

Fit for the future? The reform of flood insurance in Ireland: resolving the data controversy and supporting climate change adaptation

Swenja Surminski

Policy paper

May 2017

In collaboration with



The Centre for Climate Change Economics and Policy (CCCEP) was established in 2008 to advance public and private action on climate change through rigorous, innovative research. The Centre is hosted jointly by the University of Leeds and the London School of Economics and Political Science. It is funded by the UK Economic and Social Research Council. More information about the ESRC Centre for Climate Change Economics and Policy can be found at: <http://www.cccep.ac.uk>

The Grantham Research Institute on Climate Change and the Environment was established in 2008 at the London School of Economics and Political Science. The Institute brings together international expertise on economics, as well as finance, geography, the environment, international development and political economy to establish a world-leading centre for policy-relevant research, teaching and training in climate change and the environment. It is funded by the Grantham Foundation for the Protection of the Environment, which also funds the Grantham Institute for Climate Change at Imperial College London. More information about the Grantham Research Institute can be found at: <http://www.lse.ac.uk/grantham/>

About the author

Swenja Surminski is a senior research fellow at the Grantham Research Institute on Climate Change and the Environment, as well as a member of the Centre for Climate Change Economics and Policy (CCCEP). Swenja has published widely, is a contributing author to the Intergovernmental Panel on Climate Change, and works closely with industry and policy-makers.

Acknowledgements

This work is part of the 'Costing climate change impacts and adaptation in Ireland' research project conducted jointly by University College Cork (UCC) and the Grantham Research Institute on Climate Change and the Environment. The work is funded by Ireland's Environmental Protection Agency (EPA) under the EPA Research Programme 2014–2020.

The author would like to thank Joel Hankinson (Grantham Research Institute) and Tom McDermott (UCC) for their input and Georgina Kyriacou (Grantham Research Institute) for her editorial support with this paper. Thanks also go to Caroline Kousky (Resources for the Future), Leigh Wolfram (OECD) and Declan Conway (Grantham Research Institute) for their very helpful review comments.

The author declares financial support from EPA for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

This policy paper is intended to inform decision-makers in the public, private and third sectors. It has been reviewed by at least two internal referees before publication. The views expressed in this paper represent those of the authors and do not necessarily represent those of the host institutions or funders.

Contents

Executive summary	3
1. Introduction	5
2. What are the challenges surrounding flood risk and insurance in Ireland?	7
3. Risk assessment and data-sharing arrangements in other countries	12
4. Turning the data controversy into an opportunity for climate adaptation and flood insurance in Ireland	14
5. Features of a new data platform	17
6. Conclusion: How could a new data platform make flood insurance in Ireland fit for the future?	19
References	21

Executive summary

Flood insurance in Ireland is not fit for the future but remains a key tool for coping with risk

It is becoming increasingly clear, in Ireland and elsewhere, that the current approach to flood insurance is not fit for the future as risk levels change. Yet a range of people and sectors continue to rely on flood insurance as a key tool to cope with flood risk and to continue operating. These include homeowners and businesses, who do so directly, and mortgage providers, property investors and developers, and national and local government, indirectly. This raises important questions for those who are insured or seeking cover, the insurers, and governments tasked with addressing flood risk and protecting citizens from its impact.

The underlying risks must be addressed in order to improve the current and future availability and affordability of flood insurance

As seen in Ireland and elsewhere, there is a danger that discussions about flood insurance turn to short-term, stop-gap efforts, rather than moving towards a more sustainable flood insurance approach. Problems with flood insurance are a symptom of the underlying issue: that flood risk is increasing as a result of climate change and socio-economic trends, such as land-use and property development. The only truly sustainable response, therefore, is a significant increase in efforts to address the underlying risks now and in the future, as this will help to ensure the affordability and availability of insurance. The benefits of such action would also reach far beyond insurance as they would address the wider negative impacts that flooding has, such as emotional stress, health issues and declines in economic competitiveness of impacted communities and regions.

Improvements in access to and use of high-quality data and transparency about risk are needed

This paper's stock-take of current flood insurance provision in Ireland shows that use of data, and transparency about risk levels and efforts to reduce them, are the issues that need to be resolved first. Access to flood risk data is essential for any flood insurance scheme, but the quality and use of data can be a matter of dispute between insurers, their customers and the government. There is much distrust among both consumers and the government about the behaviour of insurance companies, which is unlikely to change without greater transparency from insurers about their understanding of flood risk, their underwriting practices and how they support flood risk management. There is concern that if these issues are not addressed, the premiums associated with insuring flood risks will exceed consumers' ability or willingness to pay, or that the private sector may find flood insurance commercially unattractive and withdraw from the market. Efforts such as the Memorandum of Understanding (an agreement between the Irish government and Insurance Ireland – a representative body for insurers – to guide the use of information about flood defences for underwriting) are aimed at finding a resolution, but these issues appear to persist.

A fundamental review of the collection and sharing of flood risk data is required

There is an important opportunity in Ireland to develop a truly forward-looking approach to using flood risk data, including for insurance purposes, that also enhances climate change adaptation. The current discussions about the Flood Insurance Bill and the upcoming consultation on the National Adaptation Framework provide a chance to explore the possibility of a radical shift away from the current approach to collecting and sharing flood risk data. The main starting point is an understanding of who owns data relevant for flood risk management, and who makes decisions

that will impact on current and future flood risk. Understanding this will require engagement with actors beyond the insurance and government sectors, to include, among others, mortgage providers, utility companies, infrastructure investors, property developers, local planners and emergency responders. While their actions impact on current and future flood risk, it is often unclear whether or not they take into account flood risk data, and they tend not to share data that they own and that may help others to understand current and future exposure and vulnerability.

A data platform would aid a collaborative approach to understanding flood risk and resilience

A data platform populated with information from and used by a wide range of sectors, groups and institutions could become a powerful tool for flood resilience and climate change adaptation. Its objectives would be to:

- provide more insights to help resolve the current problems with flood insurance (**address the symptoms**); and
- facilitate data sharing across sectors to help them recognise and manage current and future risk levels, enabling different stakeholders to incorporate this into their day-to-day decision-making (**address the causes**).

Importantly, such a data platform could support the transition of flood insurance in Ireland from being ad hoc and short-term into a sustainable and coordinated approach, while also supporting flood risk management and climate change adaptation efforts. However, in order to satisfy the needs of a range of stakeholders, it is important that the data platform would be based on a broad suite of principles. **The UK Government's Department for Environment, Food and Rural Affairs has identified eight principles, agreed by government and industry in relation to the adoption of Flood Re, that are useful for this purpose.** They include ensuring that:

- (i) flood insurance is widely available;
- (ii) flood insurance pricing reflects risk;
- (iii) the provision of flood insurance is equitable;
- (iv) the approach does not distort competition;
- (v) insurance is practical and deliverable;
- (vi) the approach encourages insurance take-up;
- (vii) the approach encourages investment in flood risk management activity; and
- (viii) the approach is sustainable in the long-term.

If designed with these principles in mind, the data platform would offer transparency and guide any possible government interventions, for example to provide short-term relief measures for those currently struggling to secure affordable insurance, without losing sight of the underlying picture of risk.

Many countries have created data exchanges between the private and public sector by, for example, sharing mapping data (e.g. HORA in Austria and ZÜRS in Germany), sharing claims data (e.g. Norway) and the provision of risk management information (e.g. PREP in Australia and the *Observatoire National des Risques Naturels* in France). However, none has adopted a broad perspective to include data owned by other sectors such as banks, property developers or utility companies, who can provide valuable information on the uptake of mortgages and the extent of property-level protection measures or maintenance levels of drainage systems, for example. The government and private sector in Ireland should embrace the lessons from these examples and create a truly collaborative approach to understanding and addressing current and future flood risk. A data-sharing platform could be used by the public, government and private companies when making decisions on where and how to build, how to protect and how to underwrite. Transparency would be important to this approach, as it would create trust.

1. Introduction

Increasing flood risk, due to climate change and socio-economic trends such as changing land use practices, is a major challenge for Ireland. This is putting pressure on existing strategies – including flood insurance – to cope with floods and reduce their impacts.

This paper provides suggestions to inform the current debate about flood insurance in Ireland, based on exploration of how it could be reformed to be fit for the future in the context of climate change. The broader research background is described in Box 1.

There is an important opportunity in Ireland to develop a truly forward-looking approach to using flood risk data, including for insurance purposes, that enhances climate change adaptation. The current discussions about the Flood Insurance Bill, the upcoming consultation about the National Adaptation Framework, and efforts to develop an online data portal for flood risk information by the Office of Public Works (OPW) together provide a chance to explore the possibility of a radical shift away from the current approach to flood risk data – a shift that would embed flood insurance aspects into a wider flood risk data platform. This paper is intended to inform such an exploration.

This introduction outlines the current situation with Irish flood insurance, particularly in relation to data sharing.

Flood insurance is a key part of the approach to flood risk management in Ireland

As a risk management tool, flood insurance is already facing challenges. Historically, a large proportion of damages to homes and businesses has been addressed through flood insurance, offered exclusively through private insurance companies as part of standard home and business cover. However, the provision of flood insurance is not mandatory for insurers. Comprehensive insurance cover, including flood insurance, tends to be a requirement under mortgage and business loan arrangements. This has led to a very high penetration rate, with about 98% of households in Ireland having some form of building or contents coverage (IFPCG, 2016). How many of those policies include flooding is unclear, with estimates ranging from 78% to 89%, depending on the region and risk levels (Irish Times, 2016; IFPCG, 2016). This makes insurance a key component in the Irish approach to flood risk management, and is based on the understanding that insurance mechanisms offer a more effective way of addressing the costs of disasters than relying on post-disaster assistance (e.g. Hallegatte, 2014; Brainard, 2008). Insurance can also address economic disruption and the impact of disasters on public finances (e.g. Von Peter et al., 2012; Standard & Poor's Rating Services, 2015).

Box 1. Research background

To manage flood risk effectively, more needs to be known about the economic costs of flooding and its impact on economic activities in the short, medium and long term. This is the focus of a research project, to which this paper contributes, conducted jointly by University College Cork and the Grantham Research Institute on Climate Change and the Environment and funded by Ireland's Environmental Protection Agency (EPA).

This paper was preceded by a discussion note, the aim of which was to facilitate external scrutiny of our initial stock-take of flood insurance in Ireland against five parameters: (i) technical risk cost modelling and risk communication, (ii) the roles of the public and private sectors, (iii) incentives for risk reduction, (iv) take-up rates of flood insurance and (v) rate-setting and the distribution of costs of catastrophes. The discussion note also formed part of the consultation on our research and supported a webinar held on 23 February 2017.

The findings presented in this paper are the result of consultation following the discussion note, a literature review, assessment of existing data and information, and discussions with stakeholders.

The insurance industry is being criticised over affordability and availability

Over the past few years, the provision of flood insurance has come under increased scrutiny due to concerns about affordability and availability of cover in flood-prone areas. In the wake of a bout of flooding events, the insurance industry has been accused of treating certain areas of the country that include insurable properties as uninsurable through its use of a geocoding approach. Allegedly this involves characterising large areas with the same level of risk, despite recent advances in flood protection (both at the government and individual level) and therefore discriminating against those homes and businesses that stand to benefit from protection measures (Houses of the Oireachtas, 2012). There are also reports of premiums rising to unaffordable levels and terms and conditions being imposed, such as deductibles, that would render flood insurance unviable for owners of homes or businesses (Reddan, 2014).

Insurers have responded by arguing that lack of investment and ineffective planning restrictions mean that exclusions are necessary to reflect rising risk levels and to maintain flood insurance provision at affordable rates for those at lower risk (Houses of the Oireachtas, 2015a).

Measures to address the symptoms and causes are often treated separately

The current flood insurance debate shows **two dimensions to the problem**:

- Measures to address the current concerns of those struggling to access or to pay for flood insurance, while also recognising the aims and objectives of others, such as governments, regulators and insurers. This involves efforts to amend the way flood insurance is provided, for example through changes in regulation or pricing. **These measures address the symptoms.**
- Measures to address underlying risk trends, behaviour and risk characteristics in order to create an environment in which current and future flood risk is managed so that insurance is affordable and available. **These measures address the underlying causes.**

In Ireland, as in most other countries, these two dimensions tend to be approached separately: efforts to reform flood insurance focus on addressing current needs and demands, often triggered by political pressure to alleviate concerns about rising insurance prices. This can lead to a stop-gap mentality, offering temporary financial relief to homeowners and businesses rather than reforming the system in a forward-looking way. This has been seen with the UK's Flood Re, which fails to incentivise homeowners and government to reduce risk (Surminski, 2017).

Insurers have a crucial role to play in climate change adaptation but there is distrust of the sector

It is widely recognised that climate change adaptation and flood risk management are particularly important to the future availability of flood insurance (Prudential Regulation Authority, 2015). The only truly sustainable response to flooding and climate change is a significant increase in efforts to address the underlying risks and to minimise future risks, which in turn would help to ensure the affordability and availability of flood insurance. This would also support those who are not benefitting from insurance, by, among other measures, addressing the intangible effects of flooding such as emotional stress, health issues and the economic competitiveness of communities and regions.

The Irish National Climate Change Adaptation Framework 2012 highlights the importance of insurance mechanisms as a means of tackling climate change, noting both that the insurance

industry is a climate-sensitive sector and that it can play a crucial role in capacity-building through disseminating information on risk reduction and sending pricing signals (DECLG, 2012). However, it is exactly this function of attaching a price tag to flood risk that causes controversies, as currently seen in Ireland. There is a degree of distrust from both consumers and the government about how insurers use flood risk information, mixed with concerns that the premiums associated with insuring flood risks may exceed the consumer's ability or willingness to pay.

Evidence from the insurance industry in other countries suggests that data from risk-reducing initiatives are not effectively passed on to modellers, that there can be delays between completion and recognition of new protection schemes on maps, and that the industry lacks sufficient information about effectiveness and usage to include flood risk reduction measures in their pricing decisions.

Interestingly, the fact that underwriting flood risk is not an exact science is often overlooked, with the risk assessment capacities of insurers sometimes significantly overestimated. This gives rise to concerns that the private sector may find flood insurance commercially unattractive or take on too much risk, which might require some form of regulatory intervention (Surminski, 2014).

Recognising these different dimensions of the flood insurance problem is key to finding a sustainable way forward in providing flood insurance in Ireland.

This stock-take of existing flood insurance provision in the country shows that the problems in the current provision of flood insurance, including the concerns about pricing and affordability, are all linked to flood risk data and how it is used by different stakeholders. Transparency about current and future risk levels, as well as the use of risk data for insurance and other purposes, are key issues that need to be resolved.

Structure and scope of the paper

Section 2 briefly summarises trends in flood risk in Ireland and their impact on the provision of flood insurance. This is followed by a review of risk assessment and data-sharing arrangements in other countries in **Section 3**. **Section 4** proposes a data platform that could help turn the data controversy into an opportunity for climate change adaptation in Ireland, and assesses how fit for the future flood insurance is currently, assessed against a set of principles for sustainable flood insurance. **Sections 5 and 6** conclude by setting out key features and principles for the data platform.

2. What are the challenges surrounding flood risk and insurance in Ireland?

The problem: flooding is Ireland's most concerning and costly form of natural disaster

Ireland has a long history of natural disasters, with 'the night of the big wind' in 1839 remaining the most destructive to date. However, flooding has become Ireland's natural disaster of primary concern, following a series of recent major flooding events across the country, including in the Dublin area and in the south-west, particularly around Cork. For example, coastal flooding in 2002 caused €60m of damage and flooded at least 1,250 properties, while fluvial and groundwater flooding in 2009 caused €250m of insured losses (Houses of the Oireachtas, 2015a). Cumulatively,

recent events have cost over €800m (Houses of the Oireachtas, 2015a and loss data on 2015-16 floods).

Main physical causes of flooding

These events have been caused by a combination of fluvial (river), pluvial (precipitation), groundwater and coastal flooding, with the most significant types for Ireland being fluvial and coastal (IFPCG, 2016). For example, fluvial and groundwater flooding in late 2015/early 2016 caused by Storm Desmond (Siggins, 2016) resulted in infrastructure damage costing €106m. The storm led to 37 of 75 hydrometric gauging stations recording their highest ever flood levels (IFPCG, 2016). This is consistent with climate change projections (although not proof of cause and effect), which indicate that the frequency of very wet days in winter could increase by 20% in high greenhouse gas emission scenarios (Gleeson et al., 2013). Ireland's Environmental Protection Agency predicts that river and coastal flooding are particularly likely to increase as a result of higher precipitation intensities (Houses of the Oireachtas, 2015a). Pluvial flooding can also be expected to increase.

Other factors

Climate change is just one factor that has contributed to Ireland's exposure to flooding. In particular, the Environment Pillar, an association of environmental non-governmental organisations, has suggested that the opportunist re-zoning of land by local councils, together with certain land use practices (such as drainage and hedge clearances under the Farm Modernisation Scheme over the past 40 years), have had a major effect (Environment Pillar, 2016). Local politicians also historically had the power to overrule planners through the use of 'Section 4 notices', allowing planning decisions that exacerbated flooding impact to be pushed through (O'Callaghan, 2016).

Governmental response

In response, the Irish Government has taken a number of steps to tackle both climate change and flood risk through a number of public reports and investigations. In relation to climate change, a new National Adaptation Framework is currently being drafted, and is expected to be available for consultation by the end of June 2017. This Framework will require government departments to prepare adaptation plans (IFPCG, 2016). Furthermore, flood defences adopted by the OPW are designed to take the effects of climate change into account. The OPW's policy states: 'The possible effects of climate change, and the associated uncertainty in projections, shall be considered at all stages of activity under the National Flood Risk Management Programme, and the development, design and implementation of all policies, strategies, plans and measures for, or related to, flood risk management must be sustainable and cognizant of the potential impacts of climate change' (ibid). Other programmes, such as the Green Low-Carbon Agri-Environment Scheme, also attempt to reduce the impacts of climate change (ibid).

With regard to flood risk, the Catchment Flood Risk Assessment and Management Programme (CFRAM) is designed to give a comprehensive picture for over 300 locations, including through flood mapping (IFPCG, 2016). Furthermore, through the Interdepartmental Flood Policy Co-ordination Group, the government has undertaken a study into individual property protection. It is estimated that the average resistance package per household would cost €7,000 (ibid).

Following the 2016 general election, the new government set out its approach to flood risk management. It includes establishing a new national forecasting system, providing funding for flood resilience, considering access to flood insurance and exploring individual property protection,

as mentioned above (ibid). Recently, €430m has also been allocated to flood risk management under Ireland’s infrastructure investment plan, known as the Capital Investment Plan 2016–2021.

Local authorities are also required to comply with the Planning System and Flood Risk Management guidelines, which were adopted in 2009 as a key step towards a national climate change strategy. In general, the guidelines require: (i) avoiding development in high flood risk areas (particularly floodplains); (ii) the adoption of a sequential approach to flood risk management when preparing new developments; and (iii) the incorporation of flood risk assessment into planning decisions.

The symptom: concerns have led to the Flood Insurance Bill

A number of public reports and investigations¹ into flood insurance in Ireland have explored the issue of affordability and availability, seeking to identify cause and effect, as well as solutions. For example, the Department of Finance recently decided that the most effective solution to problems with flood insurance would be to continue to focus on improving data sharing between insurers and the government, and on investing in flood defences (Department of Finance, 2016 in IFPCG, 2016). Most recently, an alternative solution has been promoted by Fianna Fáil through the introduction of the Flood Insurance Bill 2016 to the Dáil Éireann, which is currently proceeding through the parliament. The discussion informing these reports and investigations has focused on the availability of flood insurance, driven by concerns about growing difficulties in accessing flood insurance for some households and for small and medium-sized enterprises (SMEs). It mirrors similar debates in other countries, most notably the UK and Australia, which have recently introduced reforms to flood insurance in response to fears that some households or businesses may be left without cover, particularly after flood events.

This paper’s stock-take seeks to clarify the current situation, identifying existing data and highlighting different positions, as summarised in Table 1. This is based on a framework of five parameters, developed by Kunreuther and Kousky for disaster insurance in the United States (Kousky, 2017, and applied in Surminski, 2017), which applies a mix of quantitative and qualitative metrics and criteria, based on analysis of the available data, stakeholder interviews and literature.

Table 1. Summary of findings from analysis of current flood insurance provisions in Ireland across five performance parameters

Parameter	Findings
1. Roles of the public and private sectors	<p>The private sector underwrites flood insurance and handles claims; the public sector is responsible for flood risk management. There is the MoU between insurers and government to govern the use of flood risk information, but it has been accused of having little practical effect (Scanlon, 2016). Concerns exist on both sides:</p> <ul style="list-style-type: none"> • Insurers are concerned that the government has failed to prevent building in flood risk areas (Houses of the Oireachtas, 2015a). • The public sector is concerned that insurers are failing to take into account remedial flood defence works through the use of geocoding (Houses of the Oireachtas, 2015a).
2. Penetration rates of flood insurance	<p>There is evidence of coverage gaps and increasingly unaffordable rates, for example in Cork (O’Sullivan, 2016). A lack of comprehensive data means that it remains unclear to what extent flood insurance is actually available/being refused in high-risk areas.</p> <p>Take-up rates remain relatively high due to bundling and mortgage requirements, but there is growing concern about the lack of availability in high-risk areas and after a</p>

¹ These have been conducted by the Joint Committee on Environment, Culture and the Gaeltacht (Houses of the Oireachtas, 2012), the Joint Committee on Finance, Public Expenditure and Reform (Houses of the Oireachtas, 2015b), and an initiative led by the Department of Finance to explore reform options, with the Interdepartmental Flood Policy Co-ordination Group (IFPCG) publishing an interim report (IFPCG, 2016).

	<p>flood: anecdotal evidence suggests property owners are having difficulties in obtaining insurance after flooding events (Houses of the Oireachtas, 2015b).</p> <p>Insurance Ireland estimates penetration rates with some form of flood insurance to be 98% for Irish homes, reflecting that flood cover is a standard part of household insurance (IFPCG, 2016). Data from the OPW on 16 flood defence schemes shows the penetration rate is 89% in areas with fixed flood defences, compared with 78% in areas with demountable (i.e. non-fixed) defences (Irish Times, 2016).</p> <p>Importantly, insurance coverage levels should also be assessed in relation to overall damages, which allows an assessment of how much of the total damage was insured. This may create a more accurate picture of how well insurance is covering flood losses. Simply looking at the number of households that have some form of insurance cover will not provide information about their level of protection, nor does it indicate what level of insurance cover is taken out by local authorities for their own buildings or infrastructure.</p> <p>There is no evidence relating specifically to coverage for SMEs and this is a significant gap in the data.</p>
3. Technical risk cost modelling and risk communication	<p>Use of risk information by insurers is unclear and non-transparent: most insurers are using some form of in-house risk models; the current model utilised by many was developed by JBA Risk Management while other commercial models are under development (for example by modelling firm RMS). Insurers are also using public risk data prepared by the OPW, but face usage limitations when using it for underwriting. The focus is on risks within 12-month policy timeframes.</p> <p>There is concern about the use of a broad geocoding mapping approach and lack of recognition of flood risk management efforts by insurers, encapsulated in the following quote from the Joint Committee (2012): 'It does seem insurance companies are geocoding parts of the country in a blanket approach. Accordingly, a house deemed to be in a flood-risk or subsidence-risk area will not get cover. For example, it is impossible to get flood insurance for a dwelling within 100m of a river even if it is an apartment 100ft off the ground.'</p> <p>The true cost of risk is not visible to policy-holders due to the bundling of flood insurance with household policies. Improved risk information is expected as a result of the CFRAM, but usage restrictions for insurers may apply (source: discussion with insurance representatives).</p>
4. Incentives for risk reduction by policy-holders	<p>There is no evidence that risk reduction measures, such as property improvements, are recognised by insurers at the point of underwriting. No incentives are currently provided. Evidence from the UK insurance industry suggests that data from risk-reducing initiatives are not effectively passed on to modellers, that there can be delays between completion and recognition of new protection schemes on maps, and that the industry lacks sufficient information about effectiveness and usage for including flood risk reduction measures in their pricing decisions (source: meeting with UK industry representatives).</p>
5. Distribution of the costs of disaster events	<p>Private flood insurance is the main funding mechanism, supplemented by ad hoc government relief measures and some support measures for SMEs, for example following the 2015–16 floods (Irish Red Cross, 2016).</p> <p>Anecdotal evidence exists of implicit cross-subsidisation between low- and high-risk properties through the insurance system (Houses of the Oireachtas, 2015a).</p>

Source: Author, based on Kousky (2017) and Surminski (2017)

The Memorandum of Understanding is resolving data issues to an extent but underlying problems remain

The stock-take and discussions with stakeholders for this research indicate that access to and use of data are key issues that need to be resolved in order to address short-term as well as longer-term concerns about flood risk and how it is managed. The Memorandum of Understanding (MoU) agreed in 2014 by the OPW and Insurance Ireland attempted to resolve this. Under the MoU, Insurance Ireland agreed to ensure insurers would take flood defence measures into account when

making underwriting and pricing decisions, provided the OPW could provide information on those defences and, in general, could verify that they satisfy a 1:100-year standard.

While the MoU has helped to bring insurers and government closer together in discussing flood risk issues, the recent problems indicate that this has not helped to alleviate the underlying problems with risk data. Insurers are continuing to face restrictions on using public data for underwriting (e.g. in terms of flood maps not available for commercial use), while insurance companies themselves do not usually share further insights about their own risk and claims data (Scanlon, 2016; Dennehy, 2016), citing data protection and commercial confidentiality as their reasons. In a commercial flood insurance market, companies compete on data and risk knowledge, which should lead to innovation and investment in new data tools. In turn, this would mean the provision of more accurate terms, which would benefit customers outside high risk areas, but may lead to price rises or exclusions for those at risk. However, in practice, the underwriting and pricing decisions remain far from transparent to insurance customers, who are usually presented with one overall price without further explanations about the different risk components and their impact on insurers' decisions.

Across many insurance markets there are signs that underwriting has become more technically orientated (Surminski et al., 2014). However, technical flood risk analysis is far from straightforward. Conducting risk analysis requires: access to high quality data with appropriate resolution (on hazards and assets, and on their exposure and vulnerability); tools and models; and multi-disciplinary technical expertise to develop, interpret and understand the uncertainties associated with the analysis (Golnaraghi et al., 2016). Thus, there is also a danger of overestimating the risk assessment capacity of insurers. While many reinsurers have dedicated teams and technical experts, there is a clear lack of expertise and skills within many insurers. The industry relies heavily on commercial models, but whether or not this drives commercial underwriting decisions is far from clear.

Regulatory requirements, such as the European Union's Solvency II directive,² have increased the need for technical risk assessment, but discussions with market participants from several countries for this research have revealed that this is far from an exact science. Furthermore, the industry is mostly focused on risks over the 12-month policy coverage period, rather than on longer-term trends. This is a well-known problem, and it leads to a short-sighted approach to current risks, with insurers knowing that they have the flexibility of changing terms and conditions every year should the risk profile change. However, as the experiences with the 2007 floods in the UK show, this can create significant reputational issues for insurers, who therefore often refrain from making dramatic changes and continue coverage at a discounted price to ensure good customer relations (Surminski and Eldridge, 2014).

In Ireland, modelling firm RMS is developing a full commercial flood risk model, due to be released in 2018. This indicates an appetite in the insurance market for more tools to support underwriting, which could lead to a reassessment of current underwriting terms. This will enable insurers to make a more granular assessment of risk, which insurers claim will lead to cover improvements, such that homes and businesses that have previously been deemed to be at high risk due to geocoding would receive improved risk assessments. However, improved risk analysis is also likely to increase concerns about the affordability and availability of cover. Recent advances in public flood risk assessment which include climate change projections, such as the CFRAM models, are widely praised for being high-quality. This was evident in a recent webinar conducted by the Grantham Research Institute and University College Cork with public sector, insurance and modelling

² The EU Solvency II Directive (2009/138/EC) addresses the level of capital required to be held by insurance companies in Member States in order to mitigate insolvency risk. It requires insurers and reinsurers to adopt '...a regular practice of assessing their overall solvency needs with a view to their specific risk profile (own-risk and solvency assessment)', increasing the need for technical risk assessment.

representatives. However, the impact remains unclear, as there is no information available about how the data are taken into account when making public and private decisions, such as insurance underwriting, local planning (including in complying with the Planning System and Flood Risk Management guidelines), infrastructure investment, property development, and house purchases. This underlines the importance of developing a new approach to sharing and using flood risk data.

3. Risk assessment and data-sharing arrangements in other countries

Across the world, a number of countries have implemented innovative approaches for improving risk assessment and data sharing. The main driver behind these efforts is a recognition that flood losses are increasing and that there is a mutual benefit in sharing data. Key issues are the commercial sensitivity of private insurance data and data protection. Table 2 provides examples that have been designed to address both these issues, through a variety of approaches, and based on the underlying assumption that greater transparency is beneficial to all.

Table 2. Examples of approaches to risk assessment and data sharing from around the world

Approach to risk assessment and data sharing	Examples
Sharing mapping data	<p>In Austria, the HORA risk zoning and mapping model for floods was launched by the Ministry of Agriculture (<i>Lebensministerium</i>) and the insurance industry (represented by the Austrian Insurance Association) following major flooding in 2002 (Steifelmeyer and Hlatky, 2008). The government provides GIS data, and the insurance industry engages in modelling and development.</p> <p>In Germany, the German Association of Insurers (GDV) had a country-wide flood hazard zoning system ('ZÜRS') as early as 2001. Criticism of the maps generated by ZÜRS prompted discussions about flood hazard mapping and greater collaboration between the GDV and the government, leading to local flood hazard zones being added to ZÜRS (Kron, 2013). Maps developed by public water authorities in accordance with the European Floods Directive (2007/60/EC) have also been integrated into ZÜRS, improving the consistency of hazard information and assessment. A more limited version, ZÜRS Public, is available online.</p>
Sharing flood risk management information	<p>In Australia, the ICA Property Resilience and Exposure Program (PREP) facilitates the sharing of information between the insurance industry and the government (Insurance Council of Australia, 2016). Local governments provide insurers with all locally held hazard maps and specific building data which might affect risk assessments. This information is then utilised by the insurance industry in order to produce a number of outputs, including a 'resilience heat map' for local governments that identifies areas at greatest risk (including those due to poor design and building controls, where this information has been made available). This information is shared on the same platform as the National Flood Information Database, which is owned and operated by the insurance industry.</p> <p>In Denmark, local authorities have approached the Association of Danish Insurers to develop a better understanding of how risk reduction measures can impact on insurance provision and terms, including price. In consultation with member companies, the Association is providing some high-level guidance, based on the assumption that, on average, 15% of a typical home insurance premium is related to flood insurance cover.</p> <p>France has developed the 'Observatoire National des Risques Naturels', which facilitates the exchange of flood risk information between public and private</p>

	partners. This is based on the understanding that an exchange of flood risk data has mutual benefits. Through its website it provides an open-source geographic interface with access to indicators on exposure, claims data and prevention developments. The indicators can be examined at municipal or departmental level for different climatic risks (e.g. flood, storm or drought).
Sharing claims data	In Norway , municipalities are engaging with the insurance industry to create data platforms, which can be used for public planning decisions. The Norwegian Natural Perils Pool has developed ClimRes, a map-based online interface for the data on insurance compensation payments. It provides three modes: a straightforward map display; an interactive dashboard; and a participatory tool where users can be actively engaged in a debate on factors that make a place more resilient.
Limited data sharing	In the United States , the Federal Emergency Management Agency (FEMA) is primarily responsible for data sharing and risk assessment under the National Flood Insurance Program. It does so through its Risk MAP program. This involves flood insurance studies of areas identified as being at particular risk, which are then fed into flood insurance rate maps. However, there is limited information on how insurers specifically contribute to this process. Furthermore, FEMA will not share parcel-level claims data.

Source: Author

Cooperation between stakeholders is important for data collection but barriers and limitations to use remain

The international examples highlighted in the previous section demonstrate the importance of cooperation between key stakeholders in achieving improved data collection and risk reduction.

In many countries, such data is not readily available and accessible for risk modelling purposes owing to a number of factors, such as restrictive national data policies, institutional ownership of data, prohibitive costs for hardware and software, and a lack of staff who understand the limits of catastrophe models (computerised simulations of the impact of catastrophes, combining statistical datasets with science, technology and engineering knowledge). A thriving insurance market with a demand for better models could play a role in addressing these issues. The best flood modelling seems to be undertaken in places where there is an active flood insurance market. This could be an opportunity for Ireland.

However, a lack of transparency in commercial models has also made the understanding of the inherent uncertainties challenging. These factors have led to the development of open-source risk modelling methodologies. The OASIS loss modelling framework is one such example: a non-profit open-source catastrophe modelling platform and framework funded by the worldwide insurance and reinsurance community, which aims to make these tools and methodologies available to any user.

Many of these international examples show some degree of collaboration in order to develop underlying risk data and modelling capacity, and public dissemination of those data through online platforms in order to improve individual capacity for self-assessment. However, these approaches are often limited in their application. For most it is unclear how and to what effect they are used in decision-making. Another limitation appears to be a relatively narrow focus on the insurance industry and government, with the role of other sectors and stakeholders in gathering and using the data receiving little consideration. Recent efforts in Scandinavian countries, driven by municipal governments worried about the lack of insurance availability in their cities, are attempting such a broader approach. This includes bringing together key sectors whose decisions influence risk levels and then using the data to inform development, house buying, infrastructure planning and public budgeting. As such, the development of a data platform in Ireland may be of most benefit if it focuses less on insurers and the government, and incorporates a broader range of stakeholders.

The current approach in Ireland shows limited collaboration in comparison to international efforts

The approach taken in Ireland, most notably the MoU, appears rather high-level in comparison to other countries, showing a very limited degree of collaboration between the insurance industry and government. Flood maps are prepared by the OPW with little input from the insurance industry. Discussions informing this paper which were held with representatives from the Irish and the UK insurance industry also revealed concerns about the time lag between information becoming available to the government and to insurers. However, it also remains far from clear how insurers actually use the risk data and how they influence commercial decisions. Some insurers appear to face a challenge in understanding and making decisions based on flood data. This might be caused by data issues, such as gaps in the geographic coverage, and by differences in the format of flood risk information, meaning it is often incompatible with data sets held by the insurers themselves. A further problem is that many insurance companies do not have the in-house expertise to be able to interpret the data. This seems to be a particular problem when customers seek recognition from insurers of their own efforts to reduce the level of flood risk affecting their properties.

As such, Ireland is not fully deriving the benefits of risk information, which is crucial for informed decision-making: it increases the understanding of the characteristics of risk, supports a more transparent approach to pricing risk, informs efforts to help those facing the biggest threats from rising risks, and helps the design and evaluation of costs-to-benefits of various risk management strategies.

4. Turning the data controversy into an opportunity for climate change adaptation and flood insurance in Ireland

This paper proposes an innovative approach that turns the current data controversies that are emerging around flood insurance into an opportunity for climate change adaptation. While improved data alone will not solve any problems, they are the foundation of better informed decision-making, transparency and trust. Therefore a new data platform is proposed, populated with information from and used by a wide range of stakeholders. Its objectives would be to:

- provide more insights to resolve the current problems with flood insurance (i.e. **address the symptoms**); and
- facilitate data sharing across sectors to help them recognise and manage current and future risk levels, enabling different stakeholders to incorporate this into their day-to-day decision-making (i.e. **address the causes**).

Eight principles of sustainable flood insurance can be used to frame the needs of different stakeholders

Importantly, any effort needs to reflect the overall aim and vision. For flood insurance in particular, it is clear that stakeholders have different expectations, ambitions and assumptions, and that these can clash: for example, the need for insurers to meet regulatory solvency requirements, the need for affordable flood insurance for homes and SMEs in high-risk areas in order to access mortgages or commercial loans, and the government's priority to keep its own financial exposure as small as possible by involving the private sector.

Eight principles of sustainable flood insurance provide a useful way of framing these needs and requirements. Agreed by the government and industry in the UK during the negotiations about Flood Re (Defra, 2011), this list offers a set of criteria against which to check existing approaches to flood insurance. Testing the results from this paper’s stock-take against the eight principles of sustainable flood insurance provides the picture shown in Table 3. As experience from the UK and elsewhere shows, there are often very limited data underpinning the understanding of the current situation (Surminski, 2017). Table 3 highlights how the proposed new data platform could improve this and increase the transparency of risk levels, insurance and risk management efforts. For some of the questions arising there is no objective answer; for others approximations are sufficient. But it is clear that to resolve all of these problems, greater collaboration, between, but also beyond, government and the insurance industry, is required. Gathering together existing evidence in one place and sharing it would be a useful start. The platform would seek to address disparities in the information available about risk and about the positive impact of risk reduction measures.

With rising risk levels, sustainable flood insurance and climate change adaptation cannot be achieved without a greater degree of transparency, trust and risk ownership. The data platform that is proposed in this paper can facilitate this. At the very least it removes the danger that a lack of risk data, or limited access to them, may become a convenient excuse not to take any action. And most importantly it can also generate benefits far beyond the current flood insurance discussions, and support the overarching aim of flood resilience today and in the future.

Table 3. How a new data platform could support the questions arising from eight principles for sustainable flood insurance

Principles for sustainable flood insurance	Key issues
1. Insurance cover for flooding should be widely available	<p>High take-up rates suggest flood insurance is available, but there are concerns about lack of access for some, and regional differences in availability.</p> <p>Questions that could be answered through the data platform:</p> <ul style="list-style-type: none"> • What are local coverage levels (in terms of risk and percentages of homes/businesses)? • How is affordability impacting insurance purchase decisions?
2. Flood insurance premiums and excesses should reflect the risk of flood damage to the property insured, taking into account any resistance or resilience measures	<p>Premiums and excesses appear to be based on risk, but it is unclear to what extent geocoding is obscuring this. There is no evidence of how insurers account for flood defences and other protections, while limitations about the use of public flood risk data for underwriting exist.</p> <p>Questions that could be answered through the data platform:</p> <ul style="list-style-type: none"> • How is information about flood risk management efforts factored into underwriting decisions by insurers? • Is there a systematic approach to track this issue, including flood risk management at property, local and national level?
3. The provision of flood insurance should be equitable	<p>There is evidence to suggest some property owners cannot access flood insurance despite the adoption of new defence mechanisms, pointing to inequitable access.</p> <p>Questions that could be answered through the data platform:</p> <ul style="list-style-type: none"> • Where are these problems occurring?

4. The insurance model should not distort competition between insurance firms	There appears to be no competition distortion in the Irish flood insurance market.
5. Insurance provision needs to be practical and deliverable	The current flood insurance model has been in operation for a long time – paying out claims and offering cover to most homes and businesses in Ireland – and has been recognised by the European Commission as efficiently developed (IFPCG, 2016).
6. The insurance system should encourage the take-up of flood insurance, especially by low-income households	<p>Penetration rates are estimated to be high already. At the moment there is no indication of a lack of demand, but affordability concerns may lead to reduced take-up by low-income households.</p> <p>Questions that could be answered through the data platform:</p> <ul style="list-style-type: none"> • Where are the coverage gaps? • What are the factors driving take-up of insurance?
7. Where economically viable, affordable and technically possible, investment in flood risk management activity, including resilience and other measures to reduce flood risk, should be encouraged through insurance. This includes, but is not limited to, direct government investment	<p>There are no specific risk reduction incentives provided by insurers. The expectation is that the charging of risk-based premiums will sufficiently incentivise policy-holders to reduce their risk, but it is unclear to what extent this is occurring.</p> <p>The government continues to invest in flood management but insurers argue that investments to date have been insufficient. However, there is a lack of data on the take-up of property-level resilience measures by policy-holders in Ireland; as such, it is unclear to what extent the charging of risk-based premiums is incentivising them to reduce their own risk.</p> <p>Discussions with UK insurers suggest there is also little incentive for insurers themselves to invest in risk reduction, particularly in the light of the typically short-term nature of insurance contracts.</p> <p>Questions that could be answered through the data platform:</p> <ul style="list-style-type: none"> • How effective are flood protection measures? • How well are they maintained and operated? • Which protection measures work best for which type of risk? • What determines the demand for property-level protection measures? • How do insurers take into account risk reduction efforts when underwriting? • Are resilient repairs after an event encouraged and can this be tracked?
8. The flood insurance system should be sustainable in the long run in the face of future risk levels, affordable to the public purse, and offer value for money to tax-payers	<p>The current model is affordable at an overall level, but its lack of focus on future risk trends and risk management efforts is problematic. If the penetration of flood insurance decreases this would increase costs for tax-payers. Increased flooding risk due to climate change will continue to put pressure on the Irish flood insurance market. This suggests reform is needed if it is to be sustainable and provide value for money.</p> <p>Questions that could be answered through the data platform:</p> <ul style="list-style-type: none"> • How are future risk trends taken into account when making decisions, such as investment, planning, home purchase, or insurance underwriting? • Will investments lead to reduced insurance prices? • Is enough being invested in flood risk management?

	<ul style="list-style-type: none"> • Are stakeholders that contribute to future risk (for example, property developers) also paying for flood risk management? • Are stakeholders who benefit from a functioning insurance system also paying for it?
--	---

Source: Author

5. Features of a new data platform

A new data platform would need to maintain a high degree of usability, providing timely and easy-to-apply information for the different stakeholders. Online accessibility is another important need, as is visual clarity. Table 4 below highlights three key elements of the proposed wider approach.

Table 4. Three key elements of a new platform approach to data sharing

A: Create a common understanding of current and future flood risk, based on hazard, exposure and vulnerability data
<p>•For example:</p> <ul style="list-style-type: none"> •Historic flooding and future projections, including climate change impacts •Asset (public- and private-owned) information including building stock (such as new developments, planning permission) •Infrastructure map – indicating structural types, location, business usage •Insurance penetration for homes and businesses, including historic payouts by location •Public support schemes for flood losses, including historic payouts by location
B: Identify and integrate past, current and planned efforts to manage flood risk
<p>•For example:</p> <ul style="list-style-type: none"> •National, local and property-level information about risk management efforts – considering timing of completion and maintenance •Information about cost-effectiveness and risk-reduction impact of protection measures •Funding levels and streams (who pays) •Beneficiaries (who benefits)
C: Design platform to support different types of decision-making
<p>•For example:</p> <ul style="list-style-type: none"> •Address commercial sensitivity and data protection •Find common format and tools to translate data from different stakeholders •Ensure visibility and ease of access •Promote, and, possibly require, use of platform, for example in local planning process •Avoid timing problems (completion of defences, new developments and updates to data/maps) •Visualise information and link to other existing tools <p style="text-align: center; margin-top: 10px;"><i>Source: Author</i></p>

More accurate risk mapping and data about insurance take-up and cover levels could help inform the design and targeting of any short-term support measures

At the very least, such a platform would create greater transparency and a much improved evidence base about current and future risks, and the efforts to manage and insure those risks. However, the possible negative impacts of more accurate risk mapping also need to be addressed; for example, concerns about the risk of creating blight – i.e. high-risk areas without flood defence projects.

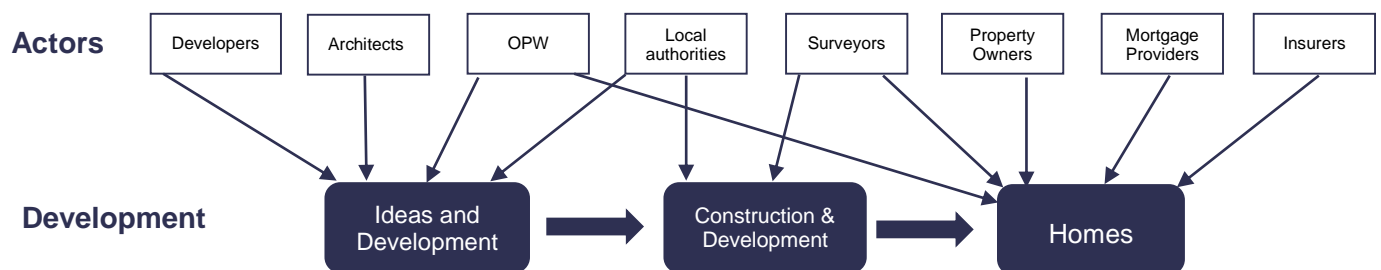
Addressing these concerns may require some short-term support measures for those affected, particularly homes and SMEs. The Irish government has considered a number of options, including the adoption of a compulsory flood levy in support of those at high risk. This idea was originally rejected but it continues to feature in ongoing discussions between the government and insurers (thejournal.ie, 2016a), despite a recent study suggesting that only 23% of the Irish public would be willing to pay a higher premium to help others afford flood insurance (thejournal.ie, 2016b).

Importantly, any short-term support measures should not distract from the need to address the underlying cause of the problem. good options include extra flood risk management investment in low-income areas, flood risk surveys, and the use of vouchers for insurance to encourage policy-holders to sign up to flood alerts or to adopt other hazard mitigation measures. For example, Kousky and Kunreuther (2013), in the context of the National Flood Insurance Program in the United States, proposed providing vouchers to homeowners that are coupled with interest-free loans and would be repaid through a reduction in insurance premiums over time. The proposed data platform could become an important tool in guiding those measures and offering insights into how to target, structure and implement support activities. As in many other countries, there is very little evidence available to inform those decisions in Ireland at present.

A new data platform should consider a wide range of sectors and stakeholders, beyond insurance and government

The key to this approach is the recognition that flood risk management is relevant to a wide range of sectors, groups and institutions. An assessment of who owns risk data and who would require it in order for it to be included in decisions should be the starting point for such an initiative. Figure 1 shows this approach when applied to the value chain for new properties, indicating the stages in the process when decisions are made about where and how new homes will be built. This is an illustrative example; similar value chains can be created for infrastructure development and maintenance, business investment decisions and other relevant processes.

Figure 1. Stakeholders involved in decisions about the development of new properties



Source: Author, adapted from Surminski et al. (2014) and from Crick et al. (2016)

A new data platform, potentially coupled with other measures (e.g. greater supervision or disclosure requirements), could become a tool for generating greater risk ownership beyond insurance and government. Currently, mortgage providers, investors and property developers do not have an incentive or a need to take flood risk into account when making their business decisions. They either rely on insurance cover protecting the homes and businesses they invest in, or their business timeframes do not extend beyond the completion date of a new property or infrastructure, and thus they are not concerned with future risk, or they simply disregard the risk in favour of other over-riding priorities, such as location or demand.

Internationally, the insurance industry and regulators are starting to reflect on these issues as they may create a systemic financial risk, should protection by insurance be no longer viable (Prudential Regulation Authority, 2015). Several central banks in Europe have started to investigate the flood

risk exposure of mortgage and investment portfolios, while insurers are exploring how to align the risk information and knowledge for underwriting with their own investment decisions (University of Cambridge Institute for Sustainability Leadership, 2016). A key issue that arises in all of these discussions is the need for transparency and better data about risk and risk management efforts. The proposed platform could provide a useful template for those ongoing efforts.

6. Conclusion: How could a new data platform make flood insurance in Ireland fit for the future?

The discussions about flood insurance in Ireland are seeking ways to address current concerns about flood insurance, while the government is also developing a new National Climate Change Adaptation Framework. This paper proposes that both processes should be closely linked to ensure that a sustainable approach to flood insurance can play its part in the country's efforts to manage current and future risks.

The Irish Government's Department of Finance recently suggested that greater data sharing is important for the future of flood insurance (IFPCG, 2016), while the OPW is considering the development of a data portal for flood information. The proposals in this paper would support those efforts, while also broadening the data platform to involve other sectors in order to transition from ad-hoc and short-term insurance measures to a more sustainable approach that also supports climate adaptation efforts.

The data-sharing platform proposed in this paper would provide an opportunity to increase transparency, clarify risk ownership and provide improved evidence for policy-making. As highlighted by the international examples, there are some key barriers that would need to be resolved first. For instance, in the United States, the government may be reluctant to share any detailed flood risk data for fear of violating privacy regulations and industry might not share it for fear of helping competitors.

However, restricting the use of accurate risk data for fear of increasing insurance prices and reducing the appetite for investment would be very short-sighted and ultimately would be counterproductive to efforts to manage future risks. At the same time, it is important to understand how insurers approach current and future risks to avoid mistrust, particularly where there are concerns that insurers might use flood risk as an excuse for price rises or reduce coverage without any underpinning evidence.

The platform would only be successful if there are strong incentives for all stakeholders to participate and use the data

Sharing of information and greater transparency about risks should be at the core of any forward-looking flood risk management strategy and adaptation plan. However, the real value of the proposed new data platform would come from its use by different stakeholders. This is important in two different ways:

- **The new data platform would need to capture data that are owned by different stakeholders.** There are questions about how to motivate participation. What are the incentives to share the data? Is there something to be gained in return? To address these questions, it is important to explain the power of information and the value of such a transparent system. Indeed, evidence from a funded research project, ENHANCE, funded by

the European Union shows that the prospect of new risk data can trigger multi-sectoral partnerships and collaboration (Aerts and Mysiak, 2016).

- **The new data platform would need to be used in day-to-day decision-making.** Securing buy-in from stakeholders and generating a large user community would be important success criteria for the data platform. But this alone would not guarantee more adaptive behaviour or a greater recognition of future flood risk in decisions about planning, buying a home, locating a business or investing in infrastructure. It would be important, therefore, to ensure that there are incentives for stakeholders to take account of flood risk in their decisions.

The insurance industry should work very closely with the public sector to identify ways to incentivise the use of risk information by other stakeholders and to remove possible disincentives. Image and reputation are important, as is leading by example. However, as shown by the stock-take described in this paper, it is far from clear whether insurers themselves currently consider flood risk beyond a 12-month policy term, and whether they have an incentive to invest in risk reduction. Similarly, it is unclear to what extent the charging of risk-based premiums is incentivising their policy-holders to reduce their own risk. This is a key current shortcoming and insurers should be encouraged to show how their underwriting, as well as their investments, can support society's current and future flood resilience. The new data platform could increase transparency and offer information about the effectiveness of risk reduction measures to insurers as well as their customers. It could also be used to encourage insurers to show flood risk levels on their customers' insurance documents and to disclose the price of flood cover to their customers.

However, despite clear planning guidelines, it remains doubtful that local authorities are adequately incentivised to prevent building in high-risk areas, given that the responsibility for flood risk management and flood recovery costs tends to lie with national government. And it is clear that developers tend to disregard flood risk as it does not usually affect the price of new developments.

The new data platform would need to be designed with these issues in mind – with the objective that greater transparency should be the starting point for a re-evaluation of risk ownership, and underlining the importance of joint efforts to manage current and future risks. It is therefore essential to outline the advantages that such a data platform could bring to different stakeholders, including those currently struggling to obtain flood insurance, local authorities, investors, insurers and those tasked with managing current and future flood risk.

At the very least, this data platform would remove any excuses of not taking action due to a lack of data. Hiding behind controversies about data or claiming ignorance of the risks may appear attractive at the moment, but it is not a sustainable strategy for any stakeholder.

Ireland could be a front-runner on this issue, given the limited scope and application of efforts by other countries at present.

References

- Aerts, J. C. J. H., & Mysiak, J. (2016) *Novel Multi-Sector-Partnerships in Disaster Risk Management*. (FP7 Enhance Project). Amsterdam: VU University Press.
- Brainard, L. (2008) *What is the role of insurance in economic development?* Zurich Government and Industry Affairs, Thought Leadership Series (No. 2). Available at https://www.draudimas.com/allpics/What_is_the_role_of_economic_development.pdf
- Brennan, C. (2016) 'Insurance Ireland says that building flood defences is the government's problem, not theirs', 8 January, *thejournal.ie*. Available at <http://www.thejournal.ie/flooding-insurance-ireland-2536974-Jan2016/>
- Dennehy, M. (2016) 'Households still finding it difficult to obtain insurance flood risk cover', *The Echo*, 4 July.
- Department for Environment, Food and Rural Affairs (Defra) (2011) *Flood risk and insurance: A roadmap to 2013 and beyond*. Final report of the flood insurance working groups. Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69467/pb13684-flood-risk-insurance.pdf
- Department for Environment, Food and Rural Affairs (Defra) and Environment Agency (2015) *Delivering benefits through evidence: Cost estimation for flood warning and forecasting - summary of evidence*. Bristol: Environment Agency
- Department of the Environment, Community and Local Government (DECLG) (2012) *National Climate Change Adaptation Framework – Building Resilience to Climate Change*. Dublin: Department of the Environment, Community and Local Government.
- Environmental Pillar (2016) *Environment Pillar policy statement on the flooding crisis 2016 – a call for a comprehensive and systematic overview*. Dublin: Environmental Pillar. Available at <http://environmentalpillar.ie/wp/wp-content/uploads/2016/01/Flood-Crisis-Doc-Final-2016.pdf>
- Gleeson, E., R. McGrath and M. Treanor (2013) *Ireland's Climate: the road ahead*. Dublin: Met Éireann.
- Golnaraghi, M., S. Surminski and K.-U. Schanz (2016) *An Integrated Approach to Managing Extreme Events and Climate Risks: Towards a Concerted Public-Private Approach*. Zurich: Geneva Association. Available at https://www.genevaassociation.org/media/952146/20160908_ecoben20_final.pdf
- Hallegatte, S. (2014) *Economic Resilience: definition and measurement*. Washington DC: World Bank.
- Houses of the Oireachtas (2012) *Difficulties in Obtaining Home Insurance: Discussion with the Irish Insurance Federation*, 25 September. Available at: <http://oireachtasdebates.oireachtas.ie/Debates%20Authoring/DebatesWebPack.nsf/committees/ENJ2012092500003#>
- Houses of the Oireachtas (2015a) *Report of the Committee on Flooding and Property Insurance in Ireland, 2015*. Dublin: Joint Committee on Environment, Culture and the Gaeltacht. Available at: <http://www.oireachtas.ie/parliament/media/committees/archivedcommittees/environmentcultureandthegaeltacht/Flooding-and-Property-Insurance--20160111---Final.pdf>
- Houses of the Oireachtas (2015b) *Report on hearings in relation to the provision of insurance in areas at risk of flooding*. Dublin: Joint Committee on Finance Public Expenditure and Reform
- Houses of the Oireachtas (2016) *Flood Insurance Bill 2016*. Available at: <https://www.oireachtas.ie/viewdoc.asp?DocID=30635>

- Insurance Council of Australia (2016) *Local government and insurance – sharing flood risk information*. Sydney: Insurance Council of Australia.
- Interdepartmental Flood Policy Co-ordination Group (2016) *Interim Report to Government*. Available at: <http://www.opw.ie/en/media/Interim-Report-Interdepartmental-Flood-Policy-Coordination-Group-final.pdf>
- Irish Examiner (2016) 'Insurers using OPW maps to refuse flood cover', 12 September, *Irish Examiner*.
- Irish Red Cross (2016) *Emergency Humanitarian Flooding Assistance*. Available at: <https://www.redcross.ie/emergency-humanitarian-flooding-assistance/>
- Irish Times (2016) 'Insurance sector rules out blanket flood cover', 26 January
- Kron, W. (2013). "Versicherung von Hochwasserschäden". In: Patt, H., R. Jüpner (Eds.), *Hochwasserhandbuch*, 2nd edition. Berlin: Springer. pp. 553-606 [in German].
- Kousky, C. and H. Kunreuther (2013) *Addressing Affordability in the National Flood Insurance Program*. Issue Brief 13-02. Washington DC: Resources for the Future and Wharton Risk Management and Decision Processes Center
- Kousky, C. (2017) *Financing Flood Losses: A Discussion of the National Flood Insurance Program*, RFF Discussion Paper 17-04. Washington DC: Resources for the Future
- O'Callaghan, C. (2016) 'Taxpayers aren't willing to pay higher insurance premiums to help flood victims, so what's the solution?' 12 January, *thejournal.ie*. Available at: <http://www.thejournal.ie/readme/floods-insurance-2543313-Jan2016/>
- O'Sullivan, C. (2016) 'Cork homeowners more likely to be refused house insurance over flood risk', 14 November, *Irish Examiner*.
- Prudential Regulation Authority (2015) *The impact of climate change on the UK insurance sector: A Climate Change Adaptation Report by the Prudential Regulation Authority*. London: Prudential Regulation Authority. Available at: <http://www.bankofengland.co.uk/pru/Documents/supervision/activities/pradefra0915.pdf>
- Reddan, F. (2014) 'After the deluge comes flood cover restrictions and pricier premiums', 11 February, *The Irish Times*.
- Scanlon, E. (2016) 'Insurance companies action on flood insurance "an absolute disgrace"', 16 December, *The Avondhu*.
- Siggins, L. (2016). "Storm Desmond a year on – little wind and rain forecast", 5 December, *The Irish Times*.
- Standard & Poor's Ratings Services (2015) 'The Heat is On: How Climate Change Can Impact Sovereign Ratings', 25 November, *Ratings Direct*.
- Surminski, S. (2017) *Fit for Purpose and Fit for the Future? An Evaluation of the UK's New Flood Reinsurance Pool*, RFF Discussion Paper 17-04. Washington DC: Resources for the Future. Available at: <http://www.lse.ac.uk/GranthamInstitute/publication/fit-for-purpose-and-fit-for-the-future-an-evaluation-of-the-uks-new-flood-reinsurance-pool/>
- Surminski, S. (2014) 'The role of insurance in reducing direct risk: The case of flood insurance', *International Review of Environmental and Resource Economics*, 7, 3–4, 241-278. Available at: <http://www.nowpublishers.com/article/Details/IRERE-0062>
- Surminski, S. and J. Eldridge (2014) 'Flood insurance in England: An assessment of the current and newly proposed insurance scheme in the context of rising flood risk', *Journal of Flood Risk Management*. Available at: <http://onlinelibrary.wiley.com/doi/10.1111/jfr3.12127/abstract>
- thejournal.ie. (2016a). 'Insurance Ireland says that building flood defences is the government's problem, not theirs', 8 January. Available at: <http://www.thejournal.ie/flooding-insurance-ireland-2536974-Jan2016/>

- thejournal.ie. (2016b) 'Two thirds of the country are against paying higher insurance premiums in order to help flood victims', 11 January, thejournal.ie. Available at: <http://www.thejournal.ie/claire-byrne-flooding-poll-2542816-Jan2016/>
- University of Cambridge Institute for Sustainability Leadership (2016) *Closing the protection gap: ClimateWise Principles Independent Review 2016*. Cambridge, UK: Cambridge Institute for Sustainability Leadership.
- Von Peter, G., S. von Dahlen and S. Saxena (2012) *Unmitigated disasters? New evidence on the macroeconomic cost of natural catastrophes*, BIS Working Paper No. 394, Basel: Bank for International Settlements. Available at: www.bis.org/publ/work394.pdf