

Institution: 10007140 Birmingham City University		
Unit of Assessment: UoA12 Engineering		
Title of case study: Establishing Property Flood Resilience (PFR) in Flood Risk Management		
Period when the underpinning research was undertaken: 2015-2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Professor David Proverbs	Professor- Associate Dean International	2014 to Present
Dr. Hong Xiao	Senior Lecturer in Property, Construction & Planning	2003 to Present
Dr. Victor Oladokun	Reader (University of Ibadan, Nigeria)	December 2015- August 2016
Period when the claimed impact occurred: 2015 - 2020		
Is this case study continued from a case study submitted in 2014? N		
<p>1. Summary of the impact (indicative maximum 100 words)</p> <p>Research carried out by the Water, Environment and Communities Research Group has pioneered the establishment of property flood resilience (PFR) in UK flood risk strategy and response. The findings have driven UK policy on PFR, leading to the implementation of resilient technologies in 11,000 thousand homes in 2015-16 alone, and with the potential for 200,000 homes to benefit across the UK by 2039. PFR is strongly advocated in the 2020 Environment Agency Flood and Coastal Erosion Risk Management strategy, and the research has informed the UK Climate Change Risk Assessment. Defra has described this research “as one of the most influential flood resilience studies of recent times”. The research is used by the Royal Institution of Chartered Surveyors as part of its international guidance for professionals and in Brazil, the coastal state of Santa Catarina (population more than 6,000,000) has adopted PFR measures across its 295 municipalities.</p>		
<p>2. Underpinning research (indicative maximum 500 words)</p> <p>The Environment Agency (EA) estimates a total of 5.2million properties with an estimated value of over £220 billion in England and Wales, or one in six homes, are at risk of flooding. Research carried out within the Water, Environment and Communities Research Group has helped to identify a total of 139 resilient technologies and revealed the effectiveness and benefits of property flood resilience (R01). Property flood resilient technologies applied to buildings, such as the use of water resilient fittings and furnishings, are designed to limit damage, and or speed up recovery where water has entered a property. PFR will reduce the costs of future flooding on households by between 50-100%, lessen the disruption on the lives of homeowners and reduce the long-term psychological impacts (R01, R03). Despite campaigns to raise awareness, the uptake of these measures has remained very low within the at risk population (around 5%) (R02).</p> <p>A cost-benefit analysis research project carried out by Professor Proverbs firstly helped to determine the costs of installation of resilience technologies at the point of reinstatement (R03). Following on from this, the Defra research project FD2682 (RG01) brought together a multi-disciplinary team of researchers and experts to examine the technical, social and behavioural aspects of supporting the implementation of low cost flood resilient measures. Proverbs provided the main technical input whilst others coordinated the co-production (Collingwood Environmental Planning) and behavioural (MDA Consultants) and economic expertise (University of the West of England, and Cunningham and Lyndsey). This project took an action research approach working with community representatives from the flood affected town of Tewkesbury and an expert advisory group to co-design and test new technical interventions. The research has identified a</p>		

range of technologies applied to the fabric of the building (including door and window guards, non-return valves and water resistant rendering), as well as recommendations for fixtures, fittings and contents to help improve resilience and identified a number of key intervention points when it might be prudent to consider implementing these. Defra has described this research “as one of the most influential flood resilience studies of recent times”.

Subsequent research for the Royal Institution of Chartered Surveyors (RICS) (**RG02**), found a lack of professional expertise to help advise and guide property owners towards the implementation of property flood resilience not only in the UK, but also in Australia, China, Germany and the US (**R04**). Further research carried out in 2020 for RICS is helping to establish the application of property flood resilience for commercial buildings (**RG03**). In the 2015-16 winter flood event, an estimate of business property damages was £513 million and this research has revealed there is much scope for the development of technical interventions that can be retrofitted to commercial premises (such as equipping elevators with water sensors, raised storage of goods and products, and raised electrical wiring and controls) to help improve their resilience.

Between 2017 and 2019, international collaborations and funding has extended the research to Nigeria (**RG04**), Peru (**RG05**) and Brazil (**RG06**). A project funded by the Brazilian National Council for Scientific and Technological Development researched low-cost devices to improve the resilience of communities. It found that the nature of flooding and the building materials and technologies used were highly suitable for the application of PFR technologies to property types in Brazil.

During 2020, research was started in collaboration with the Chair of the National Flood Forum to understand resilient approaches at the city scale (**R05**) and, working with a team from China, on assessing community resilience to flooding for multiple types of the transient population (**R06**). This research has developed a new method for comprehensively quantifying the flood resilience of different types of transient communities, based on 16 indicators and classified into four dimensions of residential property typology, economic prosperity, community engagement, and social capital.

3. References to the research (indicative maximum of six references)

- R01.** Rose, C and Lamond, J., Dhonau, M., Joseph, R and **Proverbs, D.**, (2016) Improving the Uptake Of Flood Resilience At The Individual Property Level . *International Journal of Safety and Security Engineering*, 6 (3). pp. 607-615. ISSN 2041-9031; DOI: 10.2495/SAFE-V6-N3-607-615
- R02.** **Proverbs, David** and Lamond, Jessica (2017) *Flood Resilient Construction and Adaptation of Buildings*. Oxford University Press, Oxford Research Encyclopedias-Natural Hazard Science.
- R03.** Joseph, R., **Proverbs, D.** & Lamond, J., (2015) Homeowners' Perception of the Benefits of Property Level Flood Risk Adaptation (PLFRA) Measures: The Case of the Summer 2007 Flood Event in England, *Journal of Safety and Security* Special Issue 5, 3, 251-265; <https://doi.org/10.2495/SAFE-V5-N3-251-265>
- R04.** Lamond, J. , Bhattacharya-Mis, N. , Chan, F., Kreibich, H, Montz, B. **Proverbs, D.** and Wilkinson, S. (2019) Flood risk insurance, mitigation and commercial property valuation, *Property Management*, 37/6, DOI: 10.1108/PM-11-2018-0058
- R05.** Adedeji, T., **Proverbs,D.**, **Xiao, H.**, Cobbing, P. and **Oladokun, V.** (2019) Making Birmingham a Flood Resilient City: Challenges and Opportunities, *Water*, 11(8), 1699; <https://doi.org/10.3390/w11081699>
- R06.** Xu, W. Xiang, L. and **Proverbs, D.** (2020) Assessing Community Resilience to Urban Flooding in Multiple Types of the Transient Population in China, *Water*, 12(10), 2784; <https://doi.org/10.3390/w12102784>

Peer Reviewed Awards

- RG01.** 2015-2017 DEFRA Tender FD2682 - Supporting the Uptake Low Cost Resilience for Properties at Risk of Flooding (£85k) *Supporting the uptake of low cost resilience: Final Report (FD2682)*. DEFRA.
- RG02.** 2015-2016 RICS Research Trust Project, An International Evaluation of the Role of Chartered Surveyors in Providing Professional Flood Risk Advice on Commercial Property (£20k)
- RG03.** RICS Research Trust (2019-2021) Exploring the application of property level flood risk adaptation (PLFRA) measures for commercial buildings (£20k)
- RG04.** Commonwealth Scholarship Awarded to Professor Victor Oladokun, Developing Resilient Approaches to Flood Risk Management in Nigeria, 2017-2018 (£60k).
- RG05.** 2018 British Council Peru Newton Fund, Researcher Links Workshop Grant, Improving Flood Resilience in Northern Peru (£45k)
- RG06.** Brazilian National Council for Scientific and Technological Development (2019) Low-cost devices to maximize the resilience of communities and buildings exposed to floods and frequent urban floods (£30k)

4. Details of the impact (indicative maximum 750 words)

Influencing UK's flood risk management policies

The programme of research carried out by the Water, Environment and Communities Research Group has pioneered the establishment of property flood resilience (PFR) in the UK leading to the implementation of resilient technologies in 11,000 thousand homes in 2015-16 alone and with the potential for 200,000 homes to benefit across the UK by 2039. The Group's research has driven the development of government policy (**S05**), leading to the establishment of BS Standard 851188 (**S01**), a Code of Practice (C790) (**S02**) and an Environment Agency National Property Flood Resilience procurement framework worth around £20m. The British Standard specifies requirements for the designation, testing, production, installation, and deployment instructions, for different types and configurations of flood resilient technologies, while the Code of Practice specifies what should be achieved including guidance documents for households, businesses and local authorities on how the standards could be met. The research has played an important part in ensuring that the UK is at the leading edge of these technologies. The Chief Executive of the National Flood Forum states that the, "*development of the techniques over the last two decades has been in no small part due to the ongoing work of Professor Proverbs and colleagues. Britain is at the leading edge of this technology*" (**S03**).

In recognition of the importance of the research findings, Proverbs was invited to help co-author the UK Climate Change Risk Assessment 2017, the statutory assessment of the National Adaptation Programme required by the 2008 Climate Change Act, published by the Committee on Climate Change (**S06**). This national risk assessment report was cited in the new National Flood and Coastal Erosion Risk Management Strategy for England published in 2020 (**S07**). This sets out the strategic flood risk priorities for the next 6 years, in which PFR is being strongly advocated as part of the £5.2bn that is being invested by the government in flood risk management towards increasing protection to 336,000 homes. The Environment Agency confirms the influence of the group's research on its strategy:

"The research Professor Proverbs and his team have undertaken on behalf of Defra has been instrumental in helping to mainstream PFR and establish this in the new Environment Agency FCERM Strategy... PFR will play a major part in delivering these targets" (**S07**).

Informing Professional Practice for Loss Adjusters and Chartered Surveyors

In 2018, the RICS used the research to inform its international guidance for professionals involved with advising business owners on how to protect their property from flooding. The research report is available via the RICS website, has been cited in an RICS Guidance Note (**S08**) and also cited on the RICS isurv on-line web information service for members of the profession (**S08**). As an example of the impact on practice, the research has also been instrumental in changing the approaches used by major loss adjusters in the reinstatement and repair of flood damaged properties, leading to the development of new policy for one of the largest loss adjusting providers (Sedgwick) in the UK. This has resulted in the installation of flood resilient measures in 85 flood affected properties. Sedgwick have used the findings as part of their training and staff development for surveyors, to help improve understanding of the practical options for

resilience. They have also used the findings in training over 100 surveyors and adjusters in the use and implementation of PFR. Sedgwick have also used the findings to develop improved protocols and processes that provide greater clarity regarding the autonomy and responsibility of their surveyors in recommending adoption of PFR. This impact has been far reaching in the insurance industry as described by the Sedgwick National Technical Manager, *“Based on the expertise developed through this research, our company now offer flood resilient surveys to the UK insurance industry and we have carried out over 150 surveys on behalf of other insurers”* (S09). The findings have been cited in reports by the Social Market Foundation (S10) towards influencing future flood risk insurance mechanisms.

The research has established PFR as one of the most tangible ways to help protect people's homes and businesses from flooding (S03) and has had significant impact on the response to flooding in the UK. For example, following the 2015/16 exceptional flooding, 11,000 out of 17,000 flooded properties were installed with PFR measures (S04), making these properties less vulnerable to future flood damage and improving their ability to recover from future events. The Environment Agency have committed to protecting thousands of households from flooding using PFR measures with the potential for at least 150,000 households to benefit from PFR, rising to over 200,000 in 2039 (S05). Additionally, PFR is now being recognised for use in non-residential properties and initiatives to support the uptake of PFR measures by businesses now being underway (see UK Climate Change Risk Assessment, 2017 (S06)).

PFR take-up in Internationally

The use of PFR is also developing internationally. The research findings from a project funded by the Brazilian National Council for Scientific and Technological Development in 2019 has led to PFR being incorporated into the Civil Defense and Protection National Policy. The coastal state of Santa Catarina (with a population of more than 6,000,000) is implementing these measures in all 295 municipalities. The Chief of the Santa Catarina Civil Defence Department, explains that these developments *“represent a significant and important change in the way we are responding to flood risk and represents a step change in our thinking. I am sure this approach will extend into other states and regions and help to inform future national flood risk management policy across Brazil”* (S11). The research has also led to the introduction of PFR approaches in Nigeria and to the establishment of the first flood resilience research centre in the country (S12).

5. Sources to corroborate the impact (indicative maximum of 10 references)

- S01. [BS Standard 851188](#) the British Standard for Flood resistance products
- S02. Code of practice for property flood resilience. Edition 1, <https://www.ciria.org/ItemDetail?iProductCode=C790F&Category=FREEPUBS>
- S03. National Flood Forum – letter dated 29th January 2020 from The Chief Executive [Named corroborator 001]
- S04. DEFRA – letter dated 31st January 2020 from Defra Policy Adviser [Named corroborator 002]
- S05. Environment Agency (2019) Long Term Investment Scenarios 2019, <https://www.gov.uk/government/publications/flood-and-coastal-risk-management-in-england-long-term-investment/long-term-investment-scenarios-ltis-2019>
- S06. **UK Climate Change Risk Assessment 2017: Evidence Report**, <https://www.theccc.org.uk/wp-content/uploads/2016/07/UK-CCRA-2017-Chapter-6-Business-and-industry.pdf> / UK Climate Change Risk Assessment (2017), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/584281/uk-climate-change-risk-assess-2017.pdf
- S07. Environment Agency
 - Letter dated 4th August 2020 from Flood and Coastal Risk Management Manager, Stakeholder Engagement Team [Named corroborator 003]
 - Environment Agency (2020) National Flood and Coastal Erosion Risk Management Strategy, <https://www.gov.uk/government/publications/national-flood-and-coastal-erosion-risk-management-strategy-for-england--2>

- S08.** RICS Guidance Note (2018) Environmental risks and global real estate, 1st edition, November 2018; RICS (2019) isurv Flood Risk
<https://www.isurv.com/site/scripts/documents.php?categoryID=1073>
- S09.** Sedgwick Repair Solutions UK Ltd – letter dated 1st February 2020 from National Technical Manager **[Named corroborator 004]**.
- S10.** Social Market Foundation – they cited the Defra report and other publications in their report on Incentivising household action on flooding - http://www.smf.co.uk/wp-content/uploads/2018/03/SMF-Incentivising-household-action-on-flooding_web-14-03-2018.pdf
- S11.** Santa Catarina Civil Defence Department – letter dated 13th March 2020 from SC Civil Defense Secretary **[Named corroborator 005]**
- S12.** University of Ibadan– letter dated 7th January 2021, from the Director of Research Management Office, University of Ibadan