploying and maintaining flood resilience measures may pose a barrier. As discussed in step three, we can often achieve disproportionate impacts by simplifying processes and information. Comics and illustrations, for example, to explain step-by-step actions and processes, have proven successful in other contexts. In one study, researchers developed a comic to explain how to cancel a credit agreement. Showing the comic to buyers of used vehicles increased the buyers' scores on questions about the process, from 78% to 97%.

Loss aversion

Flood protection measures can be costly, so there is an incentive to keep them maintained. However, this fact may not remain salient to us after we have been living with the (unused) resilience measure for several years, or if it was already installed when we moved into the home. Reminding homeowners of the value of the resilience measures, and the extra unplanned cost they would incur to replace them if they were allowed to fall into disrepair, may therefore be valuable. In particular, it would be worth highlighting the loss. Loss aversion refers to the fact that losses and disadvantages have greater impact on individual preferences than equivalent gains and advantages. This means we ascribe more value to something we already own (Loewenstein and Adler 1995). In practice, this suggests someone who moves into a home with a particular resilience measure already present may not ordinarily have chosen to spend the money on that product, but by virtue of now owning it, may value it more highly. Harnessing and encouraging this sentiment, with messaging that highlights the value and the loss we would incur by not maintaining, may be effective.

6.3 The importance of trigger points

Some literature has focused on how maintenance tasks can be prompted in various ways. Community-wide maintenance exercises would be one way of triggering residents in a particular area to think about their products. Among this work is a focus on particular moments that could be exploited to encourage maintenance and the effective upkeep of products. The installation process has been highlighted as one such point. Product-testing dry runs in particular are recommended at installation so that residents are able to see the process of using the products, and to ensure that people are aware of any equipment that may be needed (Defra 2014). Indeed, an evaluation of the property-level protection schemes found that the importance of maintenance began during the process of installation. It was a general view of stakeholders that, ideally, the handover of an installed product is not just “the provision of a training manual, but is seen as an integral part of the education process”. This would demonstrate to the homeowner that “the product is watertight, thereby ensuring confidence in the property level protection package provided”. It would also give “a valuable opportunity for the installer to train the resident in deployment” (Defra 2014).

Another opportunity is to use the engagement of people at product installation to create an artificial future trigger point through the signing of a maintenance contract with the supplier. Case study research has shown that many product providers offer such contracts, and they are recommended by the National Flood Forum (no date, a). Such contracts could be individual or community-wide and would specify a date on which the suppliers would service and maintain the products and give further training on how to use them (Defra 2014).

The evaluation of the property-level flood protection scheme also called for an independent annual test and inspection of all protection measures and their deployment arrangements. The report describes the test as “analogous with that of the MOT process that ensures the roadworthiness of vehicles. The annual testing of performance and condition by an independent and approved assessor, with the generation of an approved sign-off certificate (flood risk report), is a statement of the property level protection ‘roadworthiness’ on an annual basis” (Defra 2014). Insurers could also have a role in incentivising the use of such tests, by, for example, requiring them to be up to date for insurance renewal. Such ongoing commitments would provide a level of continuity to the maintenance, testing and training regimes that could help to deal with problems that develop through property sale or rental, or holiday properties with a relatively high turnover of residents.

Box 17. Procrastination and habit

Many of the behavioural factors discussed within previous steps – including the importance of timely moments, plan-making, prompts and reminders are again highly relevant here. We highlight two further behavioural factors: procrastination and habit.

Procrastination

Just as with buying and installing flood-protection measures, there are no clear decision points or moments of urgency for when most measures need maintenance work, or people need to practice using them. This means that people are likely to procrastinate against performing these activities, even when they are aware of the need and have the vague intention (to do them at some point). When the moment of urgency does arrive (e.g. during a flood or flood warning), there may not be enough time to fix/maintain/replace the product.

Many of the strategies discussed under step four for overcoming procrastination about installing the measures are relevant for maintaining them. Deadlines and reminders can be used to achieve maintenance goals. A key difference is that maintenance goals are ongoing – deadlines, and reminders should therefore be recurring. For instance, retailers might send reminder emails after a certain time to replace a seal or do basic maintenance work, or ‘replace by’ dates might be clearly marked on the products themselves.

Habits

Some maintenance activities are so regular that they should be a matter of routine – clearing out leaves and other debris from drainage points each time we mow the lawn, for example. The science of habit formation is therefore relevant. Traditional models for habit creation assume a strong motivation for change in the target audience, for example when we are trying to quit smoking. They emphasise a downstream approach that focuses on interventions at the individual level. Downstream interventions often involve the ‘three Rs’ of habit change: identifying conscious trigger points as *reminders* to overcome an automatic response, replacing the normal response with a new *routine*, and *rewarding* the new behaviour until it becomes automatic.

The flooding literature demonstrates that people’s motivation to prepare for floods is often weak, though, meaning that upstream interventions intended to create good habits (rather than to break bad ones) are likely to be more effective. Upstream interventions change the environment in order to shape people’s habits, often through defaults. In the context of equipment maintenance, defaults involving appointment scheduling are especially relevant.

Students who were sent an email with a default day, time and location for a flu shot appointment were 36% more likely to get vaccinated than students who were sent an email encouraging them simply to schedule an appointment (Chapman et al. 2010). Suppliers booking in a maintenance appointment or survey (unless the customer has opted out) will likely be more effective than those expecting customers to proactively book one themselves. Again, ongoing prompts and reminders are also key, while removing frictions (to make action as easy as possible) will help us to follow through on vague intentions. Attaching the action to something already done regularly (such as in the leaf-clearing example) may also be beneficial, since it attaches a new behaviour to an existing routine.

6.4 Summary of findings

After PFR measures have been installed, they may not be need to be used for a number of years. To ensure they work when needed, they will need periodic testing and maintenance which could result in them being updated or parts replaced. A recent review of the installation of resilience measures in the UK found a number of problems with maintenance. Little evidence has been found of engagement with PFR owners around the need for long-term maintenance. Maintenance of PFR could be prompted by the use of:

- Deadlines or reminders
- Independent annual tests and inspections similar to an MOT
- Signing up (when PFR measures are installed) to annual maintenance checks
- Tying maintenance check to other actions (e.g. clearing drainage points)

More research is needed to understand how maintenance behaviours can be encouraged.

7 Step six - I take action in critical moments



The flood and hazards literature says

- Only 6% of respondents to a recent survey said that they had made a flood plan and were sure of what to do in a flood, while 31% said they did not know what to do. In 2013, only 37% of people had signed up for flood warnings
- Of those with experience of a previous flood, a third did not take action after receiving a flood warning, while more than a third did not feel that a flood warning meant there was a risk that water would reach their property
- The hazard literature suggests that responses to disasters are influenced by how others react, so community-level plans are important
- Also, individual-level factors such as trust in the authorities and experience of previous hazards have an impact on how people react
- Research suggests that flood warnings need to strike a balance between being comprehensible and being as personalised as possible, while also providing instructions for what to do and not merely stating the existence of a risk
- Small businesses face specific risks during flooding that need to be managed through planning, including for access to finance and customer communications. But small businesses also have specialisations and resources that can be called on during flooding

The wider behavioural science says

- Our failure to react to flood warnings is consistent with our increased reliance on heuristics for decision making under stressful and time-constrained situations. Therefore, decisions about how to act during floods should be made before flooding events, or decision points should be removed entirely through automation
- Due to the effects of herd behaviour, our actions during floods are influenced by those around us. This is because we believe other people have more information than we do and are acting appropriately based on it, and because we fear the reputational effects of deviating from the norm
- The lack of trust in government-issued warnings means that other sources, including social networks, may be more trusted in this context.

7.1 Introduction

During a flood, residents and small business owners (and employees) in properties with resilience and resistance measures must be adequately prepared to be able to operate their products in the correct manner and to respond to advice from authorities. This is particularly true for non-permanent measures that need either installation or activation during a flood. Where preparation is in place, a review of the performance of property-level protection measures in floods in 2012 highlighted that they are effective. If deployed and used during a flood, they successfully prevented or reduced the effects of the flooding in 84% of properties (Defra 2014). Some measures were ineffective, though, either because of a defect or because they were not successfully deployed. Research from other countries has also demonstrated challenges in the deployment of the protection measures that are available. A survey of residents of New York City after Hurricane Sandy in 2012, for example, found that less than half of the respondents who owned storm shutters had actually installed them before the hurricane (Meyer et al. 2013).

7.2 Poor knowledge and inability to act

In part, a lack of use of available measures is likely to be due to a lack of knowledge about how to deploy them, especially among residents who have moved into a property after measures have been installed (Lamond et al. 2016). A recent review found that, as well as because of a lack of knowledge, some products were not used because they were inappropriate, as they were too heavy to operate for older residents (Defra 2014).

As well as impacting directly on the effectiveness of the measures that have already been adopted, efficacy could significantly impact the likelihood of PFR measures being chosen in the first place. As noted in step two (about feeling able and responsible), a vital part of deciding to take up flood protection measures is that people feel that they are effective. Confidence in measures can easily be undermined by unsatisfactory performance. This can have demotivating effects on residents within communities and could build up barriers to further uptake or use of protection measures.

7.3 Flood plans

One common route through which people can be supported to use PFR measures effectively during a flood, as well as effectively preparing for and reacting to floods more generally, is the creation of a flood plan. This might typically include a list of important contact details (such as for neighbours, utilities providers, insurers and the local council), a list of things to remember (such as the location of utilities cut-off mechanisms) and a checklist of actions to take if a flood is expected. These actions include moving electrical items and furniture to safety, putting documents in watertight containers and operating flood protection measures (such as flood boards and sandbags). Such a [personal flood plan checklist](#) is available from the GOV.UK website (Environment Agency 2017).

Small businesses are also advised to create a business continuity plan that would specify how they could minimise disruption to their business operation. This involves considering what equipment is essential to protect, how to access short-term funding to solve cash flow problems, the possibility of temporary alternative premises, and how communications and customer service problems might be minimised (Coates et al. 2016a).

While these steps could be effective, past surveys have demonstrated that people in the UK are underprepared for how to act in a flood. Only 6% of respondents said they

had a flood plan and were sure of what to do during a flood, while 31% said they did not have a plan and would not know what to do (Know Your Flood Risk, 2015). A survey among at-risk people in England in 2013 found that only 34% had thought through or prepared a flood plan (Langley and Silman 2014). Research among small businesses in the UK has also found that few have done any formal planning for flooding (Coates et al. 2016b).

Box 18. Hot-cold empathy gaps and implementation intentions

People do not always react logically to hazard warnings. Time pressures, stress, anxiety and uncertainty all cause us to act in ways we might ourselves recognise as suboptimal under more cool-headed reflection (Svenson and Maule 1993). This gap between our cool-headed intentions and our hot-headed reality is described as the hot-cold empathy gap. Studies show that we rely much more on emotion than reason when making decisions subject to stress and time constraints (Finucane et al. 2000).

The making of plans is therefore of particular importance. The literature on implementation plans and intentions highlights the importance of making pre-set strategies (under a cool-headed state) that we can draw on during the hot state without needing to improvise. In practice, this would involve encouraging people to make detailed 'if, then' plans before a flood occurs. This strategy has been shown, in a variety of contexts, to be more effective than in-the-moment, goal-directed behaviour (which lacks a pre-set strategy for dealing with particular obstacles) (Faude-Koivisto et al. 2009).

7.4 Flood warnings

A system of flood warnings is in place in the UK. People can sign up to receive warnings via a number of methods, including text messages and emails. These warnings have three levels: flood alerts are at the lowest level and are issued when flooding is an imminent possibility; flood warnings are for situations in which flooding is expected; and severe flood warnings are used when flooding is severe and poses a risk to life. These levels are the same across the four nations of the UK, and each warning is associated with a series of actions (Environment Agency 2019, Natural Resources Wales 2019, Scottish Environment Protection Agency, no date).

Understanding and trusting flood warnings is vital to helping people undertake the correct action during a flood. However, a survey among at-risk people in England in 2013 found that only 37% had signed up for flood warnings. Recent flooding events in the UK have also offered evidence that people's responses do not match the actions needed according to the level of warning and, in particular, are slow (Pitt 2008).

Research into how people respond to disaster warnings is extensive. The literature has, since it began in the 1950s, come to a number of conclusions that are widely accepted (Lindell and Perry 1992). The first is a general rule that people's first reaction to a disaster warning tends to be denial, and usually people will seek confirmation of a threat before taking any action (Drabek 2001). This was found to be the case during the 2007 floods in the UK, when poor responses to flood warnings was identified as a major issue. The second conclusion is that responses to hazard warnings should actually be seen as a complex social process, because most of the time people receive hazard warnings when they are with other people. Therefore, as well as denial, a consistent finding is that hazard warnings lead to debate about what to do (Drabek 1999). The social aspect of flood warnings was also seen to be an important part of communities' responses to the 2007 floods, with the subsequent review finding that door-to-door knocking was a key part of spreading flood warnings and ensuring that people acted on them (Pitt 2008). Social factors can also be negative, though: there is evidence that risky behaviour, such as entering flood waters during a flood, is influenced by seeing others do so (Becker et al. 2015).

The literature shows that people differ in how they respond to hazard warnings. As with risk perception, having experience of a previous hazard was found to be a factor affecting how people respond to warnings (Drabek 1999). The importance of previous experience in learning how to react during flooding has been found to be important (Pagneux et al. 2011, Miceli et al. 2008). During the 2007 floods in the UK, it was found that people who most understood their own risk were more responsive to flood warnings (Bradford et al. 2012). However, some evidence suggests that people who are unused to disaster warnings are more likely to treat them seriously and to see following them as mandatory (Drabek 2001). Research undertaken with residents in Florida found that it was people with no previous experience who expressed most worry about an approaching storm and were fastest to prepare (Meyer et al. 2013). As with the role of experience in risk perception, crucial factors may be the severity of previous experience, and social norms in how risk and hazards are perceived.

Trust in the authorities is also understood to have an impact. Similarly, in the case of flooding in the UK 'trust' in the deliverer of flood warnings was found to be a key determinant of how people responded to the warnings (Brown and Damery 2002). A sense of trust is believed to help overcome the negative emotional impacts of receiving an initial warning message (Rossi et al. 2018). A survey of at-risk people in England in 2013 found that 63% of respondents who had received a flood warning felt that it meant there was a risk of flood water reaching their property. On receiving this warning, 66% took action, although this means that a third did not (Langley and Silman 2014). Of those who took no action, 40% said this was because they did not believe the warning, while 37% said they did not believe the situation was serious enough (Langley and Silman 2014). Furthermore, belief in the flood warnings correlated strongly with flood risk (Langley and Silman 2014). The information and flood maps provided by the Environment Agency received predominantly positive feedback, as 81% of those who had seen the flood risk information said they could trust it, and 76% said that it told them what they needed to know and do (Langley and Silman 2014).

Groups who have a history of negative experiences with local authorities or law enforcement agencies, such as people from an ethnic minority background in the US or families with low incomes, tend to trust hazard warnings less than others (Perry and Lindell 1991). Furthermore, such groups are often more socially isolated and so may miss out on the informal processes of warning.

The second factor that explains differences in responses is the characteristics of the message. A key problem here is a tension between the need to make messages as simple as possible, and the finding that the more specific and personalised a warning, the more likely people are to see it as credible (Drabek 1999). The flooding literature suggests that many people do not believe that hazard warnings apply to them: this is one way in which we rationalise away the danger to avoid facing up to the reality. Personalising communications is an effective way to increase response rates (Carmody and Lewis 2006).

The third factor is the context people are in when they receive the warnings. One study of people whose holiday was interrupted by a hurricane, for example, found that people towards the end of their trips were much more likely to cancel the remainder of their holidays compared to people who were at the beginning of their holiday (Drabek 1996). The reaction of employees to flood warnings was found to vary according to how far away they lived from their office (Drabek 2001).

Finally, the characteristics of the hazard event itself, such as the length of forewarning and the possibility of escape, are also mediating factors (Drabek 1999). The importance of stressing what people should do, rather than just presenting the facts associated with the risk, has been highlighted by reviews, and echoes findings from the research on risk perception.

Box 19. Social influence, credibility and salience

Social influence

This report has shown that social influence is important because our profoundly social nature affects our actions. As noted previously in step one, our sense of danger – and our interpretation of an appropriate response – is influenced by the actions of those around us. Conformity can be quite dangerous: in a situation of danger, no one wants the danger to be real, and so there is a tendency not to react. No one wants to be the one who breaks rank and acts in a way that is potentially rash or disproportionate. This inaction is self-reinforcing as the inaction of others gives us false security (Bikhchandani and Sharma 2000).

One cause of this herd behaviour is imperfect information. Where danger is ambiguous, we look to those around us to help us make sense of the situation. This leads to people devaluing their own private information, and even public information (e.g. hazard warnings from official sources) when there is uncertainty about its validity. We instinctively outsource our decisions to the group around us, and look for reassuring leadership, even though everyone else might be doing the same thing (Bikhchandani and Sharma 2000, Banerjee 1992). This can lead to a diffusion of responsibility in which no-one takes definitive action.

Herd behaviour caused by imperfect information may be harnessed by publicising the actions of well-informed individuals. If people see a flood warning, they may be unsure of whether the risk is serious and needs action. However, if they see others responding to that flood warning, they might assume that other people have extra information that convinced them to take action. Another strategy is to improve trust in official channels of information (see Step 1), and the discussion on credibility and salience below.

Another driver of herd behaviour is people's desire to protect their reputations by conforming to the norm (Scharfstein and Stein 1990). Unhelpfully, this might include maintaining an image of being calm and not panicking which suppresses the urge to act. Injunctive social norms messaging – clearly emphasising what should be done while also addressing the reputational concerns of doing so – may therefore be useful. An interesting analogy comes from research on drink-driving. Saying 'I'm not drinking tonight' brings a certain reputational and social cost (an image of being boring, not one of the gang). The introduction of the term 'designated driver' helped to reduce instances of drink-driving, partly because it is easier to resist social pressure by saying 'I'm the designated driver'. Similarly, the recently introduced slogan 'see it, say it, sorted', encouraging public transport users to report suspicious behaviour, aims to address the social faux pas of wrongly accusing someone. It makes the action simple and emphasises that the passenger's responsibility stops at the point of bringing the behaviour to the staff attention. Similar attempts to normalise action, and to promote attitudes of being 'better safe than sorry' during a flood, may help address the subtle (but surprisingly profound) social stigma of being the person to escalate the situation.

Credibility and salience

The flooding literature has shown that it can be difficult to get people to trust, and react to, government hazard warnings. Identifying the most trusted messenger is context- and audience-specific. The flooding literature found that people take strong social cues during moments of emergency. Community-wide responses were also found to be important, messages from people's own social networks can help reinforce rather than substitute those from more official channels.

Box 20. Escalation of commitment

When situations escalate gradually, we tend to stay consistent with our past behaviour (i.e. to not respond) because there is no clear decision point at which the situation clearly moves from being safe to dangerous. The metaphor of a frog in boiling water is often used to illustrate this effect. As the water warms, the frog does not jump out until it is too late. One solution is to create artificial, salient 'reset' points or decision points that force people to re-evaluate the level of risk. To some extent, the existing system of risk levels does this, though these could be more focused around action rather than risk. Clear instruction on how to respond once the hazard warning moves from yellow to red, for example, even if the marginal difference is arbitrary, is a categorical shift that is more likely to spur action.

7.5 The importance of community-wide responses

Conclusions from this body of research point to the importance of flood warnings that are tailored to local areas and provide advice on what action to take. In particular, attention needs to be paid to ensuring that socially vulnerable or isolated households are aware of impending flooding. As such, flood warnings should ideally trigger community-wide action, which should be coordinated by local flood groups. In 2017 there were approximately 234 flood groups in England (Forrest et al. 2017). The National Flood Forum helps local flood action groups to become established and offers coordination at the local level. Such groups can help residents understand their own responsibilities, what they should do in a flood situation and can identify members of the community who need particular help. Community approaches can also challenge negative social norms, and help to mitigate against denial, which is a common first response to flood warnings (Drabek 2012).

Increased community cooperation and cohesion has been found to be a key reason for reductions in the number of deaths from coastal flooding and severe storms in Bangladesh and Cuba (Lumbroso et al. 2017). Case studies of flood events in England have highlighted the positive role that community organisations can play, and how they can also build cohesiveness for future flood preparedness. However, there is little evidence on how widespread such groups are (Harries 2009). A survey in 2013 among people at risk of flooding found that less than 1 in 10 respondents (9%) had joined a community group, although 87% agreed that 'The people in my community will help one another if it floods' (Langley and Silman 2014).

7.6 Small businesses' responses to flooding

Though recovery from flooding is beyond the scope of this report, some insights from the literature on it have implications for flood planning and becoming more resilient. For example, the importance of support networks and mutual assistance agreements for small businesses has been highlighted (McGuinness and Johnson 2019). Research has found that formal planning for flooding is rare among small businesses in the UK, even after having experienced flooding. Reasons given for this are a lack of knowledge about how to undertake such planning, as well as time constraints and limited financial resources (Coates et al. 2016b). One study found that many small businesses in the UK that had been affected by recent floods were not sure if their insurance covered flood damage until they contacted the insurer after the flood (McGuinness and Johnson 2019). Small businesses can be very vulnerable to interruptions to cash-flows caused by flooding, and research from the US has highlighted the struggles that small businesses have in sourcing emergency funding to recover from natural disasters (Runyan 2006). However, research has also indicated that small businesses are often inherently resilient because their work involves making the best use of constrained resources in situations that need flexibility and fast decision making. These capabilities tend to be sector-specific. For example, case studies have shown that firms that work in areas featuring innovation (e.g. engineering) are likely to use these skills during an emergency (Coates et al. 2016b). The implications of this are that small businesses may differ from individuals in that they have specialisations and resources that can be used during a flood. This should be taken into account in preparing for action during flooding.

7.7 Summary of findings

The final step is the action needed during a flood when people are prepared to operate their products correctly and in response to advice from authorities or their flood plans. Helping people to receive, understand and trust flood warnings is vital to helping them take action.

In practice, our actions are rarely optimal during a flood. The typical first response to a disaster warning tends to be denial, followed by seeking confirmation of a threat before taking any action. The tendency is to look to others to know how to act, this social influence can have both positive and negative impacts. Seeing others act can be a prompt to act ourselves, but no one wants the danger to be real, and so there is an incentive to not react. Also, no one wants to break rank and act in a way that is rash or disproportionate.

The use of credible messengers within communities can help improve trust in public messages. Personalising communications has been identified as potentially helpful in this context. The provision of clear instructions, with actionable steps, is very important. We also tend to not act optimally when under time pressures, stress, anxiety and uncertainty. A pre-prepared flood plan was found to be important because it gives a clear set of instructions to follow in the moments when we lack that clear thinking. However, in the UK only 6% of respondents to a survey said that they had made a flood plan and were sure of what to do in a flood. This area could benefit from further research.

8 Part 1 Conclusions

While not an exhaustive review of the literature, the evidence in this report covered over 250 pieces of literature. This demonstrates the wealth of evidence and research that has already been gathered, both in the field of hazard responses and, more broadly, the behavioural insights that might apply to it.

Across all of the six steps of the consumer journey the existing literature shows there are clear barriers to households and businesses becoming resilient to floods. In particular, it shows how a range of factors can combine to mean that very few households or businesses take up PFR measures, or even act in response to flood warnings when they occur. It also clearly demonstrates that, on their own, traditional responses in terms of communicating flood risk and providing grants for PFR installation are unlikely to deliver the increase in individual flood resilience actions needed.

Many of the barriers to action and challenges for policymakers have clear foundations in the behavioural insights literature. The role in particular of social influences, emotions, heuristics and choice overload comes through repeatedly. While the role of these factors is often clear, or can be inferred, what is less clear from the existing literature is the respective importance of each, and how they can be leveraged to increase individual actions that improve flood resilience.

The following part of this report summarises our work to identify these gaps in existing research, and puts forward proposals for how they might be filled.

Part 2 – Evidence gaps and future research needed



An example of a flood gate (Source: Environment Agency)

9 Evidence gaps

9.1 Evidence gaps and developing a research agenda

A key purpose of this report is to identify gaps in the evidence and possible research strategies for filling them. The remainder of this report:

- Identifies the evidence gaps and turns them into research questions that are not currently fully answered, where there is evidence from other contexts but not from the flood resilience literature.
- Clusters questions into three research programmes focussed around the three main behaviour-change objectives identified in the customer journey:¹
 - increasing the rate of adoption of PFR.
 - improving the rate of proper maintenance of PFR.
 - encouraging appropriate action during flooding.
- Proposes a structure for the programmes using The Behavioural Insights Team's 'Target, Explore, Solution, Trial Scale (TESTS).
- Suggests suitable research tools and techniques needed at each phase of the research.

9.2 TESTS research methodology

We propose each of the three research programmes is structured in accordance with The Behavioural Insights Team's framework known as TESTS (see Figure 1). This framework provides a clear step-by-step process for identifying the research activities needed to fill the identified evidence gaps. Each step requires a particular set of research activities drawing on best-practice qualitative and quantitative methods.

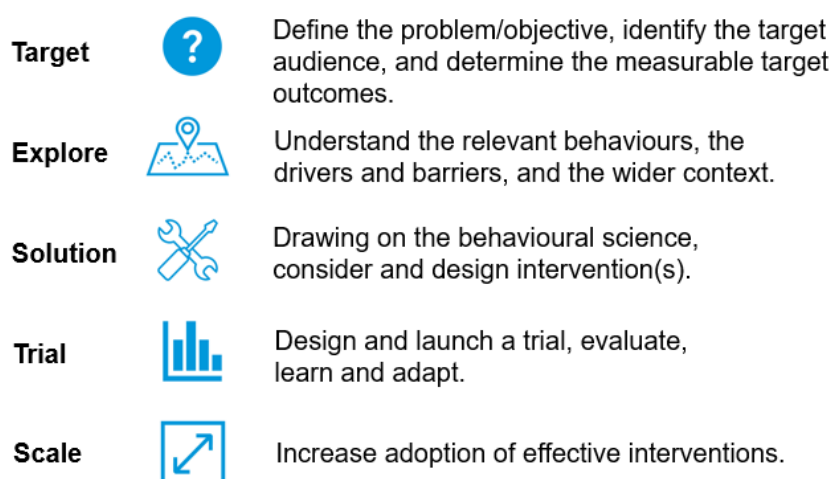


Figure 1. The TESTS framework to fill evidence gaps

¹ These have been chosen both through a top-down and a bottom-up process. Top-down is in the sense that the Environment Agency's ultimate goal is to encourage behaviour change in order to meaningfully improve the flood resilience of properties in the UK, and so it is helpful to structure the research programmes around particular behaviour-change outcomes. Bottom-up is in the sense that the evidence gaps and research questions identified by this research and a workshop naturally cluster into these three objectives.

9.2.1 Target

This first phase identifies what we want to achieve, who the target audience should be, and what specific behaviours we should be encouraging or discouraging. Each of the three high-level objectives identified at the start of this chapter will contain many sub-behaviours and sub-audiences. For example, increasing the uptake of PFR might be narrowed to increasing the uptake of product X among target audience Y, or might instead focus on an intermediate behaviour en route to PFR uptake, such as to increase the number of new homeowners in high-risk areas who seek advice on PFR measures. Each of these more specific objectives (and many others besides) is well suited to a behavioural insights project in its own right.

This exercise of narrowing down and prioritising objectives will be used to inform future research within Defra and the Environment Agency.

9.2.2 Explore

With a specific behaviour-change objective in mind, this second phase explores questions such as:

- Why individuals and businesses do or do not act in certain ways.
- What the key practical, psychological, social, environmental and financial barriers and drivers are
- What touchpoints are available to influence the target audience.

A great deal of insight into these questions is already available from the evidence summarised within this report. In some cases, this might allow us to move swiftly to step 3 the solutions stage. However, in other cases there will be remaining evidence gaps that need to be addressed through additional research.

9.2.3 Solution

The third phase considers questions relating to the impact of different behavioural interventions or policies. During this phase, interventions would be designed based on:

- Insights learnt Step 2.
- Findings from behavioural science, including the evidence summarised in this report.
- Existing frameworks such as EAST (Service et al. 2014) and MINDSPACE (Dolan et al. 2010).

9.2.4 Trial

During the trial phase, these interventions would be implemented and evaluated to determine their impact through a range of techniques such as: randomised controlled field trials, lab studies, quasi-experimental studies. For some topics there may be sufficient background knowledge, enabling us to move swiftly towards testing interventions in the field. It is recommended to identify quick wins in addition to developing longer programmes of research that need more background research.

9.2.5 Scale

Finally, questions relating to whether and how we can spread successful interventions (such as by encouraging risk management authorities around the country to adopt new procedures) are addressed during the scale phase. This phase is less an exercise in pure social research, and more an exercise in strategy, governance and implementation.

9.3 Summary of findings

The following table summarises the proposed activities for each of the three research programmes. It is not exhaustive, it presents the authors' views on where resources should be prioritised. A more complete list of research questions (most of which would naturally fit under the explore phase) is included and prioritised² in the Appendix 1.

While the TESTS methodology provides a chronological process to follow, undertaking every activity in the 'research tools and activities' column would take substantial time and resource. This would be a worthwhile endeavour because it would generate a more complete evidence base. However, we strongly recommend that, in parallel to more ambitious and ongoing work, the Environment Agency should identify a number of quick wins that could be tested in the field (or lab) with minimal extra groundwork. There is often great value to the approach of getting into the field and simply seeing what works, particularly when there is already a substantial evidence base.

² Prioritisation is based on the authors' judgement as to which questions most urgently need to be addressed to progress the state of knowledge in this field, and ultimately to enable the development of impactful policies and successful interventions. In forming this judgement the authors have also considered the views of expert stakeholders captured during a voting exercise at a workshop with the Environment Agency and representatives from academia and flood risk management authorities.

| TESTS phase | Research programme 1: Increasing the adoption of property flood resilience measures | Research programme 2: Improving the rates of maintenance of property flood resilience measures | Research programme 3: Encouraging appropriate action during a flood | Research tools and activities |
|----------------------|---|---|--|---|
| <p>Target</p> | <p>Within the target phase, a common set of questions emerges, though the answers will be unique to each research programme, directing the researcher towards a more specific set of objectives. Some of these questions would be addressed by the behavioural researchers, but some may be a matter for the Environment Agency to simply make some decisions on, or to address through a workshop.</p> <ul style="list-style-type: none"> - What micro-behaviours and decisions contribute to the overarching objective? Specifically, what behaviours should be promoted or discouraged? Can these be listed, categorised and mapped? - What does 'good' look like – what is the ideal prevalence of each behaviour, and among whom? - What is the target audience, in order to maximise benefit? Will some audiences be more amenable to change? Are some in greater need? - Where are the pressure points to achieve impact? For instance, would nudging installers or surveyors to change their behaviour potentially have a bigger impact than nudging individual homeowners? - Do the priority objectives differ for businesses and private homeowners versus landlords? - What data are available and how can uptake, maintenance and appropriate action for property flood resilience be measured? Do new data-collection mechanisms need to be established? <p>The following are some examples of target behaviours for each research programme. Each of these might form the basis of a behavioural insights research project. Many conceivable examples exist, and we would generally favour a focus on behaviours, rather than attitudes or beliefs, unless there were good reason to believe that a change in attitudes/beliefs/knowledge would translate into a change in behaviour (or it was important for its own sake).</p> <ul style="list-style-type: none"> - Increase the adoption of (a specific type of) property flood resilience measure among (a specific audience). - Increase the understanding of how to use (a specific type) of property flood resilience measure. - Increase the number of business owners who produce a flood plan. | | | <p>Behaviour mapping: Break down the high-level objectives into specific micro-behaviours that contribute to the three objectives. Some example objectives are given adjacent.</p> <p>Prioritisation workshops and dialogue: Engage experts and other stakeholders to agree priority objectives. Typically, prioritisation would consider potential impact and feasibility (various dimensions of each).</p> <p>Identify data sources: Ascertain how the target behaviours can be measured (or identify needs for new data sources such as new surveys).</p> <p>Review existing data: To understand prevalence among different population groups, to enable efforts to be targeted where impact may be highest.</p> <p>Economic/cost-benefit analysis: Though more ambitious, it may be worthwhile to undertake an economic analysis to quantify the optimum uptake of property flood resilience measures (recognising that greater uptake, beyond a point, will not always lead to improved wellbeing). Conversely, if it is unambiguously the case that optimum uptake is far higher than current uptake, this may be unnecessary.</p> |

| TESTS phase | Research programme 1: Increasing the adoption of property flood resilience measures | Research programme 2: Improving the rates of maintenance of property flood resilience measures | Research programme 3: Encouraging appropriate action during a flood | Research tools and activities |
|-------------|---|---|--|-------------------------------|
| | <ul style="list-style-type: none"> - Increase the number of homes/businesses checking their flood risk level. - Increase the proportion of insurance claims/reinstatements that are flood resilient rather than being like-for-like. - Increase the uptake of home surveys among population X. - Increase the understanding of different property flood resilience options. - Increase belief in personal responsibility and self-efficacy around flood risk. - Encourage insurers to allow and promote more resilient reinstatement. | <ul style="list-style-type: none"> - Increase the proportion of installers following best practice in demonstration/dry runs. - Encourage a specific type of maintenance (clearing of leaves from drainage points for example). - Increase the number of owners (of a particular type of property flood resilience measure) who sign up for follow-up inspections by installers. | <ul style="list-style-type: none"> - Increase the number of people who respond appropriately to public service announcements. - Increase the number of people who sign up to flood alerts. - Reduce the proportion of failures of a (particular type of) property flood resilience measure that arise due to not being properly used. | |

| TESTS phase | Research programme 1: Increasing the adoption of property flood resilience measures | Research programme 2: Improving the rates of maintenance of property flood resilience measures | Research programme 3: Encouraging appropriate action during a flood | Research tools and activities |
|-------------|--|--|--|---|
| Explore | <p>Within the explore phase, the focus is on gaining a deeper understanding of target behaviours in the wider context. The specific research questions that will emerge will depend on the target behaviours identified. However, broadly the aim is understand two sets of issues. First, why do people behave as they do, and why they do not behave in the ways that might be desirable? That is, what are the psychological, structural and practical barriers and drivers? Second, what are the systems and processes within which the target audience is operating, and thus what are the potential levers for change or touchpoints for potential intervention?</p> | | | <p>Each of the research activities below may be more or less relevant depending on the specific questions being asked. In full, this list represents a very thorough and rigorous programme of research. A typical project would not necessarily undertake all of these steps. Although it is worthwhile to begin to address each of the research questions identified for the explore phase, to build up a more complete understanding of the challenges, it is also worth identifying some quick wins and moving swiftly towards the following step (solution/trial) for promising interventions which we already have good reason to believe may be impactful.</p> <p>Develop a theory of change: The customer journey in this report is a naive and simple theory of change. This could be validated and developed.</p> <p>Map the customer journey and touchpoints: Map out the key steps and decisions an individual or business would go through en route to the target behaviour, and identify all the influencing parties and touchpoints (opportunities for influential contact) at each step.</p> <p>Data science: Patterns in existing data may give clues as to why the prevalence of certain behaviours is higher or lower under certain</p> |
| | <p>The following research questions are exemplary and identify this report's priority questions. The list is not exhaustive. See Appendix 1 for a longer list of explore questions, with prioritisation.</p> | | | |
| | <ul style="list-style-type: none"> - What are the main practical barriers to action? What role does hassle/friction play in discouraging uptake? - What motivations and barriers are unique to businesses? - What are the barriers to insurers promoting resilient rather than like-for-like reinstatement? - What are the main touchpoints (points of influence) at which the decision to adopt could be influenced? For example, home buying, contents insurance renewal, Environment Agency media communications, outreach? - Which step in the customer journey used by this report is the | <ul style="list-style-type: none"> - What proportions of consumers do and do not maintain their property flood resilience? What types of measure tend to be more problematic due to improper maintenance or use, and how can these be targeted? - What are the main touchpoints (points of influence and timely moments) at which maintenance or checking of property flood resilience measures could be prompted (home moves, contents insurance renewal, and so on)? What are the existing habits and routines to which maintenance could be connected? - Do installers tend to give operating and maintenance advice | <ul style="list-style-type: none"> - Is there a placebo effect of having property flood resilience measures that causes people to act with less urgency? - How do people perceive flood warning notifications (with ambivalence or disbelief)? - What are the main touchpoints at which interventions could encourage and prompt better action in response to a flood? (For example, social and traditional media channels, apps, community groups?) Can these touchpoints be mapped? - What proportions of consumers do and do not act appropriately during a flood? What are the most common mistakes made? What factors predict | |

| TESTS phase | Research programme 1: Increasing the adoption of property flood resilience measures | Research programme 2: Improving the rates of maintenance of property flood resilience measures | Research programme 3: Encouraging appropriate action during a flood | Research tools and activities |
|-------------|--|--|--|---|
| | <p>limiting factor? Is a lack of understanding the issue, or is a lack of perceived responsibility the bigger problem? Or hassle?</p> <ul style="list-style-type: none"> - At what point do people accept they are at risk? Beyond being flooded, are there other events, triggers or moments of change that help people to acknowledge the threat? - How can the explanation best be given to people that the government bears only partial responsibility? - If insurers reinstated resilience measures by default, would that be beneficial? If so, what incentives could be leveraged to encourage insurers to promote more resilient reinstatements? Why do insurers not currently encourage them? | <p>when they install property flood resilience measures? How does this vary between product types or installers? Does such advice help?</p> <ul style="list-style-type: none"> - What are the main frictions and barriers to developing a flood plan (lack of awareness, procrastination, lack of urgency, hassle, poor know-how)? - What opportunities are there to leverage incentives to help people to maintain their property flood resilience measures? (For example, insurance warranties, collective approaches with neighbours?) - How can social networks and social norms be leveraged to improve the rates of property flood resilience maintenance? (For example, public commitments such as community flood action days?) | <p>these mistakes? For example, does response differ by segment of the population, region, property type, and so on, and can we target specific audiences?</p> <ul style="list-style-type: none"> - To what extent do people adhere to their flood plans if they have them? - To what extent do people have different perceptions of (and thus respond differently to) threats of imminent floods of different types (surface water, drainage overflow, and so on)? Are some types perceived as more visceral and real than others, and do some forms of water ingress tend to be ignored more than others? - What is most effective way to create a sense of urgency, without creating a sense of panic? | <p>conditions. Can these be used to create meaningful customer segmentation?</p> <p>Listen: Run interviews and focus groups with members of the public, experts, risk management authorities and other stakeholders to understand barriers, drivers and opportunities.</p> <p>Ask: Run robust quantitative surveys to quantify motivations, barriers, drivers, attitudes, knowledge gaps and the baseline prevalence of behaviours.</p> <p>Observe: Using ethnographic research tools, observe, and/or explore the processes and steps needed for the target behaviours (such as to apply for a grant), to understand the frictions and difficulties, or follow the experiences of a local business having property flood resilience measures installed.</p> |

| TESTS phase | Research programme 1: Increasing the adoption of property flood resilience measures | Research programme 2: Improving the rates of maintenance of property flood resilience measures | Research programme 3: Encouraging appropriate action during a flood | Research tools and activities |
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| Solution/ Trial | <p>Within this phase, interventions are developed and evaluated. The precise research questions that emerge will depend on the nature of the intervention. However, a generic set of question should be answered, including:</p> <ul style="list-style-type: none"> - What is the impact of the intervention on the outcome (target behaviour) of interest? - What is the persistence of this impact over time? - What is the impact among different population segments? - How has the intervention led to the observed impact (process evaluation)? - Can softer nudges have a meaningful impact, or are stronger interventions needed? - Is it possible to move beyond changes to individual actions at the margins, towards deeper and wider shifts in social norms? | | | <p>Form ideas: Use co-creation workshops and best-practice behaviour-change toolkits (e.g. EAST, MINDSPACE) to develop behaviour-change interventions tailored to the specific target behaviours.</p> <p>Prioritise: Prioritise a longlist of intervention ideas on key metrics (typically feasibility and impact).</p> <p>Prototype: Where possible, prototype and pilot the intervention (such as in a small-scale launch, an online study or within focus groups).</p> |
| <p>The following are some example interventions that might be tested for each research programme.</p> | | | | |
| <ul style="list-style-type: none"> - How homebuyers who buy in a high-risk area be nudged to adopt a full flood survey (which includes specific recommendations) and, consequently, what is the impact of having this survey on uptake behaviour for property flood resilience? - What is the impact of integrating behavioural techniques into Flood Re's routine messaging to customers (or similarly, in contents-insurance letters) | <ul style="list-style-type: none"> - How might installers of property flood resilience measures be nudged to provide advice and training to their customers on how to use the product? What is the impact of that advice (which can be varied in design and format) on customers' behaviour during a flood? - What is the impact of asking customers to commit to future maintenance checks on their likelihood to actually have equipment serviced and checked | <ul style="list-style-type: none"> - What is the impact of creating a register of installations that enables personalised prompts and usage tips to be sent out during a flood? - What is the impact of more personalised or salient flood warnings, or of integrating behavioural nudges (such as social norms messages) into warnings? - What is the impact of the Environment Agency's current messaging about protecting homes on propensity to act, and can | <p>Evaluate impact (field trials): Run a robust field trial to evaluate the impact of the intervention on the target population. Typically, randomised controlled trials are recommended – the gold standard of impact evaluations. Where these are not possible, best-practice quasi-experimental methods should be used, such as propensity score matching, regression discontinuity or difference-in-differences designs.</p> <p>Lab studies: In some cases, it might be appropriate to run an impact evaluation as a lab study (in an online environment for example). This might be appropriate, for instance, in testing the impact of different communications on the level of</p> | |

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| | <ul style="list-style-type: none"> - What is the impact of developing a flood performance certificate (along the lines of the energy performance certificate), with a metric of current and potential flood resilience and specific recommendations for action? - What is the impact of various nudges at timely moments (for example, home buying) on creating a flood plan? - What is the impact of different communications or media content (such as social media videos) on perceived responsibility and self-efficacy? This could be tested in the lab and the field. - What is the impact of social norms interventions on the propensity of other homes to adopt (for example, putting signs outside homes that have had property flood resilience measures installed)? | <p>(versus the impact of defaulting checks or sending timely prompts)?</p> | <p>different messaging better encourage appropriate action?</p> <ul style="list-style-type: none"> - Would an annual flood awareness day help to build awareness of what to do in the case of a flood? Could this be linked with the Environment Agency's existing Flood Action Week campaign? - What is the impact of different messengers (their perceived credibility) on the likelihood to act? | <p>comprehension of how to use or maintain a property flood resilience measure.</p> <p>Process evaluation: Alongside a rigorous impact evaluation, a good process evaluation (often using mixed methods) aims to understand the mechanisms of behaviour change observed in response to the intervention, and to ascertain if the intervention was delivered successfully, and why.</p> |

| TESTS phase | Research programme 1: Increasing the adoption of property flood resilience measures | Research programme 2: Improving the rates of maintenance of property flood resilience measures | Research programme 3: Encouraging appropriate action during a flood | Research tools and activities |
|-------------|--|---|--|-------------------------------|
| Scale | <p>Iterate: Can the intervention be improved and retested?</p> <p>Evidence: Is the finding robust enough? Scientific rigour normally demands the replication of findings, particularly in high-stakes contexts where getting it wrong at large scale would be damaging. However, limited resources and the need to act fast often demand a more pragmatic view on where the balance of evidence lies and whether the evidence of efficacy outweighs the risk. It may also be possible to continue to measure and evaluate as scaling up occurs, for example by doing a stepped wedge trial.</p> <p>Replicability: Can the same results be replicated in other locations? Or do contextual differences need evaluating, and the findings validated, in each individual case?</p> <p>Fidelity: Is it possible to maintain the fidelity of the intervention when delivering it at large scale? Or is there a risk that important detail will be lost as others adopt it?</p> <p>Cost: Do the benefits of the intervention justify the cost? Will there be economies of scale when scaled up?</p> <p>Logistics: Are the delivery channels effective? Can they be created? Must the intervention be scaled up by repeating it one location at a time, or are there existing channels to do this en masse, for example through professional bodies or authorities? Can interventions be codified for others to adopt, or best-practice guides developed?</p> <p>Sponsorship: How can buy-in be ensured from leaders and frontline practitioners who were not involved in the initial trial, and who may need persuading of the value?</p> | | | |

10 Part 2 Conclusions

This report's review of the evidence draws on insights from a wide body of existing academic research and has shown that there is already much that we know. However, this evidence base is also patchy. Research specifically on flood resilience behaviours has, in part, been rooted in conventional wisdom that has only recently been shown to be flawed (focusing on increasing consumer understanding of probabilistic risk for example). More recent studies taking an explicitly psychological perspective are beginning to add nuance to our understanding. The applied science of behaviour change, though, particularly in the context of flooding, is still relatively nascent. There is still much to learn in this field, and many of the insights we rely on come from behavioural science research outside of the flooding context.

We have come to a two-part conclusion. On the one hand, there are many evidence gaps in the study of flood resilience behaviours. The lists of research questions summarised in Part 2 and the Appendix reveal some fairly major gaps in our knowledge. Filling these is no small task, requiring the application of a wide variety of rigorous research tools across many issues, regions and target audiences. This would be a worthwhile endeavour, but also a daunting one. We have therefore sought to engender a sense of prioritisation, and it is also a task for the Environment Agency to decide, once reviewing the evidence presented here, where to prioritise its future research.

At the same time, we draw a more encouraging conclusion: there is sufficient evidence of successful interventions in other contexts that it is possible (and recommended) that these ideas are rapidly taken into the field, to identify what does and does not work in the flooding context. By reviewing key evidence from the wider behavioural sciences, this report identifies numerous strategies proven to be effective elsewhere, ranging from improving the uptake of solar panels and loft insulation to helping consumers to make better financial decisions. Each strategy has been selected because it has an insight that is relevant to property flood resilience.

With these two conclusions in mind, we recommend the following next steps.

1. Identify priority areas for trialling behaviourally informed interventions. This might be done in a workshop format, bringing together behavioural science experts and flood resilience experts to:
 - identify specific behaviours that would make suitable targets for behaviour-change projects (more specific than identified in the three programmes of research).
 - prioritise these target behaviours based on the feasibility of changing them, and their potential impact (contribution to the problem).
2. Commission further research to develop and evaluate behaviour-change interventions targeting these prioritised behaviours to:
 - rapidly develop intervention ideas with minimal background research needed (since this step is largely covered by this report).
 - implement well-designed interventions, leading to some 'quick wins', jumping straight to the 'Solution / Trial' phases.
3. In parallel with step (i), begin to prioritise the longer-term research questions, and commission further research to address the most pressing evidence gaps identified in this report. These questions should, ideally, also be framed around a particular behavioural objective, but may be wider in scope (for instance, framed

around one or all of the three wider programmes of research we have identified). They should also culminate in the development and evaluation of behaviour-change interventions, but with the recognition that there may be a greater need for in-depth research at the explore step to initially fill some of the evidence gaps.

With this dual approach of tackling some quick wins to demonstrate the value of behavioural interventions, and systematically beginning to improve knowledge in this field, behavioural science and robust social research have a lot to contribute to the challenge of improving property flood resilience in the UK.

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List of abbreviations

| | |
|--------------|--|
| Defra | Department for Environment, Food and Rural Affairs |
| EFRA | Environment, Food and Rural Affairs Committee |
| NGO | non-governmental organisation |
| PFR | property flood resilience |
| PMT | protection motivation theory |
| RMA | risk management authority |

Appendix: Future research questions

In the following tables we have summarised additional research questions (evidence gaps) identified through this evaluation of the existing evidence, and through running a workshop with the Environment Agency, expert stakeholders from risk management authorities and academia. The majority of these questions would naturally sit within the 'Explore' phase of works. That is, they would ideally be answered, through a variety of desk-based and field research techniques, in order to further inform the design of policy solutions or interventions. Some of these evidence gaps may also be re-framed to imply intervention ideas in themselves, and thus form part of the 'Solution' phase of works. For instance, the question 'How can trust in professionals be strengthened?' might lend itself to a particular intervention well suited to a field trial or lab study – testing the impact of different messengers and measuring the impact of perceived credibility and trust.

In each case a level of priority is given for answering each research question. This is based on the authors' judgement as to what additional evidence would most usefully aid the development of effective policy and intervention ideas. Part of this consideration is related to how much evidence already existed, so indicating a low priority does not necessarily imply that the question is unimportant – rather, it may be that there is already fair knowledge of the issue. In addition to these judgements, the authors' have considered the views of the expert stakeholders who voted on the evidence gaps they identified during the aforementioned workshop.

Research programme 1: Increasing the adoption of property flood resilience measures

| | Research question | Priority level |
|----|--|----------------|
| 1. | What are the main touchpoints at which interventions could encourage individuals to adopt property flood resilience measures? (For example, new home purchase, renewal of contents insurance, communications sent from Flood Re, wider media channels, and others?) Can these touchpoints be mapped? | High |
| 2. | What are the key timely moments at which property flood resilience measures could be offered, to maximise uptake? | High |
| 3. | Why do insurance firms default to like-for-like reinstatement, and what are the barriers to them recommending or offering flood-resilient options? | High |
| 4. | If insurers reinstated resilience measures by default, would that be beneficial? If so, what incentives could be leveraged to encourage insurers to promote more resilient reinstatements? Why do they not currently promote this? | High |
| 5. | At what point do people accept they are at risk? Beyond being flooded, are there other events, triggers or moments of change that help people to acknowledge the threat? | High |
| 6. | When, where and by whom should expert advice be provided? | High |
| 7. | Should – and could – people's need to make decisions be removed, by increasing their trust in expertise? | High |
| 8. | What are people's expectations for how flood resilient their homes should be? Does it occur to homeowners that a property ought to be resilient to | High |

| | Research question | Priority level |
|-----|---|----------------|
| | water ingress in the same way they might expect it to be resistant to fire or to be energy efficient? What influencing factors might shift this perception? | |
| 9. | How can an emphasis on negative emotions be avoided? How can flood risk be explained as serious without scaring people off? | High |
| 10. | How can it best be explained to people that the government bears only partial responsibility? | High |
| 11. | How can households and small businesses be supported to feel empowered (in terms of the efficacy of their potential actions)? | High |
| 12. | How much choice do people need? How much choice should people be given? How is the complexity of options best addressed? | High |
| 13. | What are the main non-financial disincentives to adopting property flood resilience? For example, even after a flood, are inferior aesthetics a major problem? | High |
| 14. | Is the government undermining action when it says 'We protect homes?' – by diminishing the perceived consequence or sense of personal responsibility? Is trust in the government detrimental to accepting personal responsibility, and if so, is this trade-off inevitable? | Medium |
| 15. | Is an increased understanding of flood risk beneficial to the uptake of property flood resilience measures (or is the main barrier outside of a lack of awareness or understanding of risk)? | Medium |
| 16. | What is the experience of individuals and business owners who have tried to assess the property flood resilience options? Where did they turn to for guidance? How easy did they find the decision? Were they turned off by the complexity? | Medium |
| 17. | What criteria do people consider when making property flood resilience choices? (Cost, aesthetics, level of guarantee, familiarity?) Does the presentation of options connect with their needs, views and perceptions? | Medium |
| 18. | How can trust in professionals engaged in this sector be strengthened? | Medium |
| 19. | To what extent does knowledge of products and approaches improve the likelihood of taking action? | Medium |
| 20. | Is lack of affordable insurance a disincentive for people to adopt property flood resilience measures? | Medium |
| 21. | What is the best way to inform or teach people what works? Is an educational approach even necessary or desirable? | Medium |
| 22. | How do people experience the systems of grants? What are the main challenges (for example, awareness, complexity, uncertainty, inadequate incentive)? Would standardisation of the grant system help? Or other supportive nudges such as prompts and pre-filled forms? | Medium |
| 23. | What evaluation of properties or diagnostic process is in place after flooding? | Medium |
| 24. | Which subgroups are less likely to adopt measures? What differing motivations, barriers and opportunities exist between these subgroups? | Medium |
| 25. | Which component of coping appraisal is the most significant barrier: self-efficacy, response efficacy or response cost? | Medium |
| 26. | How can social networks and social norms be leveraged to improve coping appraisal and/or taking responsibility? | Medium |
| 27. | What are the main practical barriers to action? What role does hassle or friction play in discouraging uptake? | Medium |

| | Research question | Priority level |
|-----|---|----------------|
| 28. | What motivations and barriers are unique to businesses? | Medium |
| 29. | Which step in the customer journey is the biggest problem, or bottleneck, to the uptake of property level resilience? | Medium |
| 30. | Why do people not take flooding more seriously as a risk to their wellbeing? | Low |
| 31. | Are there misaligned incentives between tenants (individuals or business owners) and landlords? | Low |
| 32. | To what extent are access to finance and affordability a barrier? | Low |
| 33. | How much choice do people need or want, versus preferring to draw on a trusted expert? | Low |

Research programme 2: Improving maintenance of property flood resilience measures

| | Research question | Priority level |
|-----|--|----------------|
| 1. | What are the main touchpoints at which interventions could encourage and prompt better maintenance of property flood resilience measures? (For example, new home purchase, renewal of contents insurance, communications sent from Flood Re, wider media channels?) Can these touchpoints be mapped? | High |
| 2. | What proportions of consumers do and do not maintain their property flood resilience measures? What types of measure tend to be more problematic due to improper maintenance or use? How can the more problematic cases be targeted? | High |
| 3. | Do installers tend to give operating and maintenance advice when they install property flood resilience measures? How does this vary between product types and installers? Does such advice help? | High |
| 4. | What are the main frictions and barriers to developing a flood plan? (For example, lack of awareness, procrastination, lack of urgency, hassle, poor know-how?) | High |
| 5. | Do people know how to maintain their property flood resilience measures? Did they ever know, and does this knowledge fade over time? | High |
| 6. | When, where and from whom would expert advice be most valued? | High |
| 7. | To which activities, habits, routines or timely moments could regular check-ups on property flood resilience be linked? | High |
| 8. | What opportunities are there to leverage incentives to help people to maintain their property flood resilience measures? (For example, insurance warranties, collective approaches with neighbours?) | High |
| 9. | How can social networks and social norms be leveraged to improve rates of property flood resilience maintenance? (For example, public commitments, community flood action days?) | High |
| 10. | Is the government undermining action when it says 'We protect homes?' – by diminishing the perceived consequence or sense of personal responsibility? Is trust in the government detrimental to accepting personal responsibility, and if so, is this trade-off inevitable? | Medium |
| 11. | Do people need to test their property flood resilience? Do they do so? What is the benefit of dry runs? | Medium |
| 12. | How can trust in professionals engaged in this sector be strengthened? | Medium |

| Research question | Priority level |
|---|----------------|
| 13. What evaluation of properties or diagnostic process is in place after flooding? How can this be leveraged to understand the main issues related to poorly maintained or installed property flood resilience measures? | Medium |
| 14. Are there misaligned incentives between tenants and landlords with respect to maintaining and using property flood resilience measures? | Medium |
| 15. What factors contribute to or diminish individuals' sense of empowerment, self-efficacy and personal responsibility with respect to maintaining property flood resilience measures? | Medium |
| 16. Which subgroups are less likely to know how to use and maintain their measures? What factors drive these differences? | Medium |
| 17. Which step in the customer journey is the biggest problem, or bottleneck, to uptake of property level resilience? | Medium |
| 18. Why do people not take flooding more seriously as a risk to their wellbeing? | Low |
| 19. Is there a placebo effect of interventions that makes property owners subsequently take the flood risk less seriously? | Low |

Research programme 3: Encouraging appropriate action in a flood

| Research question | Priority level |
|--|----------------|
| 1. What are the main touchpoints at which interventions could encourage and prompt better action in response to a flood? (For example, social and traditional media channels, apps, community groups?) Can these touchpoints be mapped? | High |
| 2. What proportions of consumers do and do not act appropriately during a flood? What are the most common mistakes made? What factors predict these mistakes? Does response differ by segment of the population, region, property type, and so on, and can the most problematic audiences be targeted? | High |
| 3. Do people with property flood resilience measures know what to do in the event of flooding? How varied is this knowledge? Does it differ by population segment, by product category, and so on? Is knowledge the main issue, or are there other factors such as social dynamics? | High |
| 4. To what extent do people adhere to their flood plans if they have them? | High |
| 5. How do people react to a forecast if forecasts have been erroneous in the past? How do people generally perceive flood warnings – is there a desensitisation problem? | High |
| 6. What attributes make a flood warning messenger compelling and credible? Who would the most impactful messenger be? Would this differ between contexts and audiences? | High |
| 7. What factors contribute to or diminish individuals' sense of empowerment, self-efficacy and personal responsibility during a flood event? | High |
| 8. To what extent do people have different perceptions of (and thus respond differently to) threats of imminent floods of different types (such as surface water, drainage overflow)? Are some types perceived as more visceral and real than others, and do some tend to be ignored more than others? | High |
| 9. What is most effective way to create a sense of urgency without creating a sense of panic? | High |

| Research question | Priority level |
|---|----------------|
| 10. What kind of validation is needed to make people trust (and act on) flood messages? | High |
| 11. How can social networks and social norms be leveraged to improve action during flooding (through community level flood planning for example)? | High |
| 12. Is the government undermining action when it says 'We protect homes' – by diminishing the perceived consequence or sense of personal responsibility, even during a flood? Is trust in the government detrimental to accepting personal responsibility, and if so, is this trade-off inevitable? | Medium |
| 13. What are the main barriers to creating a flood plan? (For example, lack of awareness, poor know-how, procrastination, hassle, lack of motivation?) | Medium |
| 14. What is the role of social media (particularly Facebook for local community groups, and Twitter for up-to-date announcements) and other channels for communicating flood warnings and advice? | Medium |
| 15. Which subgroups are less likely to take action (for example, older people, people whose first language is not English, socially or geographically isolated people, people with disabilities)? | Medium |
| 16. What is the impact of mainstream media coverage of flooding? Do people look to media sources to validate information? | Medium |
| 17. Which step in the customer journey is the biggest problem, or bottleneck, to the uptake of property level resilience? | Medium |
| 18. Why do people not take flooding more seriously as a risk to their wellbeing, even when the risk is imminent? | Low |
| 19. At what point do people tend to take action? Are there common trigger points that move someone from inaction to action? | Low |

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