

# **Connecting Risk Management Theory and Practice on the Frontline of Climate Change Adaptation and Disaster Risk Reduction: The Experience of the West Yorkshire Fire and Rescue Service in the United Kingdom**

**Sanjay Narendrakumar Babulal**  
**University of Huddersfield**

*Risk management is fundamental to the pursuit of climate change adaptation, particularly in public sectors, through integrated cross-sectoral policies and government planning. This integration with Adaptation to Climate Change and Disaster Risk Reduction is a way of transforming policies into local actions. Climate emergencies are explored as a potential risk to one public sector, the Fire and Rescue Services, due to the increase in the frequency and intensity of climate-related incidents (floods and wildfires). The research assesses Britain's national policies on climate adaptation, which have developed significant environmental research and legislation since 1997: the Civil Contingencies Act (2004), Climate Change Act (2008), Climate Change Risk Assessment (2012) and periodically the National Risk Register for Civil Emergencies. From interviews with West Yorkshire firefighters, integrated community risk management is critical for gathering quality-assured data to implement positive change in public sectors, consolidating Climate Change Adaptation and supporting Disaster Risk Reduction. Although multi-agency community engagement is suitable for understanding local vulnerabilities, the frequency of incidents dictates investments and limited resources are barriers for action.*

*Keywords: climate change adaptation, disaster risk reduction, institutionalism, public sector, risk management, fire and rescue services*

## **INTRODUCTION**

Climate change is increasing the risk and occurrence of weather-related disasters. The Intergovernmental Panel on Climate Change (IPCC) reports devastating impacts due to changing rainfall patterns and sea levels, and considers the impacts of a global rise in temperatures above 1.5°C, including the occurrence of more extreme events, such as floods, heatwaves and wildfires (IPCC, 2018). The escalating frequency and intensity of these incidents across the globe, especially in Europe (Forzieri et al., 2018), are evidence of Climate Change as an environmental risk that needs to be considered by government policy and emergency planning.

The climate crisis presents a challenge for most infrastructure public services and studies have considered climate risk management in a range of public sectors in Europe, including energy (Rübbelke & Vögele, 2011; Gerlak, Weston, McMahan, Murray & Mills-Novoa, 2018), transport, health, and other societal critical infrastructures (Forzieri et al., 2018; Forzieri, Cescatti, e Silva & Feyen, 2017). A

commonly overlooked department in which the theme must be comprehensively studied is the fire and rescue services (FRS), because these organisations are on the frontline of climate adaptation, managing risks carefully and responding to disasters as the leading professional objective.

A focus on climate risk management in the FRS is essential for three reasons. Primarily, fire brigades are a vital part of “blue lights” services, the first port of call in emergencies. Secondly, most current global risks are related to climate change, increasing likelihood and ripple effects of floods, wildfires, pandemic diseases, electricity failure, which are the mainstay role of these first responders. At the same time that fire departments have to respond to climate-related incidents for civil defence, organisational resilience must be in place to maintain the business continuity of other critical infrastructures. Finally, the rationale for seeking the implications of climate change in the FRS is to establish a correlation of Disaster Risk Reduction and Climate Change Adaptation, channelling better development of strategies and policies at the local level.

Since 1997, the United Kingdom Climate Impacts Programme (UKCIP) has encouraged several organisations to identify vulnerabilities regarding climate change, and to build their preparedness, response and resilience against its potential impacts. Along with experience in human-made and natural disasters, the United Kingdom (UK) is recognised for strengthening cooperation between emergency services at national and local levels (O'Brien & Read, 2005). The country has benchmark legislation regarding risk management and business continuity, subjects embedded in its FRS. Yet, climate change imposes a significant challenge to the applicability of public policies to the local strategic capability of fire and rescue responders. The public sector austerity programme and regular funding cuts on emergency services challenge strategic planning and adequate allocation of finite resources (Murphy & Greenhalgh, 2013).

The West Yorkshire county in England serves as an appropriate case study, which could be used for comparison in other areas within the UK and abroad. The county has experienced growing incidences of flooding and moorland fires in recent years (West Yorkshire Fire and Rescue Authority's Statement of Accounts 2016, 2017, 2018; McMorrow, 2011; Forrest, Trell & Woltjer, 2019; Gazzard, McMorrow & Aylen, 2016). The West Yorkshire Fire and Rescue Service (WYFRS) is one of the leading firefighting organisations in the UK, which has continuously attained ‘Customer Service Excellence’ standard since 1998, a national key driver for service improvement.

The paper is structured as follows. In Section Two, a review of the relevant literature provides the ground theory about adaptation to changing climate, focusing on the role of national policies and plans within public services. Drawing on institutional theory for the ‘new public sector’ (Brignall & Modell, 2000), the flow path of the literature review aims to explore actions at local levels, by the development of organisational risk assessment exercises. The study analyses risk management in firefighting organisations, defining measures of performance and institutionalism procedures. Section Three presents the methodology, an instrumental case study of the WYFRS to link the topics and elucidate how climate-related hazards influence the strategies and institutional risk management. Five in-depth individual interviews explore the risk policies adopted by local authorities and their applicability for preparedness and response to climate disasters. The results and conclusions follow in Sections Four and Five.

## **LITERATURE REVIEW**

### **Narrowing Climate Change Adaptation and Disaster Risk Reduction to Public Policies**

Climate change is associated with the increase in disasters, with severe damages to public infrastructure and environment. The latest IPCC Report (2018) presents the dangerous effects of global warming above 1.5°C, estimated to occur between 2030 and 2052. Climate-related risks will depend on the magnitude of warming, geographic location, stage of development and vulnerability, and the measures taken for mitigation and adaptation. Extreme weather conditions on land are projected with increased hot days in mid-latitudes and severe cold nights in high latitudes.

The frequency and intensity of climatic events such as heatwaves, sea rise, heavy precipitation, drought, wildfires, and coastal flooding are predicted to escalate beyond the capacity to respond. Associated impacts including catastrophic infrastructure damage, pose life-threatening risks to livelihood, health systems, and

vital supply chains in most countries. Some consequences, such as the loss of ecosystems, can be long-lasting or irreversible.

Forzieri et al. (2017) stress that unless global heating and adaptation actions are taken as a matter of urgency, in Europe, nearly 350 million people may be exposed to harmful climate extremes annually by the end of the 21st century, with 50-times more fatalities compared to the current rate. Vulnerable social classes, such as the elders (a sizeable demographic trend for the next decades), the poor and people in healthcare facilities, could be most affected by severe weather events, given the reduced physical and behavioural conditions for thermoregulation, as well as less access to mitigation devices for stress reliefs, for example, air conditioners, flood-proofing or thermal insulation housing.

The IPCC suggests that “future climate-related risks would be reduced by the upscaling and acceleration of far-reaching, multilevel and cross-sectoral climate mitigation and by both incremental and transformational adaptation” (IPCC-SPM, 2018b, p. 7). The higher disaster risk is known (McBean & Ajibade, 2009), and Climate Change Adaptation (CCA) is required and described as strategies to reduce vulnerabilities and actions taken to manage the expected impacts of extreme weather events and disasters (IPCC, 2018a).

Disaster risk is the result of a complex relationship between hazards, and vulnerability conditions of exposure in a society, the latter with different dynamic dimensions: physical, social, ecological, economic, cultural and institutional (Birkmann & von Teichman, 2010). Risk assessment is defined as the process to understand and identify the nature of risk (ISO, 2009). Hence, assessing climate-related disaster risks, potential loss and damages, requires a comprehensive study of risk and the underlying relationship between hazard, exposure and vulnerability. Disaster risk reduction (DRR<sup>1</sup>) includes preventive measures, preparedness and recovery, comprising the aim of reducing vulnerabilities (Dias, Amaratunga, & Haigh, 2018). Even though disasters are surrounded by uncertainties regarding the scale, frequency, and location, there is a consensus that Climate Change Adaptation is necessary to promote disaster risk reduction and resilience in all levels of society (Thomalla, Downing, Spanger-Siegfried, Han, & Rockström, 2006; Birkmann et al., 2013), since both have the target of reducing vulnerabilities (Dias et al., 2018). Thus, the linkage between DRR and CCA is essential to prevent catastrophes and achieve sustainable development, as discussed in international climate negotiations (Birkmann et al., 2013; IPCC, 2012; and IPCC, 2014).

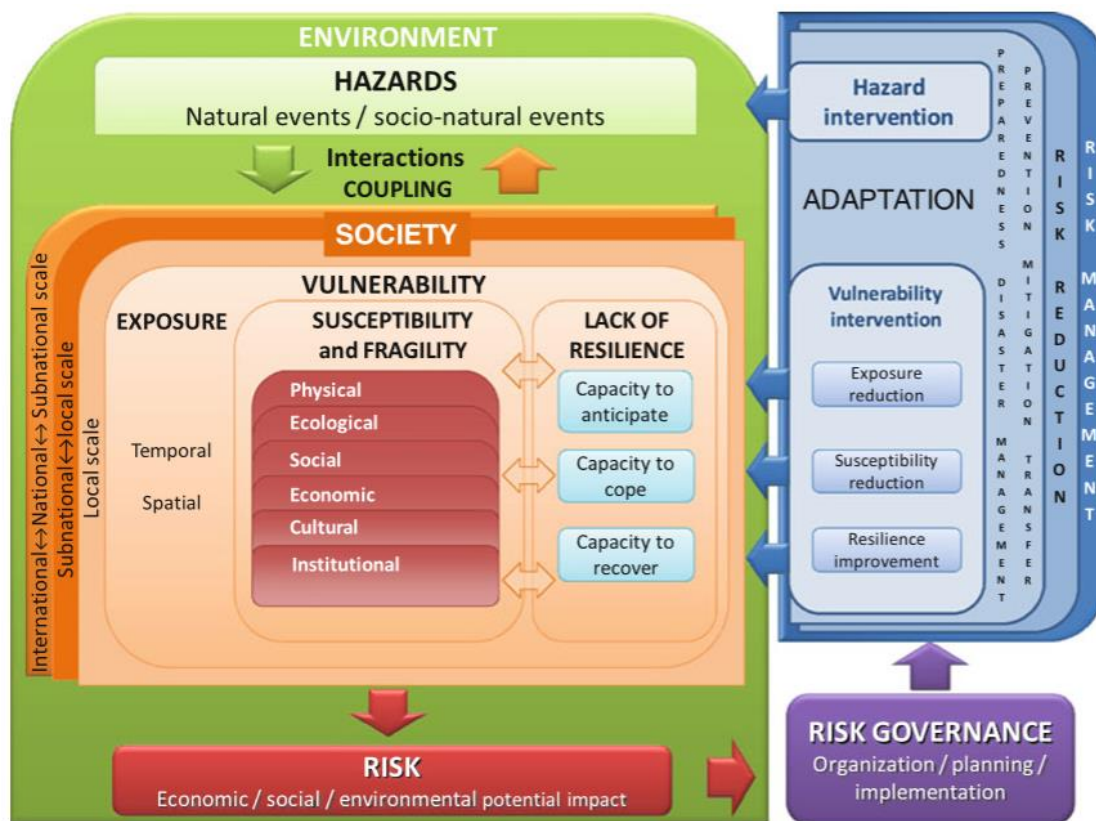
As disasters impacts vary on spatial, temporal and functional scales, depending on the geographical exposure and susceptibility, and deficiency of response capacity, integrating CCA and DRR in every country is challenging. Different norms, systems and knowledge available according to varied levels of policies and governments are barriers for combining CCA and DRR within a standard (Dias et al., 2018).

For instance, National Adaptation Programs of Action and Strategic National Action Plans are globally prepared under the Hyogo Framework for Action, to seize disasters as an opportunity for change, to build back better, either by coping or adapting, in a demonstrated definition of resilience. In this manner, European economically developed countries have published major national adaptations programmes, such as the German Adaptation Strategy to Climate Change (2008) and the UKCIP in 1997. Nonetheless, in the majority of less developed nations, there is an absence of data and resources to assess climate emergencies (e.g. wildfires, storms, floods) and plan resilience appropriately. The lack of risk assessment increases exposure and vulnerability, representing obstacles to integrate CCA and DRR, narrowing plans into actions. CCA requires long term strategies, while DRR is usually an incident related intervention with guidance for the short-term (Birkmann & von Teichman, 2010). But since both focus on reducing the exposure and vulnerability of societies to hazards by anticipating risks, resisting, coping and recovering against disruptive events (Lei & Wang, 2014), the promotion of cross-sectoral and multi-scale approaches is necessary, from national adaptation policies (CCA) to development of actions through local authorities in a DRR context (Birkmann & von Teichman, 2010; Dias et al., 2018).

Extensive assessments of hazards, level of exposure and vulnerabilities to disasters have led to the development of several frameworks for risk preparedness and increased social response (Carreño, Cardona, & Barbat, 2007; IPCC, 2012; Lei & Wang, 2014). Research in this field underlines the importance of multiple dimensions of vulnerability interpretation regarding climate emergencies (O’Brien, Eriksen, Schjolen, Nygaard, 2007). For instance, the MOVE Framework - Methods for the Improvement of

Vulnerability Assessment in Europe (Birkmann et al., 2013) – frames the role of an integrated approach to assess risks, loss and damages due to climate change hazards and vulnerabilities, and adaptive capacities for institutional resilience. The MOVE framework (Fig. 1) is also capable of transferring the theoretical concepts of adaptation and risk management into operational instructions in all levels of services. The comprehensive and feedback-loop system of the framework was exemplified in assessing the preparedness and capacity of FRS in Barcelona, dealing with earthquake-related disasters in research by Birkmann et al. (2013). The focus of this study lies on the risk management branch that can be used by similar organisations at the same local level to strengthen preparedness and response facing more frequent climate-related incidents, such as flooding, wildfires and severe snowfall.

**FIGURE 1  
MOVE FRAMEWORK**



Birkmann et. al. (2013), p.199

Because efforts to link CCA and DRR are geared towards adaptation, (Birkmann et al., 2013), Bosomworth (2015) argues that understanding CCA should be connected with risk management in disaster preparedness and response as a form of public policy. The significance of risk management in the development of adaptation policies framing all layers of governance and multisector collaboration (Dannevig, Hovelsrud, & Husabø, 2013) are extensively debated in the context of discursive institutionalism theory (Scott, 2001; Schmidt, 2010; Gupta et al., 2010; Fischer, 2003). It can be argued that climate is motivating changes in public management in the same way that enterprise practices did to the ‘new public sector’, a term coined in the 1990s by Hood (1991; 1995).

Cavallo (2014) argues that preparedness and resilience regarding climate change disasters should be achieved in a System of Systems theory, sharing responsibilities between government, emergency services, communities and individuals, in a key reductionist approach to disaster management. It is critical to

implement policies that identify and manage risks according to the local reality, to foster security and organisational resilience considering community capabilities.

The necessity of applying scientific information of climate adaptation into public policies is currently acknowledged, and it was one of the primary purposes of the IPCC, created in 1998 by the World Meteorological Organisation within the United Nations Environment Programme. However, there is not an accepted standard method for achieving it, and policies are often pursued at high levels clashing with local level applicability (Urwin, & Jordan, 2007).

Wilson (2006) affirms that the UK government, by contrast, took climatic variations evidence seriously, setting in 1997 the UK Climate Impacts Programme (UKCIP) to evaluate the impacts on the country, in a coordinated task to assist organisations in developing plans and adaptation strategies. Based on scenarios estimated by the Hadley Centre, according to greenhouse gas emissions and other environmental factors, UKCIP has been engaged in several studies on multiple sectors and public policies. It represents a knowledge network, including guidance for decision-makers in a changing climate, reports about the impacts that climate breakdown will pose on business operations, and estimations on risks under uncertainties (Pringle, 2011).

Many of the available publications by the UKCIP platform contain risk management practices to review and monitor adaptation at all levels. When the institution was conceived, it innovatively bridged the gap between government-led research and communities, to reach and inform stakeholders' actions on climate change (Lorenzoni, Jones, & Turnpenny, 2007). Hughes, Tomei & Ekins (2009) found that climate change scenarios do not provide knowledge communication. They need to be developed with communities to achieve credibility and address local challenges (Gawith, Street, Westaway & Steynor, 2009).

Although early IPCC projections are being globally evidenced (IPCC, 2012, 2018), the impacts vary according to regional and socioeconomic aspects, such as land use, geographic forms, demographic and development density (Hughes et al., 2009). Thus, commonly observed incidents of severe weather conditions that can cause major disruption to services in the UK, such as cold or heatwaves, wildfires, river and floods are focused in this paper. It is essential for the public sector, especially for the emergency services facing these incidents, to apply climate change policies, reducing vulnerabilities and supporting adaptive capacities of social systems (Boosomworth, 2015).

### **Aligning Climate Risk Management With the Public Sector Performance**

State-owned institutions have incorporated many risk management techniques and practices from the private organisations to modernise the public sector (Fone & Young, 2000; Brignall & Modell, 2000; Fone, 2005; Drennan, McConnell & Stark, 2014). By its corporate definition, risk management is a flexible and adaptive mechanism that allows organisations to handle risk and uncertainty according to the risk appetite or tolerance, reducing the expenses correlated with resources flow and volatility, ensuring organisation viability (Stulz, 1996; Smith, Nicholson & Collett, 1996). However, to the public sector, an integrated risk management approach has been developed in a transition from a compartmental risk management perspective, given the political influence, legislative regulation and wider set of stakeholders (Young & Fone, 1998; Cienfuegos Spikin, 2013).

Many academics have criticised the influence of the political sphere on the adoption of formal risk management in the public sector, as a defensive strategy to avoid blame for the lack of administrative efficiency and funding cuts (Hood & Miller, 2009; Mikes, 2011). However, the literature also recognises risk management as a tool for transparency, liability and traceability of public investments, to improve state-owned organisations by logical performance assessments (Hood, 1995; Brignall & Modell, 2000; and Lapsley, 2009).

In the UK, the risk management development was counselled by government protocols (e.g., National Audit Office, 2000; Audit Commission, 2001; Cabinet Office, 2002; and HM Treasury, 2004) and guidelines established by professional bodies in 2002, such as the Association of Insurance and Risk Managers (AIRMIC), the National Forum of Risk Management in Public Sector (ALARM) and the Institute of Risk Management (IRM). These standards were considered useful mechanisms for the implementation of austerity strategies, amid organisational exposure under uncertainties, maximising effectiveness with

limited funds (Young & Fone, 1998). The regulatory basis of risk management practices in the public sector through performance evaluation corresponds to the institutional theory for the ‘new public sector’ argued by Brignall & Modell (2000).

Currently, these risk management processes are embedded in the public sector as a measurement of good governance and enhanced delivery of public service in professional standards (Crawford & Stein, 2004; ALARM, 2009). The compliance with the government strategy and legislation is a unique feature from the ‘new public sector’ risk management in response to environmental influences, with external assessment criteria and effects on resources allocation (Brignall & Modell, 2000), grounded on institutional theory (DiMaggio & Zucker, 1988).

UKCIP in 1997, was one of the first steps towards the linkage between Climate Change Adaptation and Disaster Risk reduction in Great Britain, predominantly using risk management as a toolkit. From that time on, several legislative acts and regulations have been promulgated in the UK to ensure that Climate Change is taken into consideration at all levels of public policies and by every organisation. Table 1 illustrates the relevant legislative acts.

**TABLE 1**  
**A SUMMARY OF PROGRESSIVE CHANGES TO LEGISLATION IN THE UK, INCLUDING CLIMATIC POLICIES**

<b>Year</b>	<b>Legislation</b>	<b>Aims</b>
<b>1997</b>	The United Kingdom Climate Impacts Programme	Situated at the Environmental Change Institute at the University of Oxford, UKCIP enables partnerships with world-leading academics studying critical climate change issues. It dedicates to understand adaptation against climate change impacts, linking scientific research to policy-making practice.
<b>2000</b>	The UK Climate Change Programme	A programme established in response to the United Nations Conference on Environment and Development agreement (1992), cutting greenhouse gas emissions.
<b>2004</b>	Civil Contingencies Act	Primary legislation for emergency planning and preparedness. Responder agencies are required to work cooperatively at all levels, to ensure civil defence. Local Resilience Forums (multi-agency groups, comprising Police, FRS, Local Authorities, among others) are responsible for contingency plans concerning community risk registers.
<b>2006</b>	Climate Change and Sustainable Energy Act	Primary legislation to enhance the number of heat and electricity microgeneration installations in the UK, to cut carbon emissions and improve fuel sufficiency.
<b>2008</b>	Climate Change Act	It legislates a mandatory 80% cut in carbon emissions by 2050 (compared to 1990 levels), covering actions beyond the UK Climate Change Programme in a long-term binding goal. A Risk Assessment is published every five years, to inform government and organisations timely and cost-effective decisions preparing for Climate Change.
<b>2011</b>	Localism Act	It delegates decision-making powers from the central government to individuals and communities in England.
<b>2012</b>	Climate Change Risk Assessment	It prioritises adaptation under five critical themes: Agriculture and forestry; Business, industries and services; Health and wellbeing; Natural environment, buildings and infrastructure; Policy and actions to deal with the risks in each area.
<b>2008</b> <b>I</b> <b>2017</b>	National Risk Register for Civil Emergencies	A government assessment dividing risks into four categories: natural hazards, major accidents, societal risks, and malicious attacks. Several threats are evaluated in a matrix according to their likelihood and impacts, with preventive measures to mitigate the effects of disruption events.

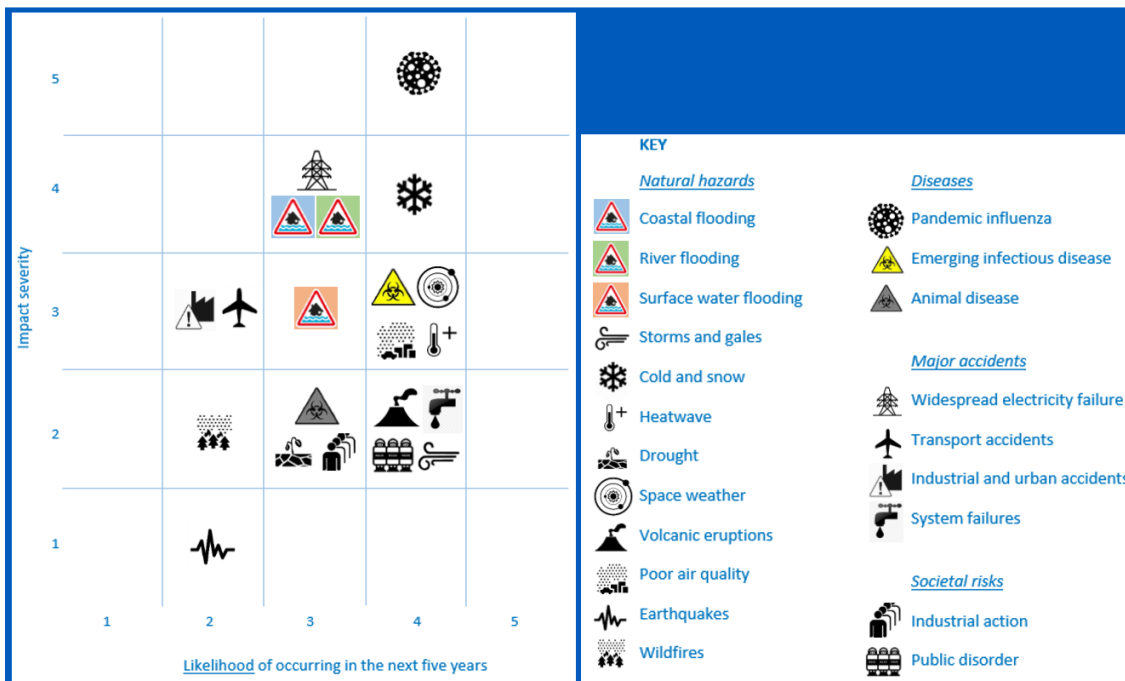
In 2009, the International Organization for Standardization (ISO) launched a risk management guideline in 2009 (ISO 31000), with principles and instructions for a broad application and assistance in any organisation (governments, public or private sectors, communities). It is worth noting that the UK Standard (ALARM, 2002) adopts the same risk terms and definitions approved by ISO. By its general organisational application, risk management is a well-documented instrument for climate change adaptation, because at the same time that is capable of orient decision-makers in public policies, it engages society in governance issues meaningfully (May and Plummer, 2011).

Hiscock & Jones (2017) emphasise the contemporary use of national risk registers (NRR) as one of the current risk management methods applied to the public sector, to assess risks and broadcast the knowledge by governments authorities comprehensively. Although Haggmann & Cavely (2012) consider that NRR did not call the attention of many security studies in the literature, examples such as the Norwegian National Risk Analysis (Norwegian Directorate for Civil Protection, 2014) and the Strategic National Risk Assessment in the United States (DHS - US Department of Homeland Security, 2011) translate the preoccupation of nations in identifying the principal risks and establishing oriented plans to prevent, mitigate and respond to the threats.

In the UK, risk reduction methods for emergencies were consolidated by the Civil Contingencies Act (2004), and then, biannually by the National Risk Register of Civil Emergencies (first released in 2008), from which given the probability and impacts of an identified risk, decisions are taken to reduce potential harm or losses within emergency procedures if that risk becomes a disaster. Figure 2 illustrates that almost every risk is related to Climate Change, and can also result in incidents managed by the emergency teams (NRR, 2017).

**FIGURE 2**  
**MATRIX RETRIEVED FROM THE NATIONAL RISK REGISTER OF CIVIL EMERGENCIES (2017)**

Matrix A - Hazards, diseases, accidents, and societal risks

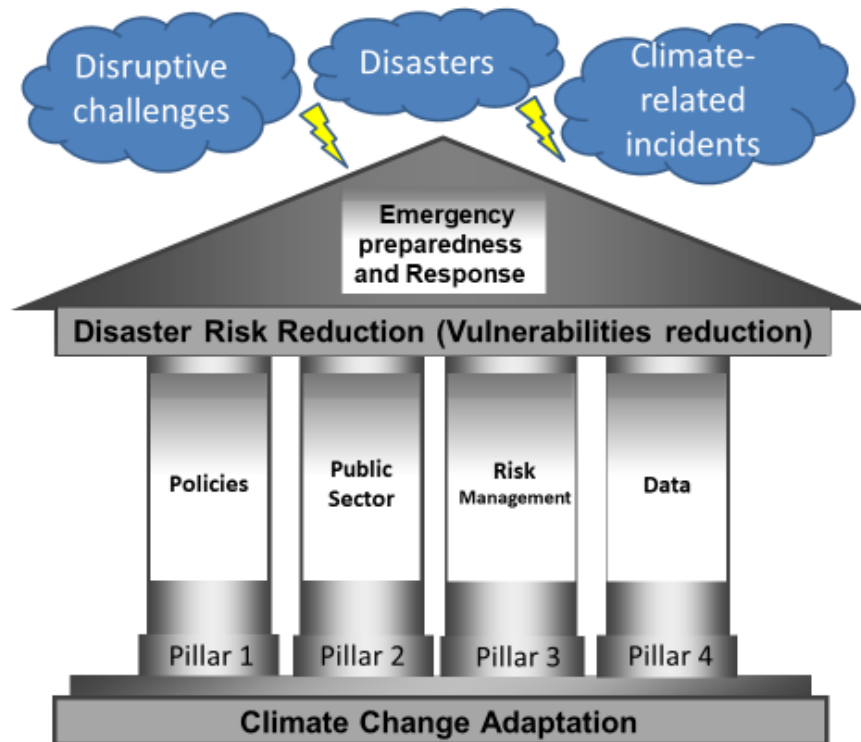


Despite the debatable ambiguity and controversial uncertainty of climate change and its implications on government's climate policies, there is no question that climate-related disasters are already posing risks

to security, environmental health and economic assets in every country. Therefore, governments sectors, businesses, and communities are addressing the challenges of climate emergency through risk management because it embraces uncertainties. By aligning the topics involved, climate risk management emerged in the literature as a research field from climatology (Travis & Bates, 2014).

A conceptual diagram can emerge from this tipping point of the literature review. Figure 3 calls into question if policies to adapt to climate change and local risk management systems are coherent to support the necessary preparedness of emergency services responding to more frequent and intense disasters, examined in details by the interview methodology. The pillar illustration highlights the concepts from the literature review and their interaction dealing with climate emergency. It is proposed that robust columns representing climate policies, risk management tools within the public sector and data are necessary for civil defence and institutions safeguard. These columns have double functions: consolidate CCA as a solid foundation and sustain DRR.

**FIGURE 3  
CONCEPTUAL FRAMEWORK**



### **Firefighting Risks in the UK**

Conceivably one of the vital branches of public institutions, FRS can strongly express the nexus between integrated climate policies of adaptation and disaster risk reduction, all of which are interconnected by exercising risk management and reflecting relevant sources of government planning under uncertainties.

Gillard (2016) argues that even though climate politics in the UK seemed to be institutionalised in multilateral and diplomatic parties agreements, there is still a gap between rhetorical pieces of paper and grounded actions. It is still necessary to demonstrate how climate policies, either adaptive or risk reductionist, are delivering operational effects at local levels, through the public services performance.

Risk management has been widely explored in firefighting organisations, particularly regarding climate-related incidents in the UK (Smith et al., 1996; Department for Communities and Local Government, 2006; McGuirk, 2010, Environmental Protection Handbook for the Fire and Rescue Service, 2015; Gazzard et al., 2016), and McGuirk (2010) advocates the transformational change that has taken



place in the UK Fire and Rescue Service in recent years. Since the New Dimension Programme, when investments were raised for the emergency services preparedness to the primary concerns of terrorist attacks (caused by the World Trade Center attack, 9/11), there was a behavioural shift from ‘cure to prevention’ approaches. The Fire and Rescue Services Act in 2004 was also the beginning of collaborative thinking to manage the range of civil emergencies, including the impacts of climate change, suggesting that this shift in the FRS also accompanied regulatory changes on climate policies (Table 1). It is possible to establish a link between the new public sector and institutional theory, where every fire brigade, already a rule-bound public organisation by nature, is now expected to be an emergency responder and a safety professional department, following the UK government framework. Table 2 describes a progressive change in the FRS legislation.

**TABLE 2  
AN OVERVIEW OF LEGISLATION CONCERNING BRITISH FRS**

<b>Year</b>	<b>Relevant legislation</b>	<b>Aims</b>
<b>2001</b>	The New Dimension Programme	An investment project in equipment and procedures to enhance FRS capacity to respond to a range of emergencies, under the Communities and Local Government's Fire and Resilience Programme.
<b>2004</b>	Fire and Rescue Services Act	Primary legislation that established the core functions and duties of fire and rescue authorities.
<b>2005</b>	Regulatory Reform (Fire Safety) Order	Fire and rescue authorities must enforce fire safety in non-domestic premises.
<b>2006</b>	Effects of Climate Change on FRS in the UK	The Fire Research Technical Report explores climate change scenarios and associated challenges for FRSs in the UK, analysing actions to mitigate impacts.
<b>2007</b>	The Fire and Rescue Services (England) Order	It specifies mandatory functions, to secure personnel, training and services for chemical, biological, radiological or nuclear incidents, collapsed structures and non-road transport wreckages.
<b>2012</b>	Fire and Rescue National Framework for England	It establishes the government’s expectations and requirements for fire and rescue authorities in compliance with the framework.
<b>2015</b>	Environmental Protection Handbook for the FRS	Guidance for high environmental risk activities at operational incidents, providing adequate response to mitigate the environmental impacts of disasters.

McGuirk (2010) clarifies that although a robust hierarchical culture was embedded in leadership management, risk analysis methods were accountable for moving to an extensive community risk reduction program with effective outcomes on emergencies reduction, consequently decreasing the figures of deaths and injuries from fires and other incidents. By planning continuously through risk assessments, promoted and modelled by technological programmes, the emergency resources can be allocated according to the right type, place and time for a better response. Other public and community sectors, such as Police, social care, and the Met Office, are cohesively involved in supporting decisions and providing both preventive and remedial measures. This movement developed a better way to systematise institutional performance, measured by marketing thinking on customer expectations, which are identified, consulted and published annually on an Integrated Risk Management Plan (IRMP). The result of this integrated community risk reduction approach was a positive social engagement beyond public relations, which is also in line with the integrated management approach argued by Young & Fone (1998).

The performance in the FRS must be defined according to the institutional management theory since it operates in the public sector. However, it is necessary first an overview of the recent public services reform in the UK, to contextualise the FRS and its improvements on Key Performance Indicators and Performance Assessments.

Between 1998 and 2004, Great Britain has asserted a government modernisation agenda, with the inclusion of national performance indicators. The Best Value administration and the Comprehensive Performance Assessment (CPA) were essential drivers of change across local government (Murphy & Greenhalgh, 2013). By the Local Government Act in 1999, FRS were assigned as Best Value organisations, required to maintain the provision for their services' improvement. In 2002, the 'Bain' report was a result of a long-running national dispute, within the government's intention of modernising the public services, and the employers' purpose of introducing new agreements for payment conditions. The 'Bain' report reviewed the Best Value regime in local government, supporting CPA in organisations, for a new performance management regime (Bain, Lyons and Young, 2002).

Even though FRS were not promptly reached by the first iterations of CPA, the Office of Public Service Reform ratified the 'Inspecting for Improvement' in 2003 and the Comprehensive Spending Review in 2005 as a movement towards periodical assessments and adequate use of resources in every public organisation. Moreover, it signalled a novel set of national targets for the public sector concerned with local results within communities, instead of particular facts and figures from individual public services (Murphy & Greenhalgh, 2013).

For the FRS, 2005 brought the introduction of the Integrated Risk Management Planning as a new development system for regional management boards and staff. Along with this shift, the government published the *Strong and Prosperous Communities*, announcing that Comprehensive Area Assessments would replace the CPA in 2009, consisting of a geographical area assessment, with the outcomes achieved collectively by public services in that specific area of the local authority (Department for Communities and Local Government, 2006a).

Murphy & Greenhalgh (2013) stress that after one year of operation, the Comprehensive Area Assessments were no longer made under the coalition government, but the resources for assessments are still in place for use. Regulated by the Open Public Services (Cabinet Office, 2011) and the Fire and Rescue National Framework for England (2012), the FRS obey a 'hybrid' form of public management, providing services on behalf of the central government within statutory elements, but predominantly locally delivered. By this performance management, measures are composed of national indicators and assessments designed at local circumspection.

Even though these are recent legislative and administrative arrangements, performance can still be defined according to Meyer and Zucker (1989), also in consonance with the institutional perspective on performance measurement in the 'new public sector' (Brignall & Modell, 2000). That is, as technical functions operated by an organisation, directed by norms of democratic governance participation in structural rules, in which the outputs are measurable according to the interests pursued by that organisation.

With the recent austerity programme, bringing reductions in public finances and the abolition of Comprehensive Area Assessments, the coalition government made it clear that FRS were expected to 'do more for less' (Murphy & Greenhalgh, 2013). Thus, the business model for a local networked fire and rescue service was rearranged "from one of planning on the basis of 'blanket fire cover', to one of planning through risk assessment" (McGuirk, 2010, p. 19).

## **METHODOLOGY**

### **Methods, Data and Sample**

The relationship between the concepts of CCA, DRR and the theory of risk management in the public sector as discussed in the review, raises the research question of how the government frameworks are influencing the improvement of preparedness, response and performance of FRS, and specifically:

Are national policies to adapt to climate change and local risk management systems efficient for disaster reduction and emergency preparedness of FRS facing more frequent and intense climatic incidents?

and:

Does the government policy equate the necessary investments to the public sector for better preparedness and response to climate risks?

An analysis of legislative documents in the UK specifies the spatial-temporal boundaries of the sampling. An instrumental case study is taken to investigate organisational strategies and practices at the local level (Stake, 1994), using the WYFRS for a better and narrow understanding of emergency planning regarding climate-related incidents. Additional material obtained by interviews with officers in the WYFRS elucidates the practice of risk management tools at the local level by the public sector following national policies. As this paper aims to assess how preparedness and response to climate-related incidents and disasters are being demonstrated by the strategical risk management policies in the UK, a semi-structured interview methodology was undertaken with five Fire Officers regarding plans, tools, and local actions carried out according to government procedures as well as expenditure contingency. The cluster method of sampling is taken for the interest in the strategical management area, reasonable to demonstrate how the FRS prepare and respond to climatic incidents. The interviews were conducted to unravel the applicability of theories and risk plans regarding the theme.

### **Data Analysis**

Thematic analysis (Braun, & Clarke, 2006) was used to identify and organise recurrent themes in the data transcribed from the interviews, in a semantic content to match the research question. Patterns of meaning were attributed to the themes according to the previous theoretical literature review, coding and providing significance to statements and their broad implications.

### **The Experience From the West Yorkshire Fire and Rescue Service**

The relationship between CCA, risk management and public organisational performance is steered to the FRS in the UK. In conjunction with the several topics discussed and the pathway through British central government legislation, the following analysis is presented to contextualise how to put risk management at work locally, with an instrumental case study to the research.

West Yorkshire is a metropolitan county with approximately 800 square miles of territory, comprising an inland and upland area in Northern England, with over two million population. It has a dense network of railways and roads, numerous rivers and canals narrowed through valleys, creating a developed urban and rural infrastructure (Office for National Statistics, 1999).

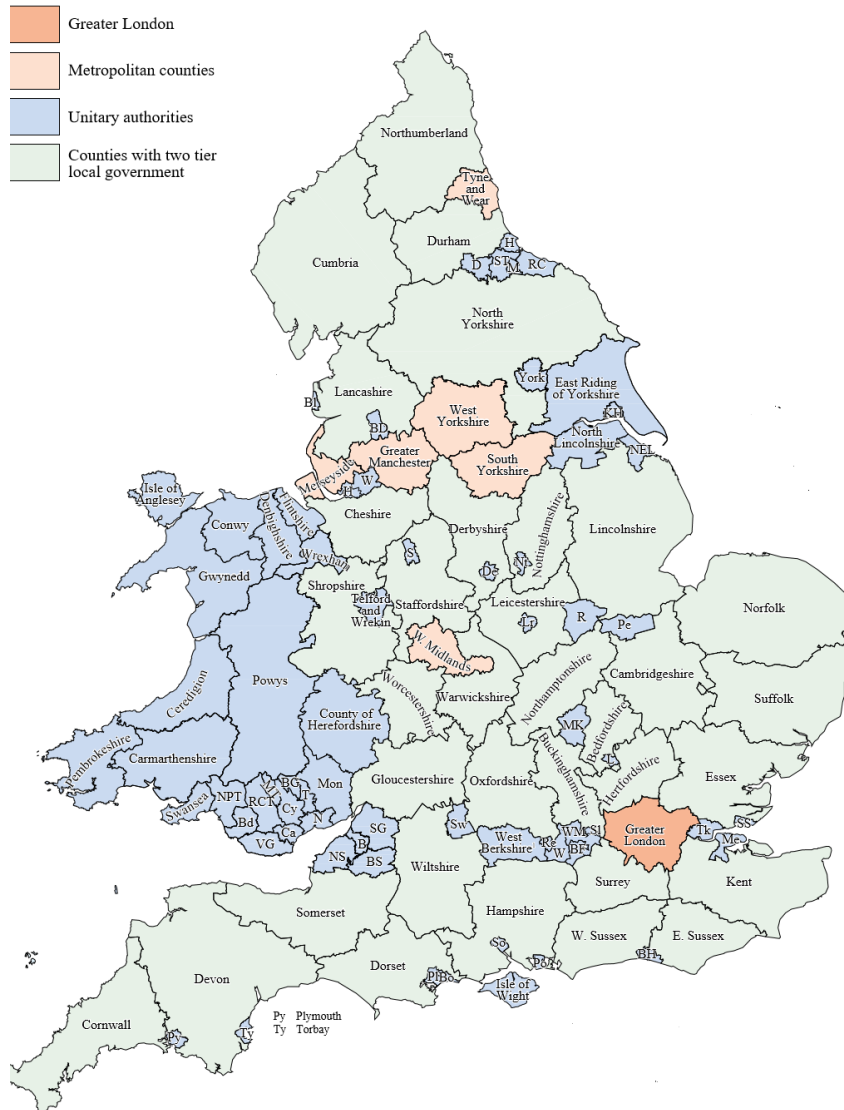
The West Yorkshire Fire and Rescue Authority (WYFRA) has 40 fire stations with trained firefighters to respond a wide range of incidents, such as road traffic collisions, train accidents, aircraft crashes, flood, fires, chemical spills, terrorist attacks, among other emergencies. The institution is funded by an annual grant from the Department for Communities and Local Government, which manages the fire and rescue matters nationally. Each FRS is required to produce and publish a set of documents for risk-based decisions, among them, a Community Risk Management Strategy, an Integrated Risk Management Planning (IRMP), and an annual Statement of Assurance. The purpose of these official papers is to provide transparency and accountability to the central government and communities that the service is being delivered efficiently and effectively (West Yorkshire Fire and Rescue Service Plan, 2015-2020).

According to the WYFRA Statement of Purpose (2017), the organisation reflects compliance with the Fire and Rescue Services Act 2004, the Regulatory Reform of 2005 and the National Framework, 2012, by establishing the government strategic drivers and commitment to deliver an efficient service to the needs of the local community. The WYFRA guides its performance through competent and ethical practices of governance to achieve value for money.

These strategic drivers and priorities are declared through a series of risk-based planning assumptions and reports, to ensure that the targets aimed across the Service Plan are delivered by the District Risk Reduction Programme. The essential methodology for putting the plans into practice is the Community Risk Management Strategy, which dictates on a database where, when, which and how many resources are deployed in West Yorkshire for maximum effectiveness. The document provides a multidimensional risk assessment outlined in the IRMP process. The IRMP highlights Prevention, Protection, Response and Resilience as a neatly guiding principle, to prepare and respond to emergencies according to the local demand. It serves to underpin the modernisation agenda of public services, translating the government's

value for money practices (McGuirk, 2010), along with optimal resource allocation and deployment (Statement of Purpose, 2017).

**FIGURE 4  
COUNTIES IN ENGLAND AND WALES**



Retrieved from Office for National Statistics (1999), p. 75.

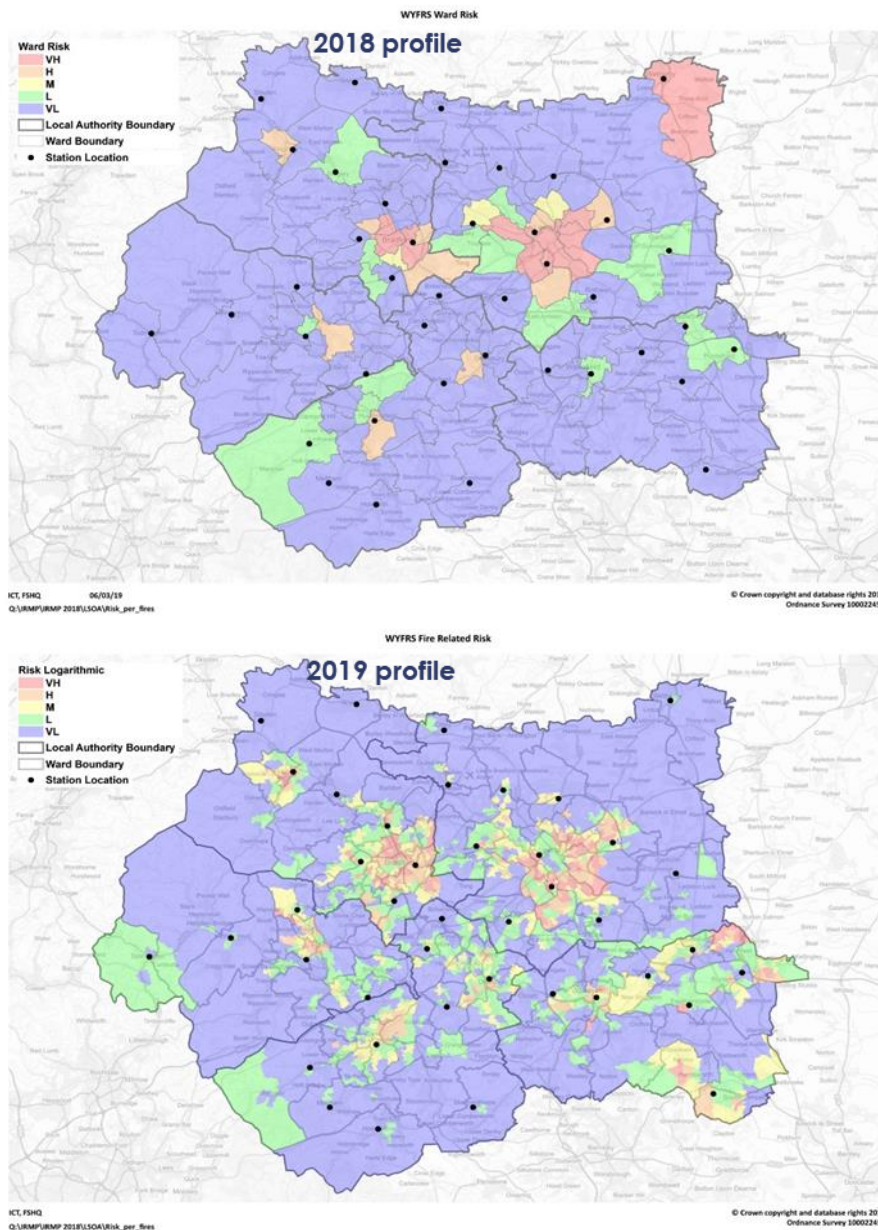
Reiterating CCA linked to DRR, and passing through the UK government policies, the WYFRS embodies direction from the legislation and gathers knowledge from local risk assessments, to translate policies into local actions.

### CASE STUDY FINDINGS

The findings of the study are presented by the thematic analysis of the interviews within the WYFRS. The integrated risk management contribution to DRR was explained by respondents as a way to identify foreseeable risks and manage preparedness through a multi-agency response.

Fire Officer D explains that in the past, the approach was based on the number of incidents and outcomes, with data that could or could not influence the risks around the Fire Station area. By pursuing data sets, there was a transition from Fire Station areas to wards, representing boundaries with meaning to the local population. Wards were graded between very high, and high, medium, low, very low, to build a risk map based on number and types of incidents according to the region peculiarity (Fig. 5). It was possible to establish a correlation between likelihood and social indicators, as deprivation for example (Fig.6). It was found that people living in the most deprived wards are six times more likely to have a fire than in the least deprived areas. The fire cover was built from these indicators. Figure 5 shows the dilution of very high-risk areas in West Yorkshire, between 2018 and 2019, with the IRMP expertise.

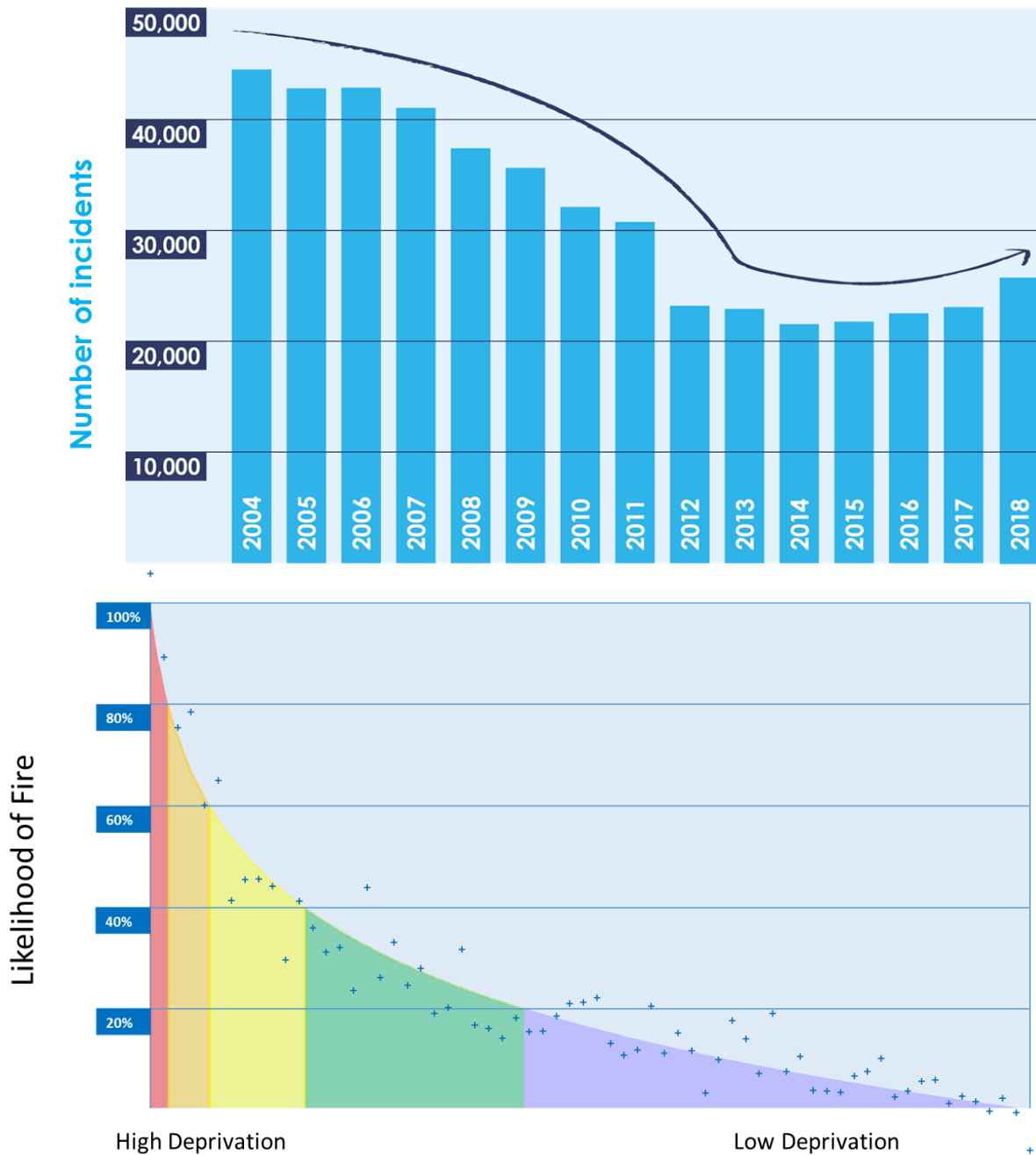
**FIGURE 5  
RISK PROFILING COMPARISON (2018-2019) IN WEST YORKSHIRE**



Retrieved from an official WYFRS document, provided by Fire Officer D.

Figure 6 illustrates the decreased rate of incidents, and the correlation between the likelihood of fires and deprivation.

**FIGURE 6  
INCIDENT RATE, AND A CORRELATION BETWEEN THE LIKELIHOOD OF  
FIRE AND DEPRIVATION**



Retrieved from an official WYFRS document (2019), provided by Fire Officer D.

Control measures consist of additional training, additional equipment or better engagement with collaborators, which are discussed in partnerships through the Local Resilience Forum. When every risk is

mapped and associated with cause and effects, actions are targeted to where, when, and how to act, to reduce risks and disasters. Data are recorded and continuously analysed with the expertise learned from past incidents, improving local resources for future events.

According to Fire Officer C, the IRMP is governed by workforce plan, or how many people on duty; the financial plan, a short to medium-term budgetary plan; and the risk register. The IRMP stays in the middle of balancing the topics by which it is ruled. The Fire Brigade has a determined number of appliances and a diminished workforce regularly in place, but in an emergency, some mothballed appliances can be recalled, as well as firefighters can be brought to duty. Resources and budget management can be optimised by identifying risk reduction in some area and shifting resources to other sectors, including prevention, protection and response. The method is based on continually evaluating risks, and measuring unforeseeable risks, assuring that crews are as equipped as they can be for any incident. Fire Officer B concerns about what is foreseeable and unforeseeable risk nowadays, using the Grenfell Tower fire to illustrate this matter. The fire in a residential building in London caused 72 deaths, and it was an unpredictable event in spite of British fire safety regulations. As a result, officers are also engaged in incidents that might not happen, characterised by rarity and severe impact. The same applies to the uncertainty of climate-related incidents, such as floods and wildfires.

Climatic risks are considered emerging risks and incorporated into strategic and operational decisions based on risk management tools, which interpret facts and incidence. Weather-related events, such as heatwaves and floods, are less tangible considering their statistical occurrence compared to dwelling fires or road traffic collisions. There are plans in place to respond to climatic incidents, but frequency and severity drive decisions regarding how much time and resources firefighting organisations want to commit to them.

Climate Change is one of the priorities on the integrated risk management model, equally to other risks faced by firefighters, for instance, deliberate fires, which are more prevalent currently. As the Fire Service continually monitors the cause of incidents, evidence suggests increasing importance of climate change. Fire Officer B reiterates that the general public expects FRS, as a public body, to lead on this topic. Still, limited funding dictates how much investment each Fire Authority can afford to deploy, to prevent and respond to the impacts of climate breakdown, given its current low likelihood.

The WYFRS is engaged in media campaigns to prevent climate-related incidents. For instance, against moorland fires, by working closely with the councils in Calderdale and Bradford to prevent people from having barbecues, restricting leisure use on the moors, and prohibiting landowners of doing controlled burning during the higher risk times of the year. However, these prevention measures are realised in partnerships. Fire Officer A states that other prevention activities regarding flooding and extreme weather events are mainly driven by the Environment Agency and Department for Environment, Food and Rural Affairs, including barriers and flood alleviation schemes. Fire Officer B admits that traditionally, firefighters deal more with the response to those incidents. However, highlighting Todmorden as an example, a vulnerable town to flash floods in the Upper Calder Valley in Calderdale, fire crews act in a community spirit, especially where they live, getting actively involved in clearing flood strains, sandbagging and rivers clean-ups.

The most likely incidents to occur due to Climate Change in West Yorkshire are floods and wildfires, followed by heavy snowfalls in extreme winters. Austerity environment puts pressure on investments in training and equipment for those, since assets have a shelf life and must be renewed periodically. As these incidents often occur in infrequent spikes of activity, FRS must balance their resources. Officer B notes that unless these incidents become less exceptional as a verified effect of climate change, senior managers will continue to have a dilemma analysing the availability of assets for preparedness and response to these types of events. He calls into question: "How long do you have to keep having spikes before it is a change?".

Preparedness and response are addressed by several different action plans, demonstrating expertise from past happenings and awareness against its risks and potential impacts. The appropriate level of resources is distributed across the county as per the risk, but the infrequency of major events cause issues to sustain a higher level of preparation for them. Business continuity structures are constructed within WYFRS for numerous scenarios, strengthening resilience to maintain operational activities.

Participants argue that WYFRS is as prepared as it can be for future increased impacts of climate change. However, efforts are prioritised according to the prevalence of emergencies. Fire Officer C advocates that IRMP is based on a medium-term financial plan, stating issues to make provisions for 10, 15 years ahead. Officer B and E argue that fire services monitor climate change nationally by continuous improvement ethic, but if there is a gradual increase on likelihood and severity of these situations, there is an extent of work to be done for a better level of preparedness.

In a hypothetical scenario of a heavy snowfall affecting multiple locations and causing major disruptions, respondents highlighted the interaction between British emergency services, following an integrated line of work. Participants described the National Operational Learning Database and JESIP (Joint Emergency Services Interoperability Principles) as platforms for guiding mutual operational learning and action. Local Resilience Forums inform and warn populations to diminish the demand for service, and make the best use of resources available. In incidents where Police, Fire, and Ambulance services respond collectively, areas of risks can be updated to improve future diligences and learn from best practices. National protocols provide mutual assistance under the National Coordination and Advisory Framework (NCAF), and military forces will support where emergency services cannot provide an adequate response using regular resources. Command structures are triggered, and the incident is supervised by the Cabinet Office Briefing Rooms – COBR or commonly referred as COBRA - a group of meetings in London to coordinate actions within the UK government bodies in response to national or regional crisis with significant implications.

According to Fire Officer E, the main issues against adaptive organisational actions to respond to climate-related incidents lie on understanding the social changes to update prevention strategies. The acceptance from politicians at national and local levels that climate emergency is a risk can make early adaptation possible, according to the need of resources, and “balancing likelihood against cost-benefit” (Fire Officer B).

As FRS are tailored by compliance with the law, Fire Officer B points out a fundamental flaw of the Civil Contingencies Act (2004), considering that there are responsibilities prescribed for plans on a multi-agency basis, but in terms of response in operational situations, there are not mandatory duties specified to any party, from a command structure point of view. Officer D criticises the limited support from the central government to implement all the actions, which are often central government-driven rather than local operated.

Officer C states two ways of looking at the influence of government policies on preparedness, response and performance of FRS. The first has a detrimental effect because of consistent reductions in funding, which affects the ability to respond. Alternatively, once the government is reducing central funding, there is an obligation for emergency services to work smarter. He explains: “The more adapted to change, the better we will cope with change”.

Fire Officer E argues that regulative frameworks devolve responsibility structured through the Local Resilience Forum to local authorities, to foresee risks, plan and prepare. The consistency of the services provided is achieved by FRS from internal and operational guidance to act against climatic incidents.

Participants unanimously answered that government policy does not equate the necessary investments to the public sector for better preparedness and response to climate risks and incidents.

Fire Officer B claims the fact that national risks are strictly protected from a high level of scrutiny by the civil service environment, which is heavily influenced by politicians and the treasury investment in it. Some risks are underplayed because to mitigate them would cost many reserves. Officer C describes that investments for climate change are usually a reactive response, in attempts of investing the enough amount of resources, which often is not enough.

Fire Officer A emphasises that, as a national body, FRS have to justify the work provided to the public. Constabulary inspections are regularly realised, basically looking at three aspects: “How effective, how efficient you are and how you look after your people”. Performance assessments within the WYFRS are carried out measuring the business governance according to finances and resources management, based on the development of quality-assured data. Data is proven to be critical for analysing trends and put arrangements in place. Without appropriate statistical information, decisions could be driven by deducing



assumptions. Strategic and operational decisions should be driven according to identified risks and the correlation between regional and social aspects, such as deprivation for instance. Once established the reasons for the events, it is possible to act with the correct control measures.

Participants affirmed that the integrated risk management approach is suitable to other FRS abroad, respecting different organisations environment, and geographical and socio-economic aspects. Officer D states that “it’s not about saying the resources you need, it’s saying of all resources you’ve got, how do you prioritise your resources”.

This case study affirms the positive potential of risk management for public services’ administration regarding climate change adaptation, and for most occasions posing challenges to governance practices. Even though Climate Change is wreaking havoc on wildlife and habitats, while putting more people’s homes and lives at risk, the likelihood of incidents has not reached a level that could demonstrate the necessity for more investments in this area within the public sector.

## **CONCLUSION**

Investments in security and prevention for unpredictable risks are seen as too much until the day that it is not enough. For dealing with the balance of nature, some extreme climate conditions and impacts are not foreseen, even with scientists reinforcing the stringency of climate change through the IPCC reports. But suddenly, the unthinkable can become distinctively possible, making organisations willing to change on how they operate, to reduce risks and mitigate highly likely disruptions and financial implications.

Risk management is not a catchphrase. It is in our risky society, to support and advise government and institutions, to transform risk-takers into change-makers. In times of austerity, climate risk management rises as a tool for implementing cost-effective policies at the same time of transforming plans into local actions, and directing policies again with data.

Through a community-integrated risk management approach, the WYFRS can identify risks and vulnerabilities, and use the adequate resource, at the precise place, at the opportune moment, with the right message or action, according to the availability of assets. It can be argued that it corresponds to the “do more for less” British policy within the public sector, while cooperatively reduces risks and disasters.

Although the likelihood of climate-related hazards dictates investments and limited resources are identified as barriers for funding actions in long-term, best practices of governance can be achieved through risk management. Data can be evidenced in an attested, factual and positive way for requesting additional provisions to the local level.

The majority of emergency services operates on a local and regional basis. Partnerships and community work are required for putting policies into practice at the local level, and Local Resilience Forums express this cooperative engagement, contributing meaningfully for linking adaptation to Climate Change to Disaster Risk Reduction. Limitations of this study consist of the different local capacities of the emergency services, considering a multi-agency approach. The community-integrated risk management is a case to be carefully targeted for key performance indicators in British emergency services. Further research in this field, based on the conceptual framework of this study, can indicate the applicability to other public sectors extensively.

## **ACKNOWLEDGEMENTS**

This dissertation is dedicated to all Fire and Rescue Services worldwide, constantly thriving against all kind of adversities in an already arduous profession by nature, giving hope and help to all those in need, without distinction. I wish to especially thank all Fire Officers from West Yorkshire Fire and Rescue Service who participated in this study.

I would like to express the deepest gratitude and appreciation to Dr. Julia Meaton and Dr. Paul Armitage. This research would not have been realised without their guidance and support.

I owe the deepest gratitude to the UK Foreign & Commonwealth Office for providing the opportunity to study at the University of Huddersfield through the Chevening Scholarship Programme. Also, to Goiás Fire Brigade in Brazil, which authorised me a license to carry on this Master's degree.

To my parents and beloved wife, thank you for being so close when I was so far.

*“There is no harm in hoping for the best, as long as you have prepared for the worst.”*  
(Stephen King, 2016. “Different Seasons”, p.75, Simon and Schuster)

## ENDNOTE

- <sup>1</sup> The term Disaster Risk Reduction is embraced by the concept of Disaster Risk Management, and both terms are commonly used as almost synonyms (Birkmann & von Teichman, 2010).

## REFERENCES

- ALARM. (2002). *A Risk Management Standard*. UK: The Public Risk Management Association. AIRMIC, ALARM, IRM.
- ALARM. (2009). *The Alarm National Performance Model for Risk Management in the Public Services*. UK: The Public Risk Management Association.
- Audit Commission for Local Authorities, & the National Health Service in England. (2001). *Worth the Risk: improving risk management in local government*. Audit Commission.
- Bain, G., Lyons, M., & Young, M. (2002). *The Future of the Fire Service: reducing risk, saving lives*. The Independent Review of the Fire Service. December 2002. HMSO, London. Online. Retrieved June 15, 2019, from <https://webarchive.nationalarchives.gov.uk/20080709132819/http://www.frsonline.fire.gov.uk/publications/article/17/306>
- Birkmann, J., & Mechler, R. (2015). Advancing climate adaptation and risk management. New insights, concepts and approaches: What have we learned from the SREX and the AR5 processes? *Climatic Change*, 133(1), 1–6. doi:10.1007/s10584-015-1515-y
- Birkmann, J., & von Teichman, K. (2010). Integrating disaster risk reduction and climate change adaptation: Key challenges—scales, knowledge, and norms. *Sustainability Science*, 5(2), 171–184. doi:10.1007/s11625-010-0108-y
- Birkmann, J., Cardona, O.D., Carreño, M.L., Barbat, A.H., Pelling, M., Schneiderbauer, S., . . . Welle, T. (2013). Framing vulnerability, risk and societal responses: The MOVE framework. *Natural Hazards*, 67(2), 193–211. doi:10.1007/s11069-013-0558-5
- Bosomworth, K. (2015). Climate change adaptation in public policy: Frames, fire management, and frame reflection. *Environment and Planning C: Government and Policy*, 33(6), 1450–1466. doi:10.1177/0263774X15614138
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. doi:10.1191/1478088706qp063oa
- Brignall, S., & Modell, S. (2000). An institutional perspective on performance measurement and management in the ‘new public sector’. *Management Accounting Research*, 11(3), 281–306. doi:10.1006/mare.2000.0136
- Cabinet Office. (2002). Risk: Improving Government’s Capability to Handle Risk and Uncertainty. *Strategy Unit Report*.
- Cabinet Office. (2011). *Open Public Services*. HMSO, London. Online Retrieved June 15, 2019, from <https://www.gov.uk/government/publications/open-public-services-white-paper>
- Carreño, M.L., Cardona, O.D., & Barbat, A.H. (2007). A disaster risk management performance index. *Natural Hazards*, 41(1), 1–20. doi:10.1007/s11069-006-9008-y
- Cavallo, A. (2014). Integrating disaster preparedness and resilience: A complex approach using system of systems. *Australian Journal of Emergency Management*, 29(3), 46–51.

- Cienfuegos Spikin, I. (2013). Risk management theory: The integrated perspective and its application in the public sector. *Revista Estado, Gobierno y Gestión Pública*, (21) doi: 10.5354/0717-6759.2013.29402
- Crawford, M., & Stein, W. (2004). Risk management in UK local authorities: The effectiveness of current guidance and practice. *International Journal of Public Sector Management*, 17(6), 498–512. doi:10.1108/09513550410554788
- Dannevig, H., Hovelsrud, G.K., & Husabø, I.A. (2013). Driving the agenda for climate change adaptation in Norwegian municipalities. *Environment and Planning C: Government and Policy*, 31(3), 490–505. doi:10.1068/c1152
- Defra. (2012). *UK Climate Change Risk Assessment*. London, UK: The Stationery Office. Online. Retrieved June 10, 2019, from [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/69487/pb13698-climate-risk-assessment.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69487/pb13698-climate-risk-assessment.pdf)
- Department for Communities and Local Government. (2006). *Effects of Climate Change on Fire and Rescue Services in the UK*. Fire Research Technical Report 1/2006, London. National Fire Chiefs Council, NFCC. Online. Retrieved June 10, 2019, from <http://www.cfoa.org.uk/12617>
- Department for Communities and Local Government. (2006a). *Strong and Prosperous Communities — The Local Government White Paper*. HMSO, London. Online. Retrieved June 15, 2019, from [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/272357/6939.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/272357/6939.pdf)
- Department of the Environment, Transport and the Regions. (2000). *Climate change: The UK programme*. UK. Parliament, London: Stationery Office.
- DHS (US Department of Homeland Security). (2011). *The Strategic National Risk Assessment in Support of PPD 8: A Comprehensive Risk-Based Approach toward a Secure and Resilient Nation*. Washington, DC, USA: Department of Homeland Security. Online. Retrieved July 4, 2019, from <https://www.dhs.gov/strategic-national-risk-assessment-snra>
- Dias, N., Amaratunga, D., & Haigh, R. (2018). Challenges associated with integrating CCA and DRR in the UK- A review on the existing legal and policy background. *Procedia Engineering*, 212, 978–985. doi: 10.1016/j.proeng.2018.01.126
- DiMaggio, P.J., & Zucker, L.G. (1988). Institutional patterns and organizations: Culture and environment. *Cambridge, MA: Ballinger*, pp. 3–22.
- Drennan, L.T., McConnell, A., & Stark, A. (2014). *Risk and crisis management in the public sector* (Second ed.). London: Routledge.
- Ellicott, G. (2006). The regulatory reform (fire safety) order - what's that? *Building Engineer*, 81(3), 12–13.
- Environmental Protection Handbook for the Fire and Rescue Service. (2015). *National Operational Guidance, Environment Agency, UK Fire and Rescue Services and the Department for Communities and Local Government*. Online. Retrieved July 15, 2019, from <https://www.ukfrs.com/sites/default/files/2017-09/Environment%20Agency%20and%20DCLG%20environmental%20handbook.pdf>
- Field, C.B., Barros, V., Stocker, T.F., Dahe, Q., Dokken, D.J., Ebi, K.L., . . . Canadian Electronic Library (Firm). (2012). *Managing the risks of extreme events and disasters to advance climate change adaptation: Special report of the intergovernmental panel on climate change*. New York, NY: Cambridge University Press. doi:10.1017/CBO9781139177245
- Fischer, F. (2003). *Reframing public policy: Discursive politics and deliberative practices*. Oxford: Oxford University Press.
- Fone, M. (2005). *Managing risks in public organisations*. New York: Palgrave Macmillan.
- Fone, M., & Young, P.C. (2000). *Public sector risk management*. Oxford: Butterworth-Heinemann.
- Forrest, S., Trell, E., & Woltjer, J. (2019). Civil society contributions to local level flood resilience: Before, during and after the 2015 boxing day floods in the Upper Calder Valley. *Transactions of the Institute of British Geographers*, 44(2), 422–436. doi: 10.1111/tran.12279

- Forzieri, G., Bianchi, A., Silva, F.B.e., Marin Herrera, M.A., Leblois, A., Lavallo, C., . . . Feyen, L. (2018). Escalating impacts of climate extremes on critical infrastructures in Europe. *Global Environmental Change*, 48, 97–107. doi:10.1016/j.gloenvcha.2017.11.007
- Forzieri, G., Cescatti, A., e Silva, F.B., & Feyen, L. (2017). Increasing risk over time of weather-related hazards to the European population: A data-driven prognostic study. *The Lancet Planetary Health*, 1(5), e200–e208. doi: 10.1016/S2542-5196(17)30082-7
- Gawith, M., Street, R., Westaway, R., & Steynor, A. (2009). Application of the UKCIP02 climate change scenarios: Reflections and lessons learnt. *Global Environmental Change*, 19(1), 113–121. doi:10.1016/j.gloenvcha.2008.09.005
- Gazzard, R., McMorro, J., & Ayles, J. (2016). Wildfire policy and management in England: An evolving response from fire and rescue services, forestry and cross-sector groups. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 371(1696), 20150341. doi:10.1098/rstb.2015.0341
- Gerlak, A.K., Weston, J., McMahan, B., Murray, R.L., & Mills-Novoa, M. (2018). Climate risk management and the electricity sector. *Climate Risk Management*, 19, 12–22. doi:10.1016/j.crm.2017.12.003
- Gillard, R. (2016). Unravelling the United Kingdom's climate policy consensus: The power of ideas, discourse and institutions. *Global Environmental Change*, 40, 26–36. doi:10.1016/j.gloenvcha.2016.06.012
- Gupta, J., Termeer, C., Klostermann, J., Meijerink, S., van den Brink, M., Jong, P., . . . Bergsma, E. (2010). The adaptive capacity wheel: A method to assess the inherent characteristics of institutions to enable the adaptive capacity of society. *Environmental Science and Policy*, 13(6), 459–471. doi:10.1016/j.envsci.2010.05.006
- Hagmann, J., & Cavelt, M.D. (2012). National risk registers: Security scientism and the propagation of permanent insecurity. *Security Dialogue*, 43(1), 79–96. doi:10.1177/0967010611430436
- Hiscock, K., & Jones, A. (2017). Assessing the extent to which the UK's national risk register supports local risk management. *Sustainability*, 9(11), 1991. doi:10.3390/su9111991
- HM Government. (2004). *Civil Contingencies Act*. The Stationery Office: London, UK.
- HM Government. (2012). *Fire and Rescue National Framework for England*. The Stationery Office: London, UK, 2012.
- HM Treasury. (2004). *The orange book: Management of risk-principles and concepts*. London: HM Treasury.
- Hood, C. (1991). A public management for all seasons? *Public Administration*, 69(1), 3–19. doi:10.1111/j.1467-9299.1991.tb00779.x
- Hood, C. (1995). The “new public management” in the 1980s: Variations on a theme. *Accounting, Organizations and Society*, 20(2), 93–109. doi:10.1016/0361-3682(93)E0001-W
- Hood, C., & Miller, P. (2009). Public Service Risks: What's Distinctive and New? *Risk and Public Services*, 2.
- Hughes, N., Tomei, J., & Ekins, P. (2009). *Critical review of the Application of the UKCIP Socioeconomic Scenarios: Lessons Learnt and Future Directions*. Department of Geography, King's College London.
- IPCC. (2018a). Annexe I: Glossary [Matthews, J.B.R. (ed.)]. In *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, & T. Waterfield (eds.)]. In Press.
- IPCC, Allen, M.R., O.P. Dube, W. Solecki, F. Aragón-Durand, W., Cramer, S. . . . K. Zickfeld (2018). Framing and Context. In V. Masson-Delmotte, V.P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y.

- Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, & T. Waterfield (Eds.), *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*. In Press.
- IPCC. (2012). Summary for Policymakers. In C.B. Field, V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, & P.M. Midgley (Eds.), *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (p.119). A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, and New York, NY, USA.
- IPCC. (2014). Summary for Policymakers. In C.B. Field, V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, & L.L. White (Eds.), *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 1–32). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- IPCC-SPM (2018b). Summary for Policymakers. In V. Masson-Delmotte, P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, & T. Waterfield (Eds.), *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* (In Press).
- ISO. (2009). *ISO/IEC 31010:2009, Risk management. Risk assessment techniques*.
- Kendon, M., McCarthy, M., Jevrejeva, S., Matthews, A., & Legg, T. (2019). State of the UK climate 2018. *International Journal of Climatology*, 39(S1), 1–55. doi:10.1002/joc.6213
- Lapsley, I. (2009). New public management: The cruellest invention of the human spirit? *Abacus*, 45(1), 1–21.
- Lei, Y., & Wang, J. (2014). A preliminary discussion on the opportunities and challenges of linking climate change adaptation with disaster risk reduction. *Natural Hazards*, 71(3), 1587–1597. doi:10.1007/s11069-013-0966-6
- Lorenzoni, I., Jones, M., & Turnpenny, J.R. (2007). Climate change, human genetics, and post-normality in the UK. *Futures*, 39(1), 65–82. doi:10.1016/j.futures.2006.03.005
- May, B., Plummer, R., Stockholms Universitet, & Stockholm Resilience Centre. (2011). Accommodating the challenges of climate change adaptation and governance in conventional risk management: Adaptive collaborative risk management (ACRM). *Ecology and Society*, 16(1), 47. doi:10.5751/ES-03924-160147
- McBean, G., & Ajibade, I. (2009). Climate change, related hazards and human settlements. *Current Opinion in Environmental Sustainability*, 1(2), 179–186. doi:10.1016/j.cosust.2009.10.006
- McGuirk, S. (2010). From cure to prevention - transformational change in the fire and rescue service. *The International Journal of Leadership in Public Services*, 6(4), 18. doi:10.5042/ijlps.2010.0632
- McMorrow, J. (2011). *Wildfire in the United Kingdom: Status and key issues*. International Association of Wildland Fire, Birmingham, AL, USA.
- Meyer, M.W., & Zucker, L.G. (1989). *Permanently Failing Organizations*. Newbury Park, Sage.
- Mikes, A. (2011). From counting risk to making risk count: Boundary-work in risk management. *Accounting, Organizations and Society*, 36(4/5), 226–245.
- Murphy, P., & Greenhalgh, K. (2013). Performance management in fire and rescue services. *Public Money & Management*, 33(3), 225–232. doi:10.1080/09540962.2013.785711
- National Audit Office (UK). (2000). *Supporting Innovation: Managing Risk in Government Departments: Report by the Comptroller and Auditor General*. Stationery Office.

- National Risk Register of Civil Emergencies. (2017). Cabinet Office: London, UK, 2017.
- Norwegian Directorate for Civil Protection. (2014). *National Risk Analysis 2014*. Tønsberg, Norway. Online. Retrieved July 4, 2019, from [https://www.dsb.no/globalassets/dokumenter/rapporter/nrb\\_2014\\_english.pdf](https://www.dsb.no/globalassets/dokumenter/rapporter/nrb_2014_english.pdf)
- O'Brien, K., Eriksen, S., Nygaard, L.P., & Schjolden, A. (2007). Why different interpretations of vulnerability matter in climate change discourses. *Climate Policy*, 7(1), 73–88.
- O'Brien, G., & Read, P. (2005). Future UK emergency management: New wine, old skin? *Disaster Prevention and Management: An International Journal*, 14(3), 353–361. doi:10.1108/09653560510605018
- Office for National Statistics. (1999). *Gazetteer of the old and new geographies of the United Kingdom*. ISBN 1 85774 298 2. Online. Retrieved July 6, 2019, from [https://webarchive.nationalarchives.gov.uk/20031223023527/http://www.statistics.gov.uk/downloads/ons\\_geography/Gazetteer\\_v3.pdf](https://webarchive.nationalarchives.gov.uk/20031223023527/http://www.statistics.gov.uk/downloads/ons_geography/Gazetteer_v3.pdf)
- Palermo, T. (2014). Accountability and expertise in public sector risk management: A case study: Risk management in the public sector. *Financial Accountability & Management*, 30(3), 322–341. doi:10.1111/faam.12039
- Pringle, P. (2011). *AdaptME: Adaptation monitoring and evaluation*. UKCIP, Oxford, UK.
- Rübbelke, D., & Vögele, S. (2011). Impacts of climate change on European critical infrastructures: The case of the power sector. *Environmental Science and Policy*, 14(1), 53–63. doi:10.1016/j.envsci.2010.10.007
- Schmidt, V.A. (2008). Discursive Institutionalism: The Explanatory Power of Ideas and Discourse. *Annual Review of Political Science*, 11(1), 303–326. <https://doi.org/10.1146/annurev.polisci.11.060606.135342>
- Schmidt, V.A. (2010). Taking ideas and discourse seriously: Explaining change through discursive institutionalism as the fourth 'new institutionalism'. *European Political Science Review*, 2(1), 1–25. doi:10.1017/S175577390999021X
- Scott, W.R. (2001). *Institutions and organisations* (2nd ed.). Thousand Oaks, California: Sage.
- Smith, P., Nicholson, J., & Collett, L. (1996). Risk management in the fire and emergency services. *Australian Journal of Emergency Management*, 11(2), 5–13.
- Stake, R. (1994). Case Studies. In N. Denzin & Y. Lincoln (Eds.), *Handbook of Qualitative Research*. SAGE publications, London.
- Statement of Accounts. (2016). *Statement of Accounts 2015-2016*. West Yorkshire Fire and Rescue Authority. Date Issued: September 2016. Online. Retrieved July 19, 2019, from <https://www.westyorksfire.gov.uk/wp-content/uploads/2016/09/STATEMENT-OF-ACCOUNTS-2015.16.pdf>
- Statement of Accounts. (2017). *Statement of Accounts 2016-2017*. West Yorkshire Fire and Rescue Authority. Date Issued: September 2017. Online. Retrieved July 19, 2019 from <https://www.westyorksfire.gov.uk/wp-content/uploads/2017/09/STATEMENT-OF-ACCOUNTS-2016.17-final-150917.pdf>
- Statement of Accounts. (2018). *Statement of Accounts 2017-2018*. West Yorkshire Fire and Rescue Authority. Date Issued: August 2018. Online. Retrieved July 19, 2019, from <https://www.westyorksfire.gov.uk/wp-content/uploads/2018/08/Statement-of-Accounts-2017-18-Final-02.11.18.pdf>
- Statement of Purpose. (2017). *Statement of Purpose*, West Yorkshire Fire and Rescue Authority. Date Revised: September 2017. Online. Retrieved July 19, 2019, from <https://www.westyorksfire.gov.uk/wp-content/uploads/2017/11/Statement-of-Purpose.pdf>
- Stulz, R.M. (1996). Rethinking risk management. *Journal of Applied Corporate Finance*, 9(3), 8–25. doi:10.1111/j.1745-6622.1996.tb00295.x
- Taylor, A.L., Dessai, S., & Bruine de Bruin, W. (2014). Public perception of climate risk and adaptation in the UK: A review of the literature. *Climate Risk Management*, 4–5(C), 1–16. doi:10.1016/j.crm.2014.09.001

- Thomalla, F., Downing, T., Spanger-Siegfried, E., Han, G., & Rockström, J. (2006). Reducing hazard vulnerability: Towards a common approach between disaster risk reduction and climate adaptation. *Disasters*, 30(1), 39–48. doi:10.1111/j.1467-9523.2006.00305.x
- Travis, W.R., & Bates, B. (2014). What is climate risk management? *Climate Risk Management*, 1(C), 1–4. doi:10.1016/j.crm.2014.02.003
- U.K. Parliament. (2009). *New dimension - enhancing the fire and rescue services. Public accounts committee, tenth report with formal minutes evidence and appendices*. HC 249 [Incorporating HC 1184–i, Session 2007–08] Published on 12 March 2009 by the authority of the House of Commons. London: The Stationery Office Limited.
- UKCIP. (2018). *UK Climate Impacts Programme*. Online. Retrieved May 15, 2019, from <http://www.ukcip.org.uk>
- Urwin, K., & Jordan, A. (2007). Does public policy support or undermine climate change adaptation? Exploring policy interplay across different scales of governance. *Global Environmental Change*, 18(1), 180–191. doi:10.1016/j.gloenvcha.2007.08.002
- West Yorkshire Fire and Rescue Service Plan (2015–2020). *Service Plan 2015-2020*. West Yorkshire Fire and Rescue Authority. Online. Retrieved July 19, 2019, from <https://www.westyorksfire.gov.uk/wp-content/uploads/2015/07/WYFRS-Interactive-Service-Plan.pdf>
- Willows, R., Reynard, N., Meadowcroft, I., & Connell, R. (2003). *Climate adaptation: Risk, uncertainty and decision-making. UKCIP technical report*. UK Climate Impacts Programme.
- Wilson, E. (2006). Adapting to climate change at the local level: The spatial planning response. *Local Environment*, 11(6), 609–625. doi:10.1080/13549830600853635
- Young, P.C., & Fone, M. (1998). Organisation risk management in UK police authorities: An integrated management approach. *International Journal of Police Science & Management*, 1(1), 48–57. doi:10.1177/146135579800100106

## APPENDIX 1: ETHICAL REVIEW FORM

**The University Of Huddersfield  
Business School Research Ethics Committee  
Student (UGT / PGT) Project / Dissertation Ethical Review Proforma (E1)**

**APPLICABLE TO ALL UNDERGRADUATE AND TAUGHT POSTGRADUATE PROGRAMMES**

Please complete and return via email to your Project / Dissertation Supervisor, along with the required documents (shown below).

**SECTION A: TO BE COMPLETED BY THE STUDENT**

Before completing this section, students should consult their Course / Module handbook alongside appropriate ethical guidelines. The student's supervisor is responsible for advising the student on appropriate professional judgement in this review.

Please ensure that the statements in Section C are completed by the student and supervisor prior to submission.

Project Title:	Connecting risk management theory and practice on the frontline of climate change adaptation and disaster risk reduction: the experience of the West Yorkshire Fire and Rescue Services (WYFRS) in the United Kingdom.
Student:	Sanjay Narendrakumar Babulal
Student number:	U1867900
Course:	Risk Disaster and Environmental Management
Supervisor:	Dr Julia Meaton
Project start date	22/05/2019

**SECTION B: PROJECT OUTLINE (TO BE COMPLETED IN FULL BY THE STUDENT)**

Issue	Please provide sufficient detail for your supervisor to assess strategies used to address ethical issues in the research proposal
Aim / objectives of the study These need to be clearly stated and in accord with the title of the study. (Sensitive subject areas which might involve distress to the participants will be referred to the Course Approval Panel).	The purpose of this study is to explore how climate-related hazards influence the strategies and institutional risk management of the WYFRS according to the UK government planning, as an instrumental case study for the improvement of emergency services management and its overall application on disaster risk reduction and climate change adaptation.
Brief overview of research methodology The methodology only needs to be explained in sufficient detail to show the approach used (e.g. survey) and explain the research methods to be used during the study.	It is a qualitative research adopting a holistic approach to understand the Climate Change Adaptation, Disaster Risk Reduction and the current theoretical position of risk management approaches in the UK. Furthermore, the paper embraces a single instrumental case study to investigate organisational strategies and practices at the local level, using the West Yorkshire Fire and Rescue Services (WYFRS) for a better and narrow understanding of emergency planning regarding climate-related incidents. The primary data will be collected through 6 in-depth, semi-structured, audio-recorded interviews from selected strategical



	managers responsible for preparedness and response (service delivery and support) in the WYFRS. The use of data-driven interviews intends to provide a more detailed account of the theme and issues of potential interest to the influence of climate change in risk management plans, reflecting the reality, experiences, and applicability of theories in place.
Does your study require any permissions for study? If so, please give details	Yes, it requires interviewees' signature in consent forms for the interviewing process.
Participants Please outline who will participate in your research. If your research involves vulnerable groups (e.g. children, adults with learning disabilities), it must be referred to the Course Assessment Panel.	5-6 strategical managers responsible for preparedness and response (service delivery and support) in the WYFRS will be selected for this study.
Access to participants Please give details about how participants will be identified and contacted.	As the student is knowledgeable of firefighters in West Yorkshire and Brazil, also by exercising the firefighter profession in his home country (Brazil), the invitation to the interviews will have easier access. Also, Dr Paul Armitage, who is a retired Fire Officer, will facilitate some contacts.
How will your data be recorded and stored?	Interviews will be recorded using a password protected Dictaphone which will be kept in a lockable secure place. The interviews will be recorded in an audio recorder digital file, to allow transcription and analysis of the data. Additionally, during the interview, I will make notes so that I can come back to any topics if necessary. However, the interviews will then be transferred as quickly as possible onto the university's k-drive, and then the original will be destroyed.
Confidentiality Please outline the level of confidentiality you will offer respondents and how this will be respected. You should also outline about who will have access to the data and how it will be stored. (This should be included on information sheet.)	During the transcription process, all information that relates specifically to identity will be removed to ensure that the interviewee remain anonymous. The data will be transcribed and analysed using a secure network and saved onto a secure password protected device. The original recording will be deleted after this process, and the transcribed data will be held for a maximum of 10 years before being destroyed. The data will remain in Europe. No person other than the researcher/s and supervisor/s will have access to the information provided. After signing a consent form, the participants will be free to withdraw up until 31 <sup>st</sup> August 2019.
Anonymity Do you intend to offer anonymity? If so, please indicate how this will be achieved.	After the transcription process, there will be an opportunity for the interviewee to see the transcription and make any alterations so that it is a true reflection of his opinions, as well as to ensure that the content and identity have been protected.
To what extent could the research induce psychological stress or anxiety, cause harm or negative consequences for the participants (beyond the risks encountered in normal life). If more than minimal risk, you should outline what support there will be for participants.	The topics to be explored within the interviews are from the strategical management area and does not induce psychological stress or anxiety, cause harm or negative consequences for the participants.

<p>Does the project include any security sensitive information? Please explain how processing of all security sensitive information will be in full compliance with the "Oversight of security - sensitive research material in UK universities: guidance (October 2012)" (Universities UK, recommended by the Association of Chief Police Officers)</p>	<p>The project does not include security sensitive information.</p>
--	---

**SECTION C – SUMMARY OF ETHICAL ISSUES (TO BE COMPLETED BY THE STUDENT)**

Please give a summary of the ethical issues and any action that will be taken to address the issue(s).

<p>Issues:</p> <ul style="list-style-type: none"> <li>a) Informed consent;</li> <li>b) Beneficence - Do not harm;</li> <li>c) Respect for anonymity and confidentiality;</li> <li>d) Respect for privacy.</li> </ul> <p>Actions:</p> <ul style="list-style-type: none"> <li>a) Before any interview in this study, the interviewee will give his informed consent to the researcher and the study. Informed consent involves more than just accepting to take part in the study, and it is based on a full understanding of what topics and motives are involved.</li> <li>b) I have the welfare of the research participant as a goal of this research study.</li> <li>c) People participating in this research are entitled to confidentiality even if the results of the research are made public. Information will not be divulged to anyone outside the research team. Prior explanation regarding anonymity and confidentiality will be given. Anonymity is guaranteed as participants will be assigned as code names or numbers.</li> <li>d) The study does not collect identifying information of individual subjects (e.g., address, Email address, etc.), or the research will not link individual responses with participants' identities.</li> </ul>
--

**SECTION D – ADDITIONAL DOCUMENTS CHECKLIST (TO BE COMPLETED BY THE STUDENT)**

Please supply to your supervisors copies of all relevant supporting documentation electronically. If this is not available electronically, please provide explanation and supply a hard copy.

I have included the following documents

Information sheet	Yes <input checked="" type="checkbox"/>	Not applicable <input type="checkbox"/>
Consent form	Yes <input checked="" type="checkbox"/>	Not applicable <input type="checkbox"/>
Questionnaire	Yes <input checked="" type="checkbox"/>	Not applicable <input type="checkbox"/>
Interview schedule	Yes <input checked="" type="checkbox"/>	Not applicable <input type="checkbox"/>


**SECTION E – STATEMENT BY STUDENT**

I confirm that the information I have given in this form on ethical issues is correct.

Signature  Date: 07/06/19


**Affirmation by Supervisor**

I can confirm that, to the best of my understanding, the information presented by the student is correct and appropriate to allow an informed judgement on whether further ethical approval is required. (Electronic signatures are acceptable).

Signature  Date: 07/06/19

**SECTION F: SUPERVISOR RECOMMENDATION ON THE PROJECT'S ETHICAL STATUS**

Having satisfied myself of the accuracy of the project's ethical statement, I believe that the appropriate action is:

Approve	
Approve subject to recommendations [please specify]	
Approve subject to conditions [please specify]	
The project proposal needs further assessment by a representative of the Business School Research Ethics Committee	
The project needs to be returned to the student for modification prior to further action (details of required modifications must be provided)	
Reject	

All documentation must be submitted according to the instructions in your Course / Module handbook.

**The completed form should be submitted to a Turnitin submission point on the Dissertation VLE site for future reference.**

## APPENDIX 2

### Interview questionnaire

- 1) How the integrated risk management approach contributes to disaster risk reduction?
- 2) How are climatic risks incorporated into strategic and operational decisions?
- 3) Is Climate Change a priority on risk management of the WYFRS?
- 4) What are the preventive or mitigation actions regarding climate change contained in the community integrated risk management?
- 5) What are the most likely incidents to occur due to climate change in West Yorkshire in the future?
- 6) What is the current level of business preparedness and performance for managing incidents related to climate change or extreme weather events?
- 7) Is your organisation prepared to respond future increased impacts of climate change incidents (reported by IPCC, NRR) such as extensive area floods, wildfires and widespread severe weather conditions?
- 8) Hypothetically speaking, if a massive, multiple locations and simultaneous climate-related disaster happened in the UK, for instance, a heavy snowfall affecting several regions of the country, making it impossible even to dispatch resources to serve all places and affected population; what would be the main issues regarding the FRS emergency planning?
- 9) What are the critical needs for implementing adaptive organisational actions to respond to climate-related incidents?
- 10) How the government's policies and regulations are influencing the improvement of preparedness, response and performance of FRS?
- 11) Does the government policy equate the necessary investments to the public sector for better preparedness and response to climate risks and incidents?
- 12) Is the current WYFRS risk management approach to climate-related incidents suitable for other fire and rescue services abroad?

### **Interview schedule and participants**

West Yorkshire Fire & Rescue Service: Service and Organisation levels

- 1) Fire Officer A - Area Manager / Senior Operations Support Officer - **25/06/2019**
- 2) Fire Officer B – Director of Service Delivery - **26/06/2019**
- 3) Fire Officer C - Group Manager / Strategic Development - **26/06/2019**
- 4) Fire Officer D - Director of Service Support - **01/07/2019**
- 5) Fire Officer E - Area Manager / Senior Operations Response Officer - **05/07/2019**

University of  
**HUDDERSFIELD**

Inspiring tomorrow's professionals

**Connecting risk management theory and practice on the frontline of climate change adaptation and disaster risk reduction: the experience of the West Yorkshire Fire and Rescue Services in the United Kingdom**

**INFORMATION SHEET**

You are being invited to take part in a study concerning your experience within your role in Risk Management, Preparedness and Response in the Fire and Rescue Services. Before you decide to take part, it is important that you understand why the research is being conducted and what it will involve. Please take time to read the following information carefully and discuss it with me if you wish. Please do not hesitate to ask if there is anything that is not clear or if you would like more information.

**What is the study about?**

The purpose of this study is to explore how climate-related hazards influence the strategies and institutional risk management of the WYFRS according to the UK government planning, as an instrumental case study for the improvement of emergency services management and its overall application on disaster risk reduction and climate change adaptation. This is your opportunity to tell me your story about working in this field.

**Why have I been approached?**

You have been asked to participate because you are currently or have previously been in this field of work. Your contribution will increase the knowledge and understanding of individuals' experience within their job role, which has practical applications in terms of developing appropriate management systems for similar organisations and other countries.

**Do I have to take part?**

It is your decision whether or not you take part. If you decide to take part, you will be asked to sign a consent form, and you will be free to withdraw up until 31<sup>st</sup> August 2019.

**What will I need to do?**

If you agree to take part in the research, you will be asked to consent to a research interview which will take approximately one hour of your time. This can be in a place that suits yourself, and the researcher is willing to travel. The chat will be recorded, only to allow transcription and analysis of the data. Additionally, during the interview, I will make notes so that I can come back to any topics if necessary. During the transcription process, all information that relates specifically to your identity will be removed to ensure you remain anonymous. During the interview, if you feel uncomfortable or somewhat overwhelmed, the interview can be stopped at your request or a break can be taken. After the transcription process, there will be an opportunity for you to see the transcription and make any alterations so that it is a true reflection of your opinions, as well as to ensure you are happy regarding the content and that your identity had been protected. This will be prior to analysis.

**Will my identity be disclosed?**

All information disclosed will be kept anonymous by the researcher.

**What will happen to the information?**

All information collected from you during this research will be kept secure. It is anticipated that the research may, at some point, be published in a journal or report. However, should this happen, your anonymity will be ensured.

**Handling of Personal Data (GDPR)**

- The University of Huddersfield is responsible for the secure management of any data collected, i.e. the 'data controller'.
- The legal basis for the collection of the data is usually 'a task in the public interest'.
- The researcher or research team (including transcribers) is the recipient of the data, i.e. 'the data processor'.
- The data subject should contact the University Solicitor (as the Data Protection Officer) if they wish to complain about the management of their data. If they are not satisfied, they may take their complaint to the Information Commissioner's Office (ICO).
- Interviews will be recorded using a password protected Dictaphone which will be kept in a lockable secure place. However, the interviews will then be transferred as quickly as possible onto the university's k-drive, and then the original will be destroyed. The data will be transcribed and analysed using a secure network and saved onto a secure password protected device. The original recording will be deleted after this process, and the transcribed data will be held for a maximum of 10 years before being destroyed. The data will remain in Europe.

**Who can I contact for further information?**

If you require any further information about the research, please contact me on:

[U1867900@unimail.hud.ac.uk](mailto:U1867900@unimail.hud.ac.uk); [sanjaybrasil@gmail.com](mailto:sanjaybrasil@gmail.com)

**Supervisor**

Dr Julia Meaton: [j.meaton@hud.ac.uk](mailto:j.meaton@hud.ac.uk)

*Version 1: dated 22:05:19*

**APPENDIX 4**



**CONSENT FORM**


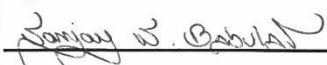
**Title of Research Project:**

Connecting risk management theory and practice on the frontline of climate change adaptation and disaster risk reduction: the experience of the West Yorkshire Fire and Rescue Services in the United Kingdom.

It is important that you read, understand and sign the consent form. Your contribution to this research is entirely voluntary, and you are not obliged in any way to participate. If you require any further details, please contact the researcher.

I have been fully informed of nature and aims of this study as outlined in the information sheet version 1, dated 22:05:19.	<input checked="" type="checkbox"/>
I consent to take part in this study.	<input checked="" type="checkbox"/>
I understand that I have the right to withdraw from the research up until 31 <sup>st</sup> August 2019 without giving any reason.	<input checked="" type="checkbox"/>
I give permission for my words to be quoted (by use of a pseudonym).	<input checked="" type="checkbox"/>
I understand that the information collected will be in kept secure conditions for a period of 10 years at the University of Huddersfield.	<input checked="" type="checkbox"/>
I understand that no person other than the researcher/s and facilitator/s will have access to the information provided.	<input checked="" type="checkbox"/>
I understand that my identity will be protected by the use of a pseudonym in the report and that no written information that could lead to my being identified will be included in any report.	<input checked="" type="checkbox"/>

If you are satisfied that you understand the information and are happy to take part in this project, please put a tick in the box aligned to each sentence and print and sign below.

Signature of Participant:  <hr/> Print: <u>Jim BUTTERY</u> <hr/> Date: <u>25-6-19</u> <hr/>	Signature of Researcher:  <hr/> Print: <u>SANJAY NARENDRAKUMAR BABULAL</u> <hr/> Date: <u>25/06/19</u> <hr/>
--	--

(one copy to be retained by Participant / one copy to be retained by Researcher)



**CONSENT FORM**

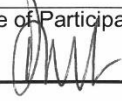
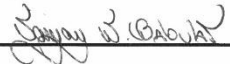
**Title of Research Project:**

Connecting risk management theory and practice on the frontline of climate change adaptation and disaster risk reduction: the experience of the West Yorkshire Fire and Rescue Services in the United Kingdom.

It is important that you read, understand and sign the consent form. Your contribution to this research is entirely voluntary, and you are not obliged in any way to participate. If you require any further details, please contact the researcher.

I have been fully informed of nature and aims of this study as outlined in the information sheet version 1, dated 22:05:19.	<input checked="" type="checkbox"/>
I consent to take part in this study.	<input checked="" type="checkbox"/>
I understand that I have the right to withdraw from the research up until 31 <sup>st</sup> August 2019 without giving any reason.	<input checked="" type="checkbox"/>
I give permission for my words to be quoted (by use of a pseudonym).	<input checked="" type="checkbox"/>
I understand that the information collected will be in kept secure conditions for a period of 10 years at the University of Huddersfield.	<input checked="" type="checkbox"/>
I understand that no person other than the researcher/s and facilitator/s will have access to the information provided.	<input checked="" type="checkbox"/>
I understand that my identity will be protected by the use of a pseudonym in the report and that no written information that could lead to my being identified will be included in any report.	<input checked="" type="checkbox"/>

If you are satisfied that you understand the information and are happy to take part in this project, please put a tick in the box aligned to each sentence and print and sign below.

<p>Signature of Participant:  _____</p> <p>Print: <u>DAVE WAIN</u></p> <p>Date: <u>26 JUNE 2019</u></p>	<p>Signature of Researcher:  _____</p> <p>Print: <u>SANJAY NARENDRAKUMAR BABUL</u></p> <p>Date: <u>26/06/2019</u></p>
--	--

(one copy to be retained by Participant / one copy to be retained by Researcher)

**CONSENT FORM**


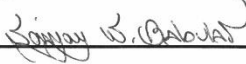
**Title of Research Project:**

Connecting risk management theory and practice on the frontline of climate change adaptation and disaster risk reduction: the experience of the West Yorkshire Fire and Rescue Services in the United Kingdom.

It is important that you read, understand and sign the consent form. Your contribution to this research is entirely voluntary, and you are not obliged in any way to participate. If you require any further details, please contact the researcher.

I have been fully informed of nature and aims of this study as outlined in the information sheet version 1, dated 22:05:19.	<input checked="" type="checkbox"/>
I consent to take part in this study.	<input checked="" type="checkbox"/>
I understand that I have the right to withdraw from the research up until 31 <sup>st</sup> August 2019 without giving any reason.	<input checked="" type="checkbox"/>
I give permission for my words to be quoted (by use of a pseudonym).	<input checked="" type="checkbox"/>
I understand that the information collected will be in kept secure conditions for a period of 10 years at the University of Huddersfield.	<input checked="" type="checkbox"/>
I understand that no person other than the researcher/s and facilitator/s will have access to the information provided.	<input checked="" type="checkbox"/>
I understand that my identity will be protected by the use of a pseudonym in the report and that no written information that could lead to my being identified will be included in any report.	<input checked="" type="checkbox"/>

If you are satisfied that you understand the information and are happy to take part in this project, please put a tick in the box aligned to each sentence and print and sign below.

<p>Signature of Participant:  _____</p> <p>Print: IAIN BOWEN _____</p> <p>Date: 26/6/19 _____</p>	<p>Signature of Researcher:  _____</p> <p>Print: SANJAY NARENDRAKUMAR BABULAL _____</p> <p>Date: 26/06/2019 _____</p>
--	---

(one copy to be retained by Participant / one copy to be retained by Researcher)

**CONSENT FORM**



**Title of Research Project:**

Connecting risk management theory and practice on the frontline of climate change adaptation and disaster risk reduction: the experience of the West Yorkshire Fire and Rescue Services in the United Kingdom.

It is important that you read, understand and sign the consent form. Your contribution to this research is entirely voluntary, and you are not obliged in any way to participate. If you require any further details, please contact the researcher.

I have been fully informed of nature and aims of this study as outlined in the information sheet version 1, dated 22:05:19.	<input checked="" type="checkbox"/>
I consent to take part in this study.	<input checked="" type="checkbox"/>
I understand that I have the right to withdraw from the research up until 31 <sup>st</sup> August 2019 without giving any reason.	<input checked="" type="checkbox"/>
I give permission for my words to be quoted (by use of a pseudonym).	<input checked="" type="checkbox"/>
I understand that the information collected will be in kept secure conditions for a period of 10 years at the University of Huddersfield.	<input checked="" type="checkbox"/>
I understand that no person other than the researcher/s and facilitator/s will have access to the information provided.	<input checked="" type="checkbox"/>
I understand that my identity will be protected by the use of a pseudonym in the report and that no written information that could lead to my being identified will be included in any report.	<input checked="" type="checkbox"/>

If you are satisfied that you understand the information and are happy to take part in this project, please put a tick in the box aligned to each sentence and print and sign below.

<p>Signature of Participant:  _____</p> <p>Print: <u>I.N. BITCOV</u> _____</p> <p>Date: <u>1-7-19</u> _____</p>	<p>Signature of Researcher:  _____</p> <p>Print: <u>SANJAY NARENDRAKUMAR BABULAL</u> _____</p> <p>Date: <u>01/07/2019</u> _____</p>
--	---

(one copy to be retained by Participant / one copy to be retained by Researcher)

**CONSENT FORM**

**Title of Research Project:**

Connecting risk management theory and practice on the frontline of climate change adaptation and disaster risk reduction: the experience of the West Yorkshire Fire and Rescue Services in the United Kingdom.

It is important that you read, understand and sign the consent form. Your contribution to this research is entirely voluntary, and you are not obliged in any way to participate. If you require any further details, please contact the researcher.

I have been fully informed of nature and aims of this study as outlined in the information sheet version 1, dated 22:05:19.	<input checked="" type="checkbox"/>
I consent to take part in this study.	<input checked="" type="checkbox"/>
I understand that I have the right to withdraw from the research up until 31 <sup>st</sup> August 2019 without giving any reason.	<input checked="" type="checkbox"/>
I give permission for my words to be quoted (by use of a pseudonym).	<input checked="" type="checkbox"/>
I understand that the information collected will be in kept secure conditions for a period of 10 years at the University of Huddersfield.	<input checked="" type="checkbox"/>
I understand that no person other than the researcher/s and facilitator/s will have access to the information provided.	<input checked="" type="checkbox"/>
I understand that my identity will be protected by the use of a pseudonym in the report and that no written information that could lead to my being identified will be included in any report.	<input checked="" type="checkbox"/>

If you are satisfied that you understand the information and are happy to take part in this project, please put a tick in the box aligned to each sentence and print and sign below.

<p>Signature of Participant: <u><i>N Smith</i></u></p> <p>Print: <u>N SMITH</u></p> <p>Date: <u>5/7/19</u></p>	<p>Signature of Researcher: <u><i>Sanjay W. Babul</i></u></p> <p>Print: <u>SANJAY NARENDRAKUMAR Babul</u></p> <p>Date: <u>05/07/2019</u></p>
--	--

(one copy to be retained by Participant / one copy to be retained by Researcher)