Examining business perceptions of flood risk in relation to the governance of flood mitigation on the Humber Estuary

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A thesis submitted to the University of Hull

For the degree of DOCTOR OF PHILOSOPHY

Department of Geography The University of Hull October 2012

<u>Abstract</u>

This thesis explores the reconciliation of economic development and flood risk mitigation on the Humber Estuary, England. As sea level-rise is increasing due to suspected anthropogenic climate change, the Environment Agency has taken a lead role in mitigating flood risk on the Humber estuary through the process of governance. However, in trying to balance sustainable economic development with flood risk mitigation, the Environment Agency has experienced considerable difficulty in engaging local and regional businesses within the governance process.

Analysis has found that although the overall importance of managing flood risk for businesses is reported to be greater in the present and the future than in the past, it remains more important for businesses which have previous experience of flooding than those which do not. Knowledge does not appear to transfer easily between different flood events, with concerns about recent pluvial flooding not percolating into risk perceptions concerning flooding from sea water. More alarmingly, businesses which have received flood risk information from the Environment Agency were found to have lower perceptions of the importance of flood risk management that those who had not, indicating a mismatch between scientific and lay knowledges. Without an understanding of how businesses perceive flood risk and how this affects participation within a governance process, the full engagement of the private sector within flood risk mitigation governance remains unlikely, therefore jeopardising sustainable economic development objectives on the Humber.

Key words: business risk perception, Environment Agency, flood risk mitigation, governance, knowledge transfer, risk communication, sustainable development.

ii

<u>Acknowledgements</u>

This research has been funded by the Economic and Social Research Council and the Environment Agency under ESRC CASE studentship number ES/ F032773/1. Firstly, I would like to thank my supervisors Sally Eden, Graham Haughton, David Gibbs, Andrew Barron and Susan Manson for their support, guidance and enthusiasm throughout the course of this research. Building upon the initial CASE studentship outline, Sally encouraged me to explore the role of risk perception within the governance of flood risk. Although this has been challenging, it has been particularly interesting and has helped to enhance the interdisciplinary nature of the research. For this and her considerable support within this research area I thank her.

I also thank my colleagues within the Department of Geography for their assistance and support throughout my studies, and in particular for those who helped to stuff envelopes during the research phase; Michelle Farrell, Joe Hall, Stephen Hall, Tim Horsfield, Karen Scott and Chris Skinner.

Beyond the department I am very grateful to all the business representatives that participated in the research, in terms of both the survey respondents and the interviewees. Without your participation this research would not have been possible. Special thanks go to my parents for their support throughout and to my sister for her understanding over my trip to the AAG to present this research, which subsequently caused me to miss her wedding when Eyjafjallajökull erupted. Finally, very special thanks are in order for David for providing the motivation and driving force to follow the thesis through to a successful conclusion, and to whom I would like to dedicate this thesis.

iii

Table of Contents

CHAPTER ONE

INTRODUCTION

1.1	Businesses and flood risk mitigation	1
1.2	Research questions	5
1.3	Thesis structure and content	7

CHAPTER TWO ECONOMIC DEVELOPMENT AND ENVIRONMENTAL GOVERNANCE

2.1	Introduction	10
2.2	The role of the state in the economy and scales of intervention	11
2.3	Sustainable development	19
2.4	Planning and environmental protection in the UK	25
2.5	The challenges for environmental governance and the Environment	
	Agency	33
2.6	Summary	38

CHAPTER THREE PERCEPTIONS, COMMUNICATIONS AND UNDERSTANDINGS OF RISK

Introduction	40
The rise of the 'risk society'	41
The role of experience in establishing perceptions of risk	48
Explicit knowledge, the role of science and trust	56
Vulnerability, resilience and recovery	65
Risk in a business specific context	72
Summary	81
	Introduction The rise of the 'risk society' The role of experience in establishing perceptions of risk Explicit knowledge, the role of science and trust Vulnerability, resilience and recovery Risk in a business specific context Summary

CHAPTER FOUR RESEARCH DESIGN AND METHODOLOGY

4.1	Introduction	84
4.2	Project study area	84
4.3	Mixed methods approach	105
4.4	Business selection for quantitative research	108
4.5	Quantitative research design	120
4.6	Qualitative research design	130
4.7	Ethical considerations and risk assessment	141
4.8	Weaknesses and limitations of research methods used	143
4.9	Data analysis techniques	145
4.10	Summary	149

CHAPTER FIVE

EXPLORING HOW BUSINESSES CURRENTLY PERCEIVE FLOOD RISK IN THE HUMBER REGION

5.1	Introduction	151
5.2	How do businesses perceive flood risk from different flood sources?	151
5.3	Does previous flood risk experience impact upon business flood risk	
	perceptions?	157
5.4	Do flood risk perceptions vary according to the distance of the business	
	from the estuary shoreline?	165
5.5	Do flood risk perceptions vary according to industrial sector?	173
5.6	Do flood risk perceptions vary according to business life?	185
5.7	Do flood risk perceptions vary according to business size?	198
5.8	Do flood risk perceptions vary according to local authority area?	203
5.9	Summary	209

CHAPTER SIX

FLOOD RISK AS A DYNAMIC ISSUE

6.1	Introduction	213
6.2	Has the importance of flood risk management as part of day to day business operations changed over time?	213
6.3	What is the importance of flood risk perceptions when choosing business premises?	229
6.4	How long do businesses estimate it would take them to recover from a flood event from a non-specific source?	249
6.5	Summary	261

CHAPTER SEVEN

BALANCING FLOOD RISK MITIGATION AND ECONOMIC DEVELOPMENT THROUGH GOVERNANCE

7.1	Introduction	266
7.2	What other business concerns does flood risk management have to contend with?	267
7.3	Where do businesses turn for flood risk information and do they trust the source(s)?	283
7.4	Businesses and the concept of governance	299
7.5	Summary	315

CHAPTER EIGHT

CONCLUSION

8.1	How do businesses construct and interpret their technical knowledge of	220
	tiood risk?	320
8.2	Has business flood risk knowledge changed over time with changes in	
	scientific understanding?	322
8.3	How do businesses juxtapose environmental and economic issues as part	
	of their daily business operations?	325
8.4	Has concern over flood risk mitigation and economic development	
	encouraged stakeholders to plan and execute their activities through	
	estuary-wide governance processes?	327
8.5	Theoretical Implications	330
8.6	Policy Recommendations	334
8.7	Further research and overall analysis	338
8.8	Concluding remarks	341

APPENDICES

Α	Questionnaire	343
В	Interview Guide	349
С	Interview Consent form	351
D	Research Ethical Evaluation	352
E	Research Risk Assessment	355

REFERENCES

List of Figures

Figure 3.1	The three kinds of science	46
Figure 4.1	Map of the Humber estuary region	85
Figure 4.2	Condition of flood defences in the Yorkshire and Humber region	91
Figure 4.3	Humber estuary flood risk management areas	94
Figure 4.4	Coastal squeeze process	97
Figure 4.5	Tides News distribution area	103
Figure 4.6	3km Humber estuary study frame and 500m interval zones	111
Figure 4.7	Distribution of total number of businesses within the 3km study zone as of April 2008	113
Figure 5.1	Question 11 from the business survey	153
Figure 6.1	Questions 17, 18 and 19 from the business survey	215
Figure 6.2	Questions 9 and 10 from the business survey	230
Figure 6.3	Question 15 from the business survey	250

List of Tables

Table 4.1	Location of existing and future planned managed realignment sites (as of 2012)	99
Table 4.2	Companies registered within 3km of Humber Estuary, classified by SIC (2003) code as of April 2008	112
Table 4.3	Sampling frame of companies within 3km of Humber estuary classified by SIC (2003) code as of August 2009	119
Table 4.4	Number of surveys returned as undeliverable by business industry	115
	code	128
Table 4.5	Survey response rate by business industry code	129
Table 4.6	Survey response rate by flood risk zone	129
Table 4.7	Respondents' self selection for interview by business industry code	132
Table 4.8	Respondents' self selection for interview by flood risk zone	133
Table 4.9	Respondents' self selection for interview by company size	133
Table 4.10	Cluster samples of interviewees from self selection process	136
Table 4.11	Details of the 20 semi-structured interviews conducted	140
Table 4.12	Statistical tests used for quantitative data analysis	147
Table 4.13	Qualitative data analysis coding framework	148
Table 5.1	Aggregate flood risk perceptions for all five flood types	153
Table 5.2	Mean risk attributed to different flood type in rank order	154
Table 5.3	Breakdown of business flood risk perceptions for the five different	
	flood types	155
Table 5.4	Risk perceptions of backflow within drainage systems by businesses'	
	experience of negative effects from previous flooding at their	1 - 7
Tabla E E	premises Bick percentions of sea water overtenning estuary defenses by	121
Table 5.5	his perceptions of sea water overtopping estuary defences by	
	their premises	158
Table 5.6	Mann-Whitney U tests for difference between flood risk perceptions	150
	and previous negative effects from flooding at business premises	159
Table 5.7	Year that businesses suffered previous negative effects from flooding	
	at their premises	161
Table 5.8	Mean risk attributed to different flood types in relation to distance of	
	business premises from estuary shoreline	165
Table 5.9	Risk perceptions of backflow within drainage systems by distance of	
	business premises from estuary shoreline	167
Table 5.10	Risk perceptions of sea water overtopping estuary defences by	
	distance of business premises from estuary shoreline	168
Table 5.11	Spearman's Rank tests for correlations between flood risk perceptions	
	and distance from estuary shoreline	169
Table 5.12	Mean risk perceptions attributed to different flood types in relation to	
	business category	174
Table 5.13	Risk perceptions of backflow within drainage systems by industrial	4
	category of business	175
lable 5.14	Risk perceptions of sea water overtopping estuary defences by	170
Table 5.45	Category of Dusiness	т\р
i adle 5.15	Kruskal-walls test for difference between flood risk perceptions and	177
	category of pushiess	т//

Table 5.16	Mann-Whitney U tests for difference between flood risk perceptions and category of business for sea water overtopping	178
Table 5.17	Mean risk perception levels attributed to different flood types in relation to business startup year	186
Table 5.18	Risk perceptions of backflow within drainage systems by company startup year	188
Table 5.19	Risk perceptions of sea water overtopping estuary defences by company startup year	189
Table 5.20	Kruskal-Walis test for difference between flood risk perceptions and company startup year	190
Table 5.21	Mean risk perception levels attributed to different flood types in relation to year respondent started at the company	191
Table 5.22	Risk perceptions of backflow within drainage systems by year respondent started at company	192
Table 5.23	Risk perceptions of sea water overtopping estuary defences by year respondent started at company	193
Table 5.24	Kruskal-Walis test for difference between flood risk perceptions and vear respondent started at company	193
Table 5.25	Mann-Whitney U tests for difference between flood risk perceptions and year respondent started at the company	194
Table 5.26	Mode startup date of businesses by industrial category	195
Table 5.27	Mean risk perception levels attributed to different flood types (classified by number of employees)	200
Table 5.28	Risk perceptions of backflow within drainage systems by business size	
	(classified by number of employees)	201
Table 5.29	Risk perceptions of sea water overtopping estuary defences by business size (classified by number of employees)	201
Table 5.30	Mean risk perception levels attributed to different flood types in	204
Table 5.31	relation to respondent local authority area	204
	local authority area	205
Table 5.32	Risk perceptions of sea water overtopping estuary defences by	
	respondent local authority area	206
lable 5.33	ruskal-Walls test for difference between flood risk perceptions and respondent local authority area	207
Table 6.1	Mean and mode values for importance of managing flood risk as part	
	of the day to day operations at company premises	215
Table 6.2	Mean importance values of managing flood risk as part of the day to	
	previous flooding	216
Table 6.3	Importance of managing flood risk as part of day to day operations at	
	company premises ten years ago by businesses' experience of	
	previous flooding	217
Table 6.4	Importance of managing flood risk as part of day to day operations at company premises at the current day (2009) by businesses'	
	experience of previous flooding	218
Table 6.5	Importance of managing flood risk as part of day to day operations at	0
	company premises over the next five years by businesses' experience of previous flooding	219

Table 6.6	Mann-Whitney U tests for difference between importance of managing flood risk and previous flooding at business premises	220
Table 6.7	Importance of managing flood risk as part of day to day operations at company premises ten years ago by industrial category	222
Table 6.8	Importance of managing flood risk as part of day to day operations at company premises at the current day (2009) by industrial category	223
Table 6.9	part of the day to day operations for the remaining six variables	224
	flood risk management and industrial category of company	225
	flood risk management and year respondent started at the company	226
	company premises	231
Table 6.13	premises by previous experience of flooding	231
Table 6.14	by previous experience of flooding	232
Table 6.15	Importance of flood risk if choosing company premises today by previous experience of flooding	233
Table 6.16	Importance of flood risk when originally choosing company premises by respondent start date	236
Table 6.17	Importance of flood risk if choosing company premises today by respondent start date	237
Table 6.18	Importance of flood risk when originally choosing company premises by local authority	238
Table 6.19	Importance of flood risk if choosing company premises today by local authority	239
Table 6.20	Tests for difference between importance of flood risk as a factor in choosing company premises for the remaining six variables	239
Table 6.21	Mann-Whitney U tests for difference between importance of flood risk as a factor in choosing company premises today	241
Table 6.22	Mean importance values of flood risk when choosing company premises by flood risk information received	242
Table 6.23	Importance of flood risk when originally choosing company premises by receipt of flood risk information from Environment Agency	242
Table 6.24	Importance of flood risk if choosing company premises today by receipt of flood risk information from Environment Agency	243
Table 6.25	Aggregate estimates of flood recovery time for all businesses	251
Table 6.26	Estimates of business flood recovery time by previous experience of flooding	252
Table 6.27 Table 6.28	Mean estimates of business flood recovery time by industrial category Mean estimates of business flood recovery time by business size	253
	(classified by turnover)	256

Chapter One - Introduction

1.1 Businesses and flood risk mitigation

The issue of climate change first started to make inroads into the global political arena through the establishment of the Intergovernmental Panel on Climate Change (IPCC) by the United Nations and the World Meteorological Office in 1988. The IPCC assesses the most recent scientific, technical and socio-economic information relevant to the understanding of climate change, which in turn is available to the 194 state government members in establishing their environmental policy (IPCC, 2011). Despite the continuing (albeit now small-scale) academic debate surrounding the causes of climate change (Royer *et al.*, 2004; Singer, 2004; Svensmark and Friis-Christensen, 2007), the IPCC asserts that this global issue is anthropogenic in origin, emanating from the emission of greenhouse gasses from processes of industrialisation (Solomon *et al.*, 2007).

One of the expected consequences of climate change (anthropogenic or otherwise) is an increase in the frequency of extreme weather events, as a warmer earth surface leads to increased evaporation and a higher intensity of water cycling (Becker and Grünewald, 2003:1099). This will not only increase the intensity and frequency of rainfall, raising the risk of pluvial and fluvial flooding, but will also increase the likelihood of coastal flooding. Mean sea level rise caused by "thermal expansion, the melting of glaciers and changes within the mass balance of the Greenland and Antarctic ice sheets" (Arnell *et al.*, 2002:422) in conjunction with more intense meteorological conditions is expected to result in more frequent and severe tidal storm surges, with potentially devastating consequences for coastal communities (Lowe and Gregory, 2005). As an island nation, these findings have potentially serious repercussions for the United Kingdom.

With statutory responsibility for all public flood defences, coupled with a greater input into planning development decisions under new policy statements such as Planning Policy Statement 25 (Communities and Local Government, 2006b), the Environment Agency can be viewed as a more robust institution with greater potential to deal with the problems posed by climate change within England (Evans and Jones, 2008). Within England, ministerial delegation of responsibility led to the Environment Agency taking over much of DEFRA's (Department of Environment Food and Rural Affairs) coastal protection functions on April 1st 2008 (DEFRA, 2007). This action went some way to addressing previous criticism levied at public agencies by academics (Kidd and Kumar, 1993; Parker, 1995; Ledoux *et al.* 2005; Lindley *et al.*, 2007) in terms of a lack of coordination between multiple agencies dealing with issues related to environmental regulation and sustainable development.

However, the challenges faced by the Environment Agency in mitigating the effects of climate change do not occur in isolation from the social and economic spheres of society. Jonas *et al.* (2002:2) highlight that the need to integrate economic development and the environment is often a "key conflict within local policy making", whereby programmes aiming to reduce the likelihood of flooding from climate change may adversely impact economic prosperity. This is particularly pertinent in the Humber region of the United Kingdom, where the Environment Agency's plans for flood risk mitigation around the estuary shoreline sit uneasily with other local stakeholders' aspirations for future economic development within the flood risk zone (Gibbs *et al.*, 2001; Gibbs and While, 2007; BBC News, 13.08.2008). In an attempt to reconcile these differences in stakeholder objectives, a process has been pursued which aims to encourage the private sector and civil society to work in collaboration with the public sector (represented by the Environment Agency) to coordinate and organise policy delivery (Bulkeley, 2005; Environment Agency, 2009b). As opposed to the flood defence works of the 1950s, this approach enables responsibility to be

re-allocated and spread over the governance triad (public, private and voluntary sectors) as opposed to being tied to the public sector alone. The Environment Agency see this as a wider change in approach from the management of *flood defences* to the management of *flood risk* (Environment Agency, 2005a).

Theoretically, governance comprises closer collaboration and accountability between groups at local and regional scales, which is often difficult to achieve through top-down central government planning (Doak and Karadimitriou, 2007). This is especially important in such instances, as in order to comply with EU wildlife legislation, it will not be possible to provide comprehensive flood risk protection to all areas of the estuary. Instead, a combination of hard-engineered defences and soft defences (Myatt *et* al., 2003a and 2003b; Environment Agency, 2008b) will need to be implemented, coupled with the total withdrawal of existing flood defences in other areas. However, the Environment Agency's Humber Strategies Team have remarked that "businesses have so far exhibited a reluctance to become involved"¹ within the flood risk mitigation process.

The effective participation of all the actors involved within the governance process is crucial in communicating the different understandings of flood risk in order to produce acceptable mitigation policies. In this sense, if those representing the private sector are not involved or cannot communicate their needs effectively, the governance process will fail to acceptably balance the social, political and economic risks involved within flood risk mitigation (Raco, 2000; Docherty *et al.*, 2001; Brand, 2007). As such, plans which are inappropriate to the

¹ This was a quote from a scoping meeting with the CASE project partner (Environment Agency Humber Strategies Team) in October 2007. The lack of business participation in flood risk governance was a key issue which they wished the project to address.

needs of local and regional businesses may be put in place, impacting upon the current and future economic development of the Humber region.

The reluctance of businesses to participate within the governance process may well be due to their underestimation of the severity of coastal flood risk around the Humber estuary, especially considering that any experience of coastal flooding has effectively been removed over the last 58 years by the existing coastal defences (Freudenberg, 2001; French, 2004). However, despite the absence of coastal flooding, the Humber region experienced widespread pluvial flooding recently in June 2007 which may have re-awakened an appreciation of flood risk. The city of Hull was worst affected, experiencing unprecedented levels of rainfall that overwhelmed the drainage system and caused damage to 7208 residential properties and over 1300 businesses (Coulthard *et al.* 2007a).

Understanding how different elements of society perceive flood risk is essential to the Environment Agency's work on flood risk mitigation schemes. Although businesses deal with risks in their everyday operations, little is known about the way in which they construct perceptions of environmental risk towards hazards such as flooding. Much of the academic literature concerning the construction of risk perceptions has been carried out from a public perspective (Irwin, 1995; O'Riordan, 1997; Simmons and Walker, 1999; Loewenstein *et al.*, 2001; Parkhill *et al.*, 2010). However, there is evidence to suggest that the way in which risk is perceived by business people differs to that of a typical member of public (Sarasvathy *et al.*, 1998; Ashcroft *et al.*, 2009). My thesis therefore aims to bridge the gap in academic literature by exploring the way in which businesses construct flood risk perceptions in order to examine whether this may impact their participation within flood risk mitigation. The research involved in examining this issue is framed by the research questions in the next section.

1.2 Research questions

The research questions have served to generate empirical data to address the lack of academic literature on the role of business perceptions and understanding of flood risk, and the role these play in facilitating private sector participation within the governance of flood mitigation. There are four research questions which I ask:

1) How do businesses construct and interpret their technical knowledge of flood risk?

The fundamental objective of my thesis is to find out how businesses construct and interpret flood risk knowledge. Sarasvathy *et al.* (1998) and Ashcroft *et al.* (2009) both indicate that business people are more likely to be risk averse than members of the general public. Therefore, using existing academic literature (Irwin, 1995; Harvatt *et al.*, 2011) concerning public perceptions of risk is unlikely to fully help in ascertaining why businesses are not involving themselves on flood risk mitigation on the Humber estuary. Exploring environmental risks from a business perspective will also provide new academic material on a subject which has so far received very limited attention.

2) Has business flood risk knowledge changed over time with changes in scientific understanding?

A temporal perspective to business flood risk knowledge helps me to examine how changes in scientific understanding are interpreted by businesses. With changes having happened to the way in which flood defences are being managed (Steers, 1953; French, 2004), it is important to find out whether businesses are aware this and its potential impact upon the flood risk mitigation governance process. Whilst literature exists on the way in which the public interpret the changing nature of scientific understanding, and the consequences it entails (Lange and Garrelts, 2007; Harvatt *et al.*, 2011), there is currently a lack of research addressing this issue from a business perspective.

3) How do businesses juxtapose environmental and economic issues as part of their daily business operations?

The pursuit of sustainable development objectives are high on the agenda of the Yorkshire Forward Regional Development Agency (Yorkshire Forward, 2006) and its Humber Local Economic Partnership successor (Bentley *et al.*, 2010). However, existing research suggests that businesses have varying approaches to reconciling environmental and economic issues (Tilley, 1999; Petts *et al.*, 2009, Zhang *et al.*, 2009). The findings from the first two research questions are used here to examine the way in which environmental and economic issues are juxtaposed by the firms, and the extent to which they influence business operations. An understanding of this issue helps to provide information with which to analyse the current low participation rate in flood risk governance amongst private businesses.

4) Has concern over flood risk mitigation and economic development encouraged business stakeholders to plan and execute their activities through estuary-wide governance processes?

This research question builds upon the findings from the previous three research questions by ascertaining the roles played by the various organisations involved in the governance of the Humber Estuary, the scale at which they operate, and also the sectors which they represent. Any conflicting aims of these organisations are identified, allowing me to examine of the effectiveness of "joined-up governance" (Haughton and Counsell, 2003; Jones *et al.*, 2004) and its ability to interpret risk across the networks in place within the Humber estuary.

The methodology used to answer the four research questions is strongly influenced by Sayer (2000:23) who advocates that "explanation requires mainly interpretive research to discover actors' reasoning and circumstances in specific contexts". This has been suitably addressed by my use of a mixed methodology where extensive research has helped to focus the subsequent intensive research at multiple points within the network of flood risk mitigation on the Humber. A questionnaire was used to gather large quantities of quantitative data to establish a picture of business flood risk attitudes, whilst a smaller number of interviews were used in order to probe into the reasons behind these attitudes, providing a greater depth and additional context to the findings.

1.3 Thesis structure and content

Chapter Two provides a general overview of the literature on economic development and environmental governance in relation to England in order to set the scene within which business flood risk perceptions are formulated. The discussion firstly outlines the changes in the role and scale of state intervention within England as part of the UK economy. This is followed by a brief overview of the challenges in reconciling economic and environmental objectives under the banner of sustainable development. The role of the planning system as a tool for facilitating sustainable development is examined in terms of its use of governance as a vehicle to enable communication between the public, private and voluntary sectors in terms of balancing economic development with flood risk management.

Chapter Three consists of a detailed review of the literature covering the perceptions, understandings and communication of risk. The chapter details the rise of the risk society, focussing upon the work of Ulrich Beck (1992) in conceptualising how risk is related to the process of modernity. The way in which such risks are perceived by the public in terms of knowledge gained from prior exposure to hazardous events is explored, in addition to the role of explicit information, which can be used to bridge knowledge gaps where previous experience is not available. The related concepts of vulnerability and resilience are also examined in relation to the consequences and of being flooded and the recovery process that ensues. The chapter concludes by examining the somewhat limited literature on how businesses deal with risks in their everyday operations.

Chapter Four provides a complete overview of the research design used to gather the empirical data for the project, including the rationale behind the selection of the study area. The reasoning behind the choice of a mixed methods approach is explained and the sampling methods chosen for the data collection are discussed and justified. Two of the larger sections of the chapter focus upon the respective quantitative and qualitative phases of the research and the way in which they were carried out. The chapter concludes with an overview of the risk and ethical considerations arising from the research design and an analysis of the weaknesses and limitations of the research methods used.

Chapter Five is the first of three empirical chapters, and addresses the first research question concerning how businesses construct and interpret their technical knowledge of flood risk. The chapter starts by investigating whether businesses perceive risk to differ with the specific type of flooding that may affect their business. A series of variables are then tested to examine whether flood risk perceptions vary according to different business characteristics, helping to build up a good picture of how businesses construct their flood risk knowledge and any variations found within different business categories.

Chapter Six is the second empirical chapter and addresses my second research question that asks how business flood risk knowledge has changed over time with changes in scientific understanding. It also addresses part of my third research question concerning how businesses juxtapose environmental risks with their daily operations. The chapter starts by exploring the importance of managing flood risk within the context of daily business operations over time, before moving on to an examination of the role business flood risk perceptions play in choosing company premises, and whether this has changed over time. The final section of the chapter adopts a slightly different context, looking at how long businesses estimate it would take them to recover from a flood event.

Chapter Seven is the final empirical chapter and develops a deeper understanding of the business flood risk perceptions through the examination of the qualitative interview data. It also provides an answer to my third research question concerning the juxtaposition of environmental and economic risks, whilst answering my fourth research question that asks whether concern over flood risk mitigation and economic development has encouraged stakeholders to plan and execute their activities through estuary-wide governance processes. The chapter starts by looking at the range of issues that businesses deal with on a day to day basis, and where flood risk mitigation fits in with these. The chapter moves on to explore where businesses obtain their flood risk information from, and the levels of confidence that they place within both the information they receive and the organisations that provide it. The chapter concludes with an analysis of the potential for a successful flood risk mitigation governance model based upon the networks available to sustain communication between the different key agencies that are involved.

Chapter Eight is the final chapter of the thesis and offers a conclusion to each of the research questions, as well as policy recommendations, avenues for further research and an overall summary.

<u>Chapter Two</u> Economic Development and Environmental Governance

2.1 Introduction

This chapter will review the literature surrounding economic development and environmental governance to set the context of my investigation. Although my thesis does not directly address governance, it is important to look at this concept in order to determine how business participation is sought by the Environment Agency. In terms of the role of the public, private and voluntary sectors within the governance triad, I make a close examination of what Rhodes (1996:652-653) refers to as "a changed condition of ordered rule, or the new method by which society is governed" regarding flood risk mitigation following the rolling back of the nation state. Establishing the shifts in responsibility and the roles of the different sectors within the governance triad throughout this Chapter will lay the foundations for work examining perceptions of flood risk later on in the thesis.

Section 2.2 first provides an historical overview of the changing scales and role of the state within the context of the rise of neoliberalism. Having established the framework for policy-making that is currently in place in England, Section 2.3 examines the role of sustainable development in reconciling economic development and environmental governance. The limitations of sustainable development, and the related theory of ecological modernisation, are explored in relation to the issues posed by climate change and flooding. In Section 2.4, I explore the role of the planning system as a vehicle for flood risk mitigation as a component of environmental protection. The way in which economic and environmental policy is integrated within the governance process is examined with reference to the specific functions of the Environment Agency as the coordinating government body. Section 2.5 takes a closer look at the institutions involved within the governance of flood risk, in terms of the way in which they interact and share their knowledge, in addition to the challenges

this poses for environmental governance and the Environment Agency. Section 2.6 provides a short summary of the key findings throughout the chapter, and how they fit in with the interdisciplinary research related to risk.

2.2 The role of the state in the economy and scales of intervention

Jessop (1997:504) states that "left pretty much to its own devices, the market cannot guarantee economic or social development", which is ultimately a key factor upon which government success is judged by the public. Government intervention within the economy is nothing new, with Schwarz (1985:80) highlighting the 1915 McKenna duties as "the first break with *laissez*-faire economic policy in the UK". This action was seen to be the first experimental approach using different forms of scalar government intervention in the economy in a bid to protect strategically important manufacturing from more competitive foreign efforts. Since then, government intervention has continued to take place in the economy on local, regional, national and supra-national scales in a bid to "remove market failures and prevent barriers to growth" (Williams, 2010b:619).

Up until the end of the 1970s, Cochrane (2011:97) observes that economic development policy was focussed upon addressing "distressed or otherwise economically disadvantaged regions". At this time, solutions focussed on the state attempting to attract new industries to areas in decline, and even encouraging business relocation from more prosperous to less prosperous areas. However the last thirty years has seen a substantial move away from these 'One State' redistributive economic policies, towards economic development based upon principles of competition and self-help. Régulation theory can help to explain these changes through the examination of 'sets of social norms', built upon the two building blocks of a "Regime of Accumulation" (ROA) and a "Mode of Régulation" (MOR) (MacLeod, 1997:532). Whereas the ROA refers to an extended period of relatively stable growth within the economy, the MOR comprises the internalized rules and social processes related to the integration of political and social relations. Capitalist expansion occurs when the ROA and MOR complement each other, however, due to what Jessop (1997:505) terms the "discontinuous nature of capitalism", crises arise from ruptures within the reproduction of the system caused by the failure of its management. Régulation theory draws upon research from the social sciences to offer explanations as to why these production paradigms suffer from mismanagement of crises which are beyond the context of orthodox economics and the notion of *homo economicus* (Boyer and Durand, 1997; Boyer and Saillard, 2003), which is also especially useful in terms of examining risk perceptions.

In relation to the concepts of Fordism and Post-Fordism, the wider influence of politics and society can be seen to have created a misalignment between the ROA and the MOR. The Fordist economies of the 1970s benefited from a "spatio-temporal matrix based upon the congruence between the national economy, national states, national citizenship and the national society" (Jessop, 2000:338). This was characterised by an ROA of mass production and monopolistic competition, and a complementary MOR consisting of demand management by the state and mass consumption driven by the welfare state (Jones and Ward, 2002). However, the growing international component of trade and investment contributed to the weakening of Keynesian economic demand on a national level, producing a structural crisis within the economy whereby the mode of social regulation was no longer suited to the accumulation system. These changes led to the abandonment of national redistributive policies, which Goodwin and Painter (1996:645) view as having created new spaces of regulation under Fordism's successor.

Post-Fordism saw the replacement of mass production and the welfare state by what Jones, Jones and Woods (2004:63) term as "niche, small batch production, economies of scope, supply side state intervention and selective consumption through welfare privatisation". This was characterised by a rapidly changing space economy through the development of "local and regional partnerships and networks" (Peck and Tickell, 1992:13) and the 'rolling back' of the nation state (Jessop, 1995). Indeed new structures of local governance are not exclusively related to the dissolution of Fordism, but are also "a causal factor in the dissolution of the possibility of pursuing Fordist strategies" (Goodwin and Painter, 1996:645). These new socio-economic approaches started what Toye (1987) calls a "neoliberal counterrevolution" attributed to what Jones (2010a:357) describes as the UK Thatcher government's (elected in 1979) "self conscious and radical break with what it regarded as the social democratic assumptions of the past".

Barnett (2010:270) succinctly summarises this new neoliberal policy as "an ideational project and political programme that seeks to supplant collective, public values with individualistic, private values of market rationality as the guiding principle of state policy, economic governance and everyday life". In order to accommodate these values, substantial changes occurred within the organisational structure of local government leading to the emergence of what Jones, Jones and Wood (2004:70) describe as "a wide variety of service providers and the multiplicity of agencies of [what has become] local governance", working in a devolved, performance driven flat hierarchy. This shift towards both centrally and locally based governance (comprising non-elected organisations of the state, voluntary agencies and the private sector) has resulted in academic interest in the relations between these various actors (Painter and Goodwin, 1996:636).

In a bid to increase efficiency and to ultimately stimulate the economy in a sustainable manner, some of the responsibility and cost of economic development was reallocated from government and spread across the additional private and voluntary sectors. Although

this was intended to prevent the public sector from 'crowding out the market', it is important to emphasise that despite the state's reduced role in such a system, it still plays a crucial role as part of the governance triad. For Rhodes, (1996:15) governance refers to "self-organising, interorganisational networks characterised by interdependence, resource exchange, rules of the game and significant autonomy from the state". By comparison Bentley et al. (2010:536) argue that despite a move towards governance, centralism has remained manifest under past administrations in the UK, with both the Thatcher and Major Conservative governments "usurping the local government role" in economic development through "curb[ing] the power of local authorities and limit[ing] their power to control their own finances" (Williams, 2010a:391). However, Jessop (2011:245) notes that over the last thirty years, "governance has shifted from top-down command toward networked governance in response to market and state failure". Musson and Tickell (2005:1396) hold neoliberal economic policy responsible for the collapse of the peripheral economies of the UK during the 1980s, as the political economy structurally favoured the South East of the country. In order to address these problems, the scale of governance needed to be tackled. Additional pressure from the European Union also required a meso-scale in the form of the region in order to fit in with its Structural Funding programme (McCarthy, 2000; Gibbs et al., 2001; Burch et al., 2005). In 1994 the Major administration created Government Offices (GOs) tasked with the coordination of regional spending on areas including trade, environment and industry for each of the standard UK economic regions. However, Musson and Tickell (2005:1398) observe that the GOs maintained a low public profile and did not represent a new scale of regional governance, instead remaining exclusively accountable to central government.

This foray into regional governance remained limited until 1999 when Tony Blair's New Labour government set up Regional Development Agencies (RDAs) and Regional Assemblies

(RAs) throughout England. The existing GOs were tasked with the responsibility of coordinating and monitoring the new RDAs and RAs, which consisted of business, voluntary and other social and economic partners. Intended as strategic drivers of economic growth, Pugalis (2010:398) lists the statutory purposes of each of the nine English RDAs as:

- 1) To further economic development and regeneration
- 2) To promote business efficiency
- 3) To promote employment
- 4) To enhance the development and application of skills relevant to employment
- 5) To contribute to sustainable development

In contrast to the specific objectives for RDAs, the Regional Assemblies had no formal powers. Although defunct since March 2009 (with the GOs being abolished in March 2011 and the RDAs following suit a year later in March 2012), RAs provided an opportunity for actors such as the local authorities, regional business groups, environmental groups and the voluntary and community sectors to voice their views in issues relating to regional governance. Despite this lack of specific power (Sandford, 2002), the RAs aligned themselves with what Goodwin *et al.* (2002:200) describe as the "new regional consensus".

New regional consensus ideology emphasises the importance of non-state and noneconomic agents in the process of economic development, such as sub-national social bodies in the voluntary sectors. This is also reflected in Cooke and Morgan's (1998) concept of associated economies which stresses that economic success is facilitated by networking and interaction and not state intervention. Such a system of coordinated governance between different economic actors relevant to the local networks within the region provides a much enhanced and multi-scalar framework for the practical, though complex, implementation of economic policy. Harmes (2006:725) sees such multi scalar governance as "...the growing diffusion of power away from national governments, both upwards to the regional level of the European Union, and downwards to the subnational level of provincial states and governments". As such, a vertical hierarchy of policy implementation can be envisaged requiring communication between the different levels in the structure. Communication can take place both ways with the network allowing grassroots projects initiated at the community level to communicate up through the chain to the supranational level. Equally, top down policies, formulated by such supranational bodies as the EU, can trickle down through the hierarchy to take effect on sub-national scales.

However, Corry and Stoker (2002) view the legacy of RDAs as a form of "New Centralism" that enables the national government to steer at arms length to ensure policy coherence at a regional level. Bentley *et al.* (2010:537) observe that although such new centralism "signifies a good attempt at governance"; the policy is essentially controlled by central government priorities whilst simultaneously allowing regional and local priorities to be addressed. Although arguably less centralised in its nature than economic policy under the Thatcher and Major governments, Shaw and Greenhaigh (2010:458) still see the plethora of recent sub-national initiatives as "symptomatic of New Labour's chaotic top-down approach to decentralisation".

In any case, the new regional meso-level within the UK has had to establish new networks through what Jones and MacLeod (2011:260) term as a "rescaling of the state and a territorial reworking of the geographies of government and governance". Cochrane (2010) explains that since 1999, RDAs successfully developed regional and sub-regional partnerships whilst working towards a regional economic spatial strategy. In some cases, this has included economic projects stretching across multiple regions. An example of this is the Northern Way strategy, which united the One North East, the North West and the Yorkshire Forward RDAs in an ill-faited quest to develop the economic potential of the north to close the economic divide with the south of the UK. However, despite what Haughton

and Counsell (2004:139) see as the government's "considerable faith in the private led RDAs", they were not given control of regional planning. Instead, this function remained with local government. A degree of central control can therefore still be seen, with the government being "both strategic and selective in the reworking of its powers within planning and in the newly empowered regional tier of governance" (Haughton and Counsell, 2004:139).

At the time this research project was drawn up, the revisions to the management of economic development across England had not yet been announced by the new Liberal Democrat-Conservative coalition government. However by the end of March 2012, all nine RDAs were abolished and replaced by new Local Economic Partnerships (LEPs). Bentley et al. (2010:535) explain that this change in governance structure has resulted in the strategic roles for business support and enterprise, investment in local economic infrastructure, skills, employment and planning being transferred to "joint local authority-business bodies" organised by the local authorities themselves. Although in this instance the body representing the state within economic governance has changed in scale from the regional level to the local level, the multi-sectoral and multi-scalar natures of economic governance are retained as under the previous apparatus of the RDAs. Bentley et al. (2010:539) state that although the local authority (or *authorities* in some LEPs) ultimately remains responsible for overseeing economic development within the geographical boundary of the LEP, "half of LEP board members are to be drawn from private local industry and commerce" in addition to a presence from college and university stakeholders and the voluntary sector. As such, the objective of economic governance in terms of garnering the viewpoints from different sectors of society represented on the board to reach a compromise remains unaltered.

However, the (so far limited) academic literature examining the shift from RDAs to LEPs unveils some strong opinions as to the potential for LEPs in the coordination of economic development in an effective manner. Walburn (2011:78) sees this change as an opportunity for a new version of localism, whereby local authorities are able "to respond more effectively to local needs than agencies pursuing national objectives" through more intimate links with local knowledge networks. This advantage is seen by Jones (2010:373b) as having the potential to manifest greater business engagement under the new LEPs, citing Michael Porter's findings (from his 2002 enquiry into the competitiveness of the UK economy) that "business leaders are less willing to engage [themselves] locally if important decisions affecting the quality of the business environment are only made centrally".

In sharp contrast however, Pugalis *et al.* (2012:3) warn that LEPs "appear to be considerably lacking in both resources and momentum", as well as lacking a statutory role when compared to their RDA predecessors. This may well have a negative impact in terms of yielding 'power' with which to drive forward and realise new economic development initiatives. Early research has indicated that many LEP boards only have a "token understanding of localism" and the role which the voluntary sector can play within economic development Pugalis *et al.* (2012:7). As such, social enterprises may attempt to bypass the LEPs and deal direct with the local authority, bypassing the governance process represented by the LEP multi-sector board. However, the very role of the local authority in terms of its local scale is called into question by Bentley *et al.* (2010:536) who assert that a supposed new localism is merely a disguise for the "national level reasserting its control over the local level by circumscribing the power of the local level" in a similar fashion that that already discussed in terms of the RDA. Although LEPs are responsible for submitting bids for economic development projects to the central government who approve the allocation of funding, Walburn (2011:78-79) identifies a critical difference between LEPs and

their predecessor RDAs in that the local authority element of the LEP is "a relatively permanent feature of the political landscape compared to economic development organisations" which should enable them to maintain some consistency of engagement. These are interesting points to bear in mind when considering the future of economic development, particularly in so far as providing a context for the results of this project.

Although LEPs are in their early days, the way in which the governance process juxtaposes this new economic policy apparatus will play an important part in Chapters Seven and Eight where my findings will be discussed in terms of implications for both current and future economic development.

In terms of both regional and local approaches to governance, Castree (2008a:143) views the neoliberal legacy maintained within government policy since the 1980s as a "simultaneous social, environmental and global project involving a renegotiation of the boundaries between the market, the state and civil society". This has had considerable success in blurring the boundaries of regional governance since the decline of Fordism. Having outlined the broad shifts in economic governance within this section, I move on to explore how environmental issues have been incorporated within such structures through the concept of sustainable development.

2.3 Sustainable development

Green political thought can trace its roots back to the 1960s, where the publication of Rachel Carson's *Silent Spring* in 1962 "alerted a readership to a new set of environmental problems" (Humphrey, 2001:1) caused by the widespread use of pesticides. The subsequent rise of the environmental movement saw the integration of environmental concerns into a whole range of policy making as early as the 1970s. More notable environmental crises which have generated policy responses over the last 40 years include concerns emanating from acid rain during the early 1980s; the discovery of a hole in the ozone layer in 1985 (attributed to the use of CFC gasses) and the continued issue of global warming, or *climate change* as it is now referred to. Such events led to the rescaling of environmental governance, often through international action in the case of CFCs (Montreal Protocol 1987) and climate change (Rio Earth Summit, 1992 and Kyoto Treaty, 1997), which presented a *challenge* to making economic and environmental management compatible. The percolation of environmental policy into the economic arena has had wide reaching implications, often forcing industry to adapt their established business practices. Such examples include the installation of scrubbers to industrial chimneys to capture the nitrous oxide that causes acid rain, and the use of alternatives to CFC chemicals in manufacturing processes. Lehtonen (2007:16) terms this action as Environmental Policy Integration (EPI), and notes that it has acted as a "centrepiece for Sustainable Development (SD)". This is particularly important within the European Union where EPI has legal status as a primary objective under Article 6 of the 1997 Amsterdam Treaty.

Since the late 1980s, many environmental issues have been brought together for policy action under the banner of sustainable development. However, SD is especially difficult to define, with Gunder (2006:211) viewing sustainability as being used in a manner that Markusen (2003:702) deems a "fuzzy concept". Originally defined by the Brundtland Commission as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987), the concept of SD has been used in such a range of situations that Prugh *et al.* (2000:xiii) liken it to "a mule that can be hitched to [so] many wagons", that sometimes the mule is abused. In terms of the discussion within this section, I shall use Gibbs and Jonas's (2001:269) explanation of SD whereby "human activities take

place within the ecological limits of the planet... requiring the integration of environmental, economic and social decision making".

However, the framework providing the context for this environmental, economic and social decision making in the UK has undergone considerable change since the 1980s as explained in Section 2.2. The recent move towards English multi-level regional (and now local) governance, involving an increased number of participating actors and organisations, can be seen to be problematic in pursuing SD due to increased fragmentation within policy networks (Gibbs and Jonas, 2001; Counsell and Haughton, 2003). Despite the best efforts of the European Union's use of EPI to align modes of economic governance with sustainable development, Williams (2004:98) highlights that "a logical result of the functional separation of government, at any level, is that individual departments develop competencies in dealing with a specific set of policy issues, but do not have the remit to develop competencies in dealing with issues in another policy area" (emphasis in original). This is particularly evident in the rescaling and re-regulating of environmental issues and policies in England. Gibbs and Jonas (2001:274) observe that certain subnational environmental responsibilities have "effectively been delegated upwards to the European level through... European Directives", whilst the responsibility for implementing and policing such policy has been passed downwards to local government and state-owned agencies, such as the Environment Agency. Meanwhile, the nine RDAs were charged with overseeing economic development at the meso-level, although subject to steering by the government at a national level (Bentley et al., 2010; Shaw and Greenhaigh, 2010).

Despite these scalar differences between the economic and environmental policy apparatus, each of the RDAs was responsible for producing both Regional Planning Guidance and a Regional Economic Strategy that were meant to complement each other. Indeed one of the five statutory purposes of the English RDAs, listed within Section 2.2, was that of contributing to sustainable development. However, with different governance regimes in place for both regional planning and economic development, a series of "localregional-national tensions" of responsibility can be seen to exist (Haughton and Counsell, 2003:237). How these tensions are likely to play out under the successor LEPs remains to be seen, as a shift away from a meso-level of economic steering may well shift the balance of power related policy yet again.

However, the multiple scales at which intervention within the economy and the environment takes place does not suggest that sustainable development cannot be achieved in any form. Jänicke (2008:557) explains that the term "Ecological Modernisation (EM) was coined in the early 1980s to provide a formula for the interplay of ecology and economy". Ecological Modernisation (EM) is often used interchangeably with the more fuzzy concept of SD (Hajer, 1995; Harvey, 1996), but Gibbs (2000:11) sees the two concepts linked together whereby SD is the "central story line" (emphasis in original) of the policy discourse of EM. Most fundamentally for both concepts, solutions are sought to the environmental problems caused by modernisation, industrialisation and science through further modernisation, industrialisation and science (Buttel, 2000). In such a sense, no radical shift is required in terms of the existing capitalist system, as a new round of accumulation is pursued using modernity to overcome modernity's contradictions through the use of greener practices. The concept of EM predominantly concerns itself with the actions that need to be adopted in order to achieve the wider remit of SD, and held wide appeal for the New Labour administration with its focus on both the market economy and a stakeholder society (Blowers, 1997). Indeed, the UK Department of the Environment, Transport and the Regions (DETR) itself argued that "to move towards more sustainable development, we need more growth, not less" Hopwood et al. (2005:42).

Revell (2005:349) highlights the emphasis that early forms of EM place on "voluntary environmental action from industry on the premise that it will be good for business", as demand for the production of low polluting goods is likely to increase since environmental amenity is itself a superior good. This produces 'win-win' scenarios that can be achieved through technological solutions, which simultaneously reduce production costs whilst helping to achieve environmental goals. However, Jänicke (2008) observes that there are inherent limits encountered by such a strategy of EM when technological solutions are not readily available. A prime example of this is climate change, where the risk is acute and immediate defensive action is required. In such a case, "ecological modernisation is despite its impressive potential - not sufficient to ensure a long term stabilisation of the environment" (Jänicke, 2008:563). Instead Blowers (1997:868) acknowledges the need to maintain coordination within governance, but notes a missing dimension in EM in the form of "long term planning as a method of environmental management". Despite the neoliberal tendency towards competition and the adoption of softer voluntary environmental policy within the doctrine of EM, there is still an argument for the strong role of government as a functional necessity within the context of multi-scalar environmental governance. Whilst Janicke (2008:559) notes that "revisionist" environmental regulation does not necessarily damage the economy, Deutz (2012) takes this further and emphasises the critical role of government policy for the success of 'modern' EM approaches.

One way in which the strong role of government has sought to shape both economic and environmental development simultaneously is through spatial planning. The role of the planning system within England is particularly important to maintain sustainable development in the face of pluvial and tidal flooding. Anthropogenic climate change is widely expected to increase the frequency of extreme weather events, in addition to causing a mean rise in sea levels (Becker and Grünewald, 2003; Environment Agency, 2005a;

Stern, 2006). Such a scenario will bring with it an increased risk of pluvial flooding throughout the UK, and will also generate more frequent and severe tidal storm surges (Lowe and Gregory, 2005). The technical definition of a storm surge is a "temporary increase in the sea level above expected tide levels" (Wells, 1997:395) due to reduced atmospheric pressure and the action of strong winds on the water's surface. Storm surges pose a particularly severe flood threat to the coastal communities of the UK, which include numerous large settlements and substantial pockets of industrial developments and infrastructure.

Economic activity along the coastline is mainly concentrated within estuaries, with prominent examples including the Humber, Morecambe Bay, the Tees and the Thames. The ports within these areas act as important hubs for their regional economies, facilitating the importing and exporting of various goods and providing facilities for the landing of gas and solid fuel to supply the nation's power stations. Hadley (2009:198) observes that some 11.5 million people in the UK live within 1km of an estuary, highlighting the potential extent of any damage that may occur from flooding during the landing of a storm surge. In comparison to pluvial flooding, coastal floods are considered to pose greater damage due to the greater depth and velocity of water overspilling within typically low-lying areas (Jonkman and Vrijling, 2008:47); whilst also posing an additional land contamination problem from sea mineral deposits after the floodwaters subside. With such highly concentrated pockets of industry and population, spatial planning has a long established role within English estuaries in terms of flood risk mitigation schemes in the form of various coastal defences; thus linking sustainable development and economic development.

Lee (1993:175) acknowledges that "coastal processes do not operate conveniently within fixed administrative boundaries", highlighting the scalar tensions associated with

reconciling economic development on a regional level and the porous boundaries of the environmental governance of flood risk. An additional factor influencing flood risk mitigation planning is the need to incorporate both national and European environmental conservation legislation, further blurring the boundaries of governance vertically as well as horizontally. These issues are explored further within the next section in terms of the impact planning has upon regionally-led economic development.

2.4 Planning and environmental protection in the UK

Healey (1999a:111) observes that the original task of planning was to promote development, regulate changes to smooth out disjunctions, correct market failures and maintain order against the threat of chaos. However, by the latter part of the twentieth century the value of planning had changed considerably due to "the decline of the welfare state's perceived ability to deliver public goods and the rise of neoliberal values" (Gunder, 2006:208). In this sense, the previous role of the national government as an exclusive manager of spatial change can be seen to have been superseded by an institutionalist approach, emphasising the "importance of institutions in shaping social action" (Healey, 2006:301).

Phelps *et al.* (2003:29) define an institution as "the social conventions and norms that serve to structure and frame economic action, acting as a source of stability and routine". A shift from government to governance has in some senses empowered such institutions, allowing planning to develop itself as a more interactive and interpretive process. Tewdwr-Jones and Allmendinger (1998:1976) view this largely as a consequence of Habermasian influence, based upon normative-communicative understandings of the lifeworld as opposed to the former closed and formal state system. Such traits can be seen in the Environment Agency

which currently plays a key role in the planning process in terms of mitigating against flood risk within England.

The Environment Agency is a national-scale Quasi Autonomous Non-Governmental Organisation (QUANGO) of the Department for Environment, Food and Rural Affairs (DEFRA) that was established on 1st April 1996. Her Majesty's Inspectorate of Pollution, the National Rivers Authority (NRA) and the Local Waste Regulation Authorities were disbanded under the Environment Act of 1995, with the defunct organisations' duties and responsibilities subsequently transferred to the newly established Environment Agency. In terms of its role in spatial planning and flood risk mitigation, the Environment Agency continued with the work that the NRA had started in 1992 on Estuary Shoreline Management Plans (ESMPs), under the objectives of Planning Policy Guidance Note 20 (PPG20). PPG20 (Department of Environment, 1992) recommended that estuary managers (in this instance the Environment Agency) work in conjunction with local stakeholders "to bridge the gap between existing statutory frameworks and initiatives" (Smith, 1997:1) which have a bearing on the use and management of an estuary. This included local businesses, local government authorities and the voluntary sector (typically consisting of nature conservation organisations). Although these different institutions were brought together with the objective of creating long-term sustainable planning on an estuary-wide scale, the Environment Agency had little in the way of statutory power to coordinate the various stakeholders involved with their varied interests and objectives.

Brandsen *et al.* (2006:546) view this 'soft' approach to governance as being "problematic when, regardless of their unofficial status, guidelines are mixed up with formal mechanisms of accountability". With the local authorities exercising full control of planning regulations around the English coastline, they were not obliged to integrate the early ESMPs into their
planning policy decisions. This "unwillingness of the planning authorities to heed the recommendation of coastal management plans in respect of where and where not to issue planning consent" (French, 2004:122) was a major issue during the 1990s, with Haughton and Allmendinger (2008:145) highlighting that such 'soft' governance can be viewed as potentially encouraging "short term incrementalism" at the expense of long term planning.

Although governance can be argued to facilitate the creation of various networks that bring together the public, private and the voluntary sector, Bulkeley (2005:880) argues that within environmental governance "the authority of such networks remains tied to traditional political arenas, primarily [that of] the nation state". This is evident in the current role of the Environment Agency whereby recent changes in legislation have altered the governance of land use planning, and granted the Environment Agency the familiar ability to usurp the power of local government in relation to planning decisions. Planning Policy Statement 25 (PPS25), released in 2006, allows the Environment Agency to block any proposed development in a flood risk area on the basis of flood risk concerns (Communities and Local Government, 2006b:9). Although the actual responsibility for planning remains with local government, the new legislation establishes the Environment Agency as a gatekeeper at a regional level. However, this is not to suggest that planning governance is monolithic, as it can be seen to exhibit internal contradictions where different scales possess different agendas. Despite being a national QUANGO, the Environment Agency splits its operations into six regional offices within England. However, the boundaries of the Environment Agency operational regions are different to those of the RDAs (and their successor LEPs), meaning that the Environment Agency must deal with multiple RDAs (and now LEPs) when addressing environmental concerns relating to economic development policy. Gibbs and Jonas (2001:275) note that "although the rationale for a regional approach to environmental issues is rarely stated... the strongest argument is that a coherent

management approach to 'natural' environment ecosystems involves, of necessity, a larger spatial scale than individual local authority areas". The regional scale of the Environment Agency is of particular importance in overcoming the problems highlighted by the 'soft' governance of estuary and coastal planning. At a meso-scale the Environment Agency has the ability to better coordinate the reconciliation of stakeholder objectives across multiple local government authorities, thereby providing a sustainable form of planning suitable for coastal processes which are not constrained by administrative boundaries.

Under PPS25, if the Environment Agency objects to a proposed development in a flood risk area, the Local Planning Authority must liaise with the Environment Agency to agree on a course of action to resolve the issues surrounding the objection. If the matter cannot be resolved, and the LPA wish to pursue the development by granting planning permission, the matter must be referred to the Secretary of State for review. This considerable power over the local authorities through central steering, or "metagovernance" (Jessop, 2000) was further enhanced in 2008, when strategic responsibility for flood risk management and coastal erosion throughout the whole of England was transferred from local government to the Environment Agency. The power which the Environment Agency wields in this instance is not merely "power over, or power to, but power as 'ability'" (Healey, 1999a:1133) to coordinate economic development whilst mitigating flood risk using the planning system. PPS25 has proved extremely effective, with the Environment Agency having objected to over 6,000 planning applications due to flood risk concerns during 2007/2008 throughout England (Environment Agency, 2009b:7). In nearly all of these cases, the decision of the Environment Agency was upheld, with only 15 major developments continuing against their advice. The new powers given to the Environment Agency appear to provide a solution to what Handmer (1996:194) observed as the compromised nature of local government in terms of its "contradictory roles" of promoting economic development, which is often seen

to be in conflict with environmental objectives. Although *allowing* a more joined-up approach to planning with a greater emphasis on sustainability, governance network steering can additionally be seen to have impeded the institutional input of local government within the flood risk governance process. In such situations, Burby and Dalton (1994:232) are of the opinion that planning "can have an effect on local development management programmes that is equivalent to that of direct, top-down, prescriptive state mandates on local governments". However, Brand (2007:631) states that environmental management "can leave no social activity untouched [and] exclude no institution, organisation or individual from its reach" in its claim to give coherence to the inherent complexity of governance. Although the Environment Agency (2009b:7) want "those involved in planning decisions to come to us early, to work with us and to listen to our advice", their pivotal role in coordinating the issues that link the different social arenas also substantially impacts upon the economic and voluntary sectors of governance in addition to local government.

Even though the redistribution of power within the planning process (in relation to flood risk mitigation) has been moved up a scale vertically, other policies from the supranational level have simultaneously moved down the scale to be implemented at the regional level. Flood risk management in coastal areas must be carried out in conjunction with the European Habitats Directive (Environment Agency 1999a), which delineates Special Protection Areas (SPAs) and Special Areas of Conservation (SACs) that protect both wildlife habitat and their native endangered species. This poses specific problems in spatial planning for flood risk management, as flood defences can have negative impacts upon the areas which the European Habitats Directive is designed to protect. As mean sea water levels increase due to climate change, foreshore levels remain static as fixed flood defence barriers prevent the EU-protected habitat from moving landward and 'rolling over' to higher

ground (Environment Agency, 2003b; Environment Agency, 2005a). Trapped between the flood defence and higher water levels, the SPA and SAC areas will become submerged more frequently within the tide cycle, and will eventually disappear.

Achieving a balance between nature conservation and flood risk mitigation, which protects the economic assets in coastal areas from storm surges, is a relatively recent problem. Whilst the EU Habitats Directive came into force in 1992, the current science surrounding climate change is far from certain and remains in flux (Royer et al., 2004; Singer, 2004; Svensmark and Friis-Christensen, 2007). Under the Keynesian Welfare State flood defences were coordinated on a national scale using public money, and were strongly supported by land and development interests as they enabled "private profit by protecting land at public expense" (Handmer, 1996:189). However, the rolling back of the nation state has shifted the provision of flood defences away from central government, subsequently reallocating some of the cost and responsibility across both the voluntary and private sectors. Although limited public money is available for the construction of flood defences through the National Flood Defence Budget, the suitability of any flood defence scheme now primarily hinges upon compliance with European environmental legislation. This has marked a sea change in the field of flood risk management away from hard engineered flood defences, towards the integration of natural processes and the restoration of habitats under the banner of sustainability (Brown and Damery, 2002; French, 2004). Whilst 'hard' defences will have to be maintained for the foreseeable future in front of some coastal settlements, Ledoux et al. (2005:129) point out that the "retention and renewal of historic defences along continuous stretches of a dynamic coastline is no longer ecologically sound, economically viable or socially sensitive". This potentially limits the number of sites which could be made available for future economic development along the coast and around the estuaries of England, as well as increasing development costs through site developers

having to contribute to any flood risk mitigation schemes at the specific location. In such a situation there could be major implications for the newly established LEPs with Walker (2000:134) highlighting that the "principal cost of following a strategy of development restraint is the loss of development and its related economic and/ or social gains". There are also likely to be a substantial political cost if high-profile development projects, such as The Northern Way, are adversely affected by flood risk mitigation policy.

In the North of England in particular, the main focus of land use planning policy has often revolved more around facilitating economic development as opposed to reconciling environmental issues within the context of sustainable development (Counsell and Haughton, 2003). Jonas *et al.* (2002) observe that throughout the 1980s and into the early 1990s, regional economic strategies have viewed the environment and its assets "as commodities which will assist in promoting economic growth rather than having a value in their own right".

With the decline of traditional industry from the early 1980s onwards, Foreign Direct Investment (FDI) was seen as a panacea for the economic hardship experienced by peripheral regions of the UK. In attracting foreign companies to open branch plants within a region, it is proposed that local firms can benefit from "spillovers" generated by the inability of foreign firms to fully internalise their advantages (Crone and Watts, 2000; Girma *et al*. 2001). The economic benefits of FDI include employment opportunities and improved local job quality as well as positive spin offs associated with major flagship investments, such as the Nissan plant in Sunderland. However, Tickell and Dicken (1993:206) note that serious issues are raised in terms of the "different capabilities of regional development organisations" in attracting such investment, not least due to the range of sites available (determined by regional planning guidance) and the proportion of eligible areas available

for UK government or supra national European Union business incentives. This is a problem that is likely to be amplified under the successor LEPs operating at a smaller local scale, especially in the terms of qualifying for and being able to access EU level funding for economic development which is primarily aimed at assisting bodies operating at a regional meso-level (Bentley *et al.*, 2010; Waller, 2011; Pugalis *et al.*, 2012).

In any case, the success of FDI as a method of economic development is a moot point, with Phelps *et al.* (2003:37) arguing that foreign manufacturing plants within the UK do "not often translate into increased local embeddedness", despite the scope for repeated investment and additional opportunities created through associated research, development, design and marketing.

Regardless of the argument surrounding FDI as a viable economic stimulant, the UK still remains "Europe's top destination for foreign direct inward investment" (UKTI, 2011). However, central government could effectively be perceived to be steering regional investment potential through the Environment Agency from both domestic and foreign enterprises. This could be an unintended consequence of the greater powers invested within the Environment Agency, whereby it has the potential to block development within certain areas owing to a focus on environmental protection. Haughton and Counsell (2003:234) recognise that although economic development, it also creates tensions in pursuing competitiveness within regional development. Since the national economy is no longer the anchorage point of accumulation, Jessop (2000:345) highlights the importance of sub-national and local economic regions in the pursuit of the "changing forms of globalisation and international competitiveness". The Environment Agency's ability to veto development in coastal areas may well decrease regional competitiveness throughout England, as developers may be barred from potential sites close to the coast; or alternatively deterred by the cost of incorporating flood risk mitigation measures into business sites if deemed necessary under PPS25.

In the same way as local government power appears to have been curtailed by a 'harder' form of governance coordinated by the Environment Agency, both RDAs (and successor LEPs) and businesses alike appear to suffer similar constraints through the encroachment of EPI into economic development policy. Meanwhile, the centrally steered flood risk governance system appears to have created the potential for greater voluntary agency input with regards to environmental conservation objectives. The English planning system, in its current form, appears to have had considerable success in redressing the imbalance between economic development and environmental management to achieve the principles of sustainable development in the face of climate change that cannot be attained through a doctrine of ecological modernity alone. The shift towards a regional scale in this instance has allowed these issues to be tackled in a joined-up fashion. However, because of the crucial role of the planning system in reconciling economic development with environmental governance, a closer look at the way in which the different institutions interact and share knowledge within a governance framework is required.

2.5 The challenges for the environmental governance and the Environment Agency

A particular concern for the governance of environmental issues such as flood risk is that they do not remain static. The Stern Report (2006:18) recommended that "policies should adapt to changing circumstances as the costs and benefits of responding to climate change become clearer over time". The system of flood risk governance can be seen to involve multiple stakeholders, with the safeguard that the Environment Agency has the power to reconcile environmental policy with economic development as outlined above. However, a

closer examination of the way the different actors communicate and interact is required to see just how suitable governance is in dealing with the dynamic issue of flood risk mitigation. Foxon (2009:7) sees an adaptive management approach as being particularly useful in this respect, as it seeks to analyse "social-ecological systems in terms of their ability to absorb disturbance, self-organise and build and increase capacity for learning and adaptation". This serves to highlight the important role of capital within regional efforts to pursue sustainable development, which comprises three broad bands:

- 1) Social capital: consisting of skills and education;
- 2) Finance capital: consisting of grants, loans and subsidies;
- 3) Physical capital: such as infrastructural property and land.

Improving regional capital is of prime importance, as Ward and Brown (2009:1239) explain that "endogenous assets and capacities" are of prime importance within regional policies which seek to develop both rural and urban areas through the mobilisation of local assets. This notion of regional embeddedness heavily emphasises the role of knowledge and innovation in development strategies, whereby the area can be envisaged as a "learning region" (Phelps et al., 2003:29). Cooperation, reflexivity and trust, in the form of social capital, are required between the various actors involved to develop collective resources, which are in turn facilitated by a framework of governance. Healey (1999a:113) cites the importance of Habermas's focus on the "normative potential of a politics which moves towards the dynamic of a 'public conversation'", whereby all affected parties have a voice and are listened to. In the case of flood risk mitigation, which attempts to reconcile both economic and environmental objectives, stakeholders within the private, public and voluntary sectors are all pursuing agendas that must be balanced within the boundaries of the planning system. This balancing act, however, ultimately rests with the Environment Agency using the powers ascribed to it under PPS25. In this instance, the Environment Agency can be seen to be demonstrating a form of strategic selectivity, whereby its own set of knowledge as an institution is privileged over others. Healey (2006:313) explains that the dominant position of the Environment Agency in flood risk governance is necessary to maintain the functioning of the system, as "governance initiatives outside the state have difficulties growing and surviving without finding a way to link to formal government in some way". In governance systems where no institution is dominant over the others, little is likely to be accomplished due to the diverse range of outcomes sought by the stakeholders within different sectors of society. Therefore, Jessop (2000:326) highlights the importance of the political responsibility which may be attached to the Environment Agency in this instance for "maintaining social cohesion in a socially divided, pluralistic social formation". This effectively casts the Environment Agency as an anchor around which governance networking is to be established using interactive and interpretive planning.

However, the success of such an approach depends upon the Environment Agency's ability to maintain active participation from the various different stakeholders within the governance process (Raco, 2000; Docherty *et al.*, 2001). The very nature of stakeholder interests in relation to planning matters is often complex and problematic, with inconsistent and overlapping preferences between different groups (Larsen and Gunnarsson-Ostling, 2009). Whilst environmental policy is constructed on the basis of scientific knowledge and technical intervention, Brand (2007:626) notes that "it can only be implemented by the modification of people's behaviour patterns across an immense range of activities". This presents a major problem in the governance of flood risk, as Roberts (2006:415) highlights that "unfortunately, the way risks impact upon development and investment in regional and local economies is something about which we know very little".

The Environment Agency is therefore placed in a particularly interesting situation as it must deal with the dynamic nature of flood risk mitigation, built upon science relating to climate change which is not certain, without detailed knowledge of how stakeholders understand climate change in terms of its implications for regional sustainable development. Research by Johnson and Penning-Rowsell (2010:30) has shown that any lack of clarity and transparency within the governance process may undermine confidence in the system, therefore having a knock-on effect of "reducing the cooperation and commitment of stakeholder engagement and increas[ing] requirements for accountability". Any such failing within the governance system also carries with it long term implications, as Williams *et al.* (2009) observe that expectations of government, which are represented in flood risk mitigation policy by the Environment Agency, are hard to shift when based upon a long established record of disappointing performance. Although the Environment Agency has the very real potential to reconcile economic development and environmental policy through its role in the planning system, this is of little use if stakeholder participation within governance is not balanced.

Considerable research has taken place into the level of participation of different actors within governance, although there appear to be many explanations which are predominantly attributed to the embeddedness within the particular place under examination by the researcher. For example, Painter (1997) identified problems with actors' willingness to participate within governance due to the unequal distribution of resources, whilst research by Martin and Foley (2000) suggested that stakeholders can be reluctant to participate on account of their perception that there is no *benefit* to collaboration. Meanwhile, Reed (2008) and Foxon *et al.* (2009) both highlight a disillusionment among policy makers and practitioners involved within governance that the participatory process is used to reinforce decisions which have already been made, therefore failing to realise the benefits claimed for participation.

With such a range of potential problems, limiting the ability of these to impact the policy process is particularly important, as any organisation involved within governance is dependent upon others for resources which need to be exchanged to achieve their goals (Rhodes, 1996; Bache, 2000). However there is also an additional danger with resources in the form of stakeholder knowledge which can also act as a stumbling block, even if there is good participation within the governance model. Larsen and Gunnarsson-Ostling (2009:261) emphasise that the "way in which climate change issues are identified within mitigation-adaptation strategies" carries major implications for the success of policy. With such a diverse range of agencies working in partnership, Evans and Jones (2008) caution against the possibility that the different actors within any scheme may be working to different understandings of specified ideals when attempting to realise the visions of sustainable development. In order to ensure that this does not lead to the breakdown of flood risk governance, Lindley et al. (2007:53) see it as critical to develop "an underlying understanding of risk" for the institutions involved. This includes the identification of the spatial, temporal and thematic dimensions of risk, as well as the driving factors behind them. Using such an approach, issues related to the institutions' specific vulnerabilities can be discovered which may prove useful in reaching "decisions most likely to generate resource sustainability (Griffin, 2007:22). This attaches considerable importance to local knowledge which Folke et al. (2002) view as playing a key role in bettering the understanding of the interconnectedness of elements within the environment.

Understanding the way in which local knowledge contributes to the perceptions of flood risk, which in turn may impact the involvement of actors within the process of governance is critical in reconciling economic development with environmental policy. Although a framework for better communication between the different actors within society is already in place through the shift from government to governance, the success of such a system

appears to lean heavily upon the private, public and voluntary sectors' perceptions of the importance of integrating environmental policy into the wider objective of economic development.

2.6 Summary

This chapter has highlighted how the changing scales and forms of government intervention within the economy have attempted to reconcile economic development objectives with environmental policy objectives through a system of governance. The shift in economic development thinking from Fordism to post-Fordism has embraced neoliberal ideals which have resulted in the blurring of boundaries between the market, the state and voluntary sectors, as responsibility for achieving policy objectives has been shared out amongst additional actors to the government. In this sense, a governance approach to economic development has helped to reposition environmental objectives within economic development policy as part of sustainable development. However, despite a transition away from the national scale to the regional scale in terms of such policy implementation, the UK government can be seen to have maintained the steering of policy through the Environment Agency with its substantial powers over development decisions in flood risk areas which have often been backed up by central government when referred to the Secretary of State. Coupled with the responsibility for overseeing supranational legislation from the EU, the Environment Agency now has the potential to block development within certain areas owing to a focus on environmental protection. This may severely compromise current and future economic development on estuaries around England, which is required in order to overcome the existing environmental problems attributed to society's process of modernisation.

However, it is evident that challenges still remain, particularly in achieving a balance within regional and local governance to ensure that actors participate sufficiently in environmental management strategies such as flood risk mitigation. Although the framework is in place to integrate the different actors within society within the planning process, the way in which different institutions understand and construct flood risk from their local embedded knowledge has not yet been examined. An understanding of these issues will help to analyse whether such a system of governance can realistically reconcile economic development and environmental objectives in a successful manner, especially as the Environment Agency is effectively acting as a coordinator of the business and voluntary sectors' diverse requirements. My thesis addresses this through developing an understanding of the ways in which businesses construct their flood risk knowledge, to see whether this can better integrate the private sector within flood risk mitigation at the regional level. This will help to determine the way in which bas developed since the 1980s, as the *de facto* vehicle for coordinating government policy in the post-fordist era.

The next chapter looks specifically at the role of risk within the governance of flood mitigation, in terms of how it is constructed, how it is understood, and the way in which risks are communicated between the different agents within society. This subsequently draws upon a different set of literature from the field of Science and Technology Studies. In bringing literature together from the fields of economic development and risk perception, I shall seek to address the interdisciplinary nature of the issues involved in successfully reconciling economic development with environmental policy.

<u>Chapter Three</u> <u>Perceptions, understandings and communication of risk</u>

3.1 Introduction

This chapter reviews the literature surrounding the perceptions, understandings and communication of risk. Drawing together the wealth of research examining the sociology of scientific knowledge will help to address the gaps I identified in Chapter Two concerning the integration of risk within the governance process. Section 3.2 explores the rise of the risk society, focussing upon the work of Ulrich Beck (1992) in conceptualising how risk is related to the process of modernity. Section 3.3 looks specifically at how such risks are perceived by the public by examining the role of tacit knowledge gained from prior exposure to hazardous events. However, the absence of a major UK coastal flood event since 1953 has left large swathes of the population without any personal experience upon which to base risk perceptions. Section 3.4 explores how official authorities may use explicit information in such circumstances to bridge the knowledge gap, whilst addressing the potential limitations of such a method and its compatibility with tacit knowledge in shaping perceptions. Although perceptions of risk can be seen as important in their influence upon flood risk governance, Section 3.5 discusses perceptions of the consequences of flooding and the process of recovery in the way that they incorporate notions of vulnerability and resilience within society. Section 3.6 examines the literature detailing how businesses currently deal with the concept of risk, and how the everyday economic risks that characterise business operations juxtapose ecological risks such as flooding. Section 3.7 concludes the chapter and incorporates a brief summary of the points mentioned in the earlier sections.

3.2 The rise of the 'risk society'

A broad definition of risk is provided by Rowe (1977:24) as "the potential for the realisation of unwanted negative consequences of an event". However, understanding and attaching values to the potential of such an event and the specific impacts of the consequences upon society presents the researcher with an ontological issue. Research has shown that there are different traditions working side by side, and that risk can be conceptualised in two different ways (Bradbury, 1989; Coulthard *et al.*, 2007a) as either:

- A 'physically given' attribute of hazardous technologies. This is based upon objective facts, which can be explained, predicted and controlled by science, therefore remaining separate from subjective values. For instance, engineers often work on the basis that Risk = Cost x Hazard.
- A 'socially constructed' attribute that cannot be treated as value free. This places a greater emphasis on the role of cultural values, signifying that risks cannot exist independently of the humans who assess and experience its effects. Within research examining adaptive mitigation, Risk = (Vulnerability/Resilience) x Hazard.

The origin of risk assessment as a method for determining the likelihood of an event lays within the first of these concepts, relating to risk as a physical attribute. Developed for various highly technical processes involved within the chemical, nuclear and aerospace industries, Wynne (1992a:113) explains that risk assessment provided a "scientifically disciplined way of analysing risks and safety problems". This allowed the examination of problems in an *intensive* manner, using assumptions of well defined and deterministic processes that could be isolated between various components. However, the role of risk assessment has since expanded far beyond its original *intensive* function in its application to

badly structured extensive risks that exist outside the laboratory (Beck, 1992; Wynne, 1992a; Adams, 1995). Examples of *extensive* risks include issues posed by the use of pesticides, the production of toxic waste and anthropogenic climate change; all of which occur on a much larger scale than intensive risks (such as aeronautical design issue in a laboratory environment) and therefore affect a range of actors across society. More importantly, these risks emanate from the very industrial processes upon which our capitalist societal foundations are built. The pursuit of modernisation through "technoeconomic development" (Beck, 1992:19) has created various 'manufactured' risks, such as climate change, in addition to the 'natural' risks such as earthquakes that humans have always faced. Beck warns that these ecological hazards to nature subsequently become imminent hazards to property and economic performance, whereby they are transformed into society through the systems of "economy, science and law" (Beck, 1995:68). Therefore, 'manufactured risks' can be described as socially constructed (Beck, 1992; Suttmeier, 1994; Tierney, 1999), as they branch out along the nodes and networks that connect the various agents which comprise human society. As a result, Irwin (1999:45) concludes that society is now "struggling increasingly with the risks and threats which it has itself produced".

Ulrich Beck addresses this struggle within his work on the *Risk Society* through three core dynamics comprising; new ecological threats to the environment, a 'reflexive' urge towards modernisation and the individualisation of politics (Bronner, 1995:70). He argues that major social change is required to deal with these new ecological threats which have emerged from the result of years of industrialisation following the Enlightenment. Lash (2003:49) considers that Beck (1992) presumes the existence of two modernities in this instance: a "'first' or 'simple' modernity... and a second 'reflexive modernity'".

The first modernity is characterised by "the Enlightenment's tenets of progress, truth and science" (Irwin, 1994:174), where scientific knowledge was objective and carried a monolithic authority. However, the fixed and certain nature of such knowledge leads Wilkinson (2001:3) to conclude that industrial society at the time was "blind to the uninsurable risks of modernisation". This is supported through research by Lange and Garrelts (2007) which highlights the futility of maintaining what they term as a safety discourse, whereby government policies sought to use scientific knowledge to calculate and ensure safety against ecological hazards under all realistic circumstances. As a result, the nature of new and uncertain 'manufactured' ecological risks resulting from industrialisation can be seen as impacting upon the authority of natural science, with knowledge being reframed as "temporary and fragmentary at best" (Lange and Garrelts, 2007:266).

This realisation of the "inherent limitation of anticipatory knowledge" (Wynne, 1992a:111) on which environmental policies are based is characterised by what Beck describes as a social change towards reflexive modernity, whereby the "certainty that underpinned the world views of industrial society" (Bronner, 1995:77) has given way to radical doubt and insecurity. Although knowledge still exists under such conditions, Lash (2003:52) emphasises that the linear agents associated with the first modernity are being erased and reformed in a reflexive fashion within a subject so constantly in motion that "knowledge itself is *of* uncertainty" (emphasis in original). As the exceptional condition threatens to become the norm, averting and managing catastrophes through the uncertainty of reflexive modernity has necessitated a "*reorganisation of power and authority*" within society (Beck, 1992:24 - emphasis in original). However, the transition between first modernity and reflexive modernity has taken place within the *continued pursuit* of capitalist modernisation. As a result, Beck (2000:19) observes that the "getters of the national and welfare state" are now being removed. Whereas individuals were once ignorant of the risks threatening society, the knowledge crisis associated with the national institutions of the 'first modernity', built upon "apodictic knowledge and certainty" (Lash, 2003:51), has encouraged individuals to seek out information and adopt strategies for perceived risk avoidance under reflexive modernity. Consequently, Parkhill *et al.* (2010:41) view the responsibility of risk as having been simultaneously "externalised to socio-political institutions *and* internalised through individualisation".

This chimes with the literature discussed in Chapter Two, whereby the structures facilitating government intervention within the market have changed due to a neoliberal shift away from a spatial fix at the national level. Economic and environmental responsibilities that were once exclusively ascribed to national government and its welfare state have subsequently been re-scaled and distributed across additional actors within society. In terms of the responsibilities for addressing ecological risk, Lash and Wynne (1992:3) observe a similar process whereby the distribution of goods as the "axial principle" of industrial society has now been replaced by the "the distribution of 'bads' or dangers" (Ibid) within the risk society. The scale at which this distribution takes place has also changed. Environmental disasters can be seen to "act indiscriminately and without respect for national boundaries" (Beck, 1992:47), meaning that they can no longer be adequately addressed by management exclusively at a national level. Rustin (1994:7) observes that "within the risk society, society is seen as evolving towards the form of a variety of networks, linked laterally as well as vertically". In such situations, the combination of social institutions with technology allows individuals to gain access to socially produced hazards through participation, in a similar way to that of the concept of governance. This enables what Wilkinson (2001:3) describes as the "emergence of a new environmentally responsible form of rationality" which has the political power to change society through reflexive modernisation on a path of ecological enlightenment.

Under the second reflexive modernity characterised within the risk society, Beck (1995:44) acknowledges that the "only safe thing to say is that safety is impossible". Ecological risks of modernisation have caught up with *all* those within society who have produced and profited from them, creating what he terms as a "boomerang effect" (Beck, 1992:23) that percolates national boundaries and which no one can avoid. The significance of capital and class in countering the effects of such ecological hazards in this instance are dismissed, with Beck arguing that the aversion of risk within society is instead dependent upon knowledge and available information as opposed to wealth. Without sufficient knowledge, he warns that the population "is composed of nothing but would-be engineers" (Beck, 1992:58). However, the role of knowledge in both *framing* and *acknowledging* such risks posed by techno-scientific production has received little attention within Beck's work.

Both Alexander and Smith (1996) and Bulkeley (2001) are especially critical of Beck's failure to explain how risks are detected, and indeed the way in which they come to dominate the public arena through knowledge networks. Although Wilkinson (2001:9) highlights that Beck aims to theorise the social contexts within which people construct a knowledge of hazards as risks, he criticises Beck's thesis as highly partial with specific reference to the way in which he "underestimate[s] the complexity of the reality" he is seeking to understand. In this instance, Beck's failure to acknowledge the role of cultural factors within risk perception has made him "a prisoner of objectivism" (Alexander and Smith, 1996:256). In order to account for risk in terms of its dynamic mediation through social and cultural processes, Parkhill *et al.* (2010:41) notes that risk perceptions need to be taken out of a "purely realist frame".

Irwin *et* al. (1999:1312) have sought to address this through the use of 'constructionism' by questioning "risk response in a manner which is sensitive to everyday culture and meaning".

They argue that local knowledges can make a positive contribution to policymaking through the new reflexive social institutions which have arisen from the transition away from the first modernity. In this sense, Irwin *et al.* (1999:1325) conclude that "risk does not stand apart from the range of social relationships, worldviews, every day practices and shared understandings which constitute local culture". Drawing upon the literature of Sociology of Scientific Knowledge (SSK), Collins and Yearley (1992:321) note that the understanding of "what humans do as they make knowledge" can help in avoiding the broad generalisations and grand theorising concerning the interpretation of science that Beck has received criticism for. By shifting the focus to individual experiences, the complexity surrounding the perception of risk and hazard severity (Kasperson and Kasperson, 1996; Parkhill *et al.*, 2010) can be better addressed through what Funtowicz and Ravetz (1992) term as 'postnormal science" (Figure 3.1).



Figure 3.1 - The three kinds of science Source: Jasanoff and Wynne (1998:12)

According to Funtowicz and Ravetz (1993:750), postnormalism implies that the "puzzle solving exercises of normal science are no longer appropriate for the resolution of policy issues of risk and the environment". In essence, a new approach is required to take into account the "interpretive flexibility" (Jasanoff and Wynne, 1998:15) caused by scientific uncertainty, where different and competing social actors promote understandings consistent with their policy interests. However, postnormal science is not a replacement for applied science and expert opinion. Instead, it can be seen more as a vehicle for embodying the diversity and uncertainty emerging from the collapse of the authority of scientific institutions under reflexive modernity. Essentially, Funtowicz and Ravetz (1993:744) define postnormal science as the "sharing of fields of knowledge between both experts and amateur citizens, where facts are uncertain, values are in dispute, stakes are high and decisions are urgent". In this way, the 'information deficit' model of risk understanding (Wynne, 1992a; Irwin, 1994), whereby the public are seen as "empty vessels that need to be filled" (Brown and Damery, 2002:422) with authoritative expert scientific information on risk, becomes challenged when confronted with geographically embedded lay-knowledge generated from the experience of everyday day life (Wynne, 1992a and 1992b; Irwin et al. 1999).

As science is based upon "sets of *assumptions* about the external world which are *social* in their origination" (Irwin, 1995:51 - emphasis in original), the perception and construction of risk can be best understood by analysing the underlying value systems used by stakeholders within society. Beck (2000:18) sees the key political problem of the second modernity as being the way in which society negotiates the multiple changes stemming from new ecological risks on "all levels at the same time". In doing so, the way in which risks are communicated and addressed by the different institutions and organisations within society are of paramount importance. Social capital plays a key role in this instance, as Allen

(2006:98) notes that geographically embedded capacity-building is an important part of the process of "shap[ing] social institutions and contribut[ing] to policy".

However, as Jasanoff and Wynne (1998:30) observe, the uncertainties generated by the "interplay of social and political interests around science and technology" appear to depend upon their distance from the point at which knowledge production occurs. Research by Slovic *et al.* (1980, 1985) suggests that risk perceptions are influenced by a wide range of factors, including the respondent's prior experience regarding the risk in question. As public rankings of risk differentiate dramatically with that of experts (Jasanoff and Wynne, 1998:38), a more detailed explanation of how risks are constructed and understood is required. This is explored within the next section.

3.3 The role of experience in establishing perceptions of risk

Adams (1995:65) observes that within the disciplines of psychology and anthropology "the world is experienced through filters that are the product of earlier experience". The way in which risk perceptions are constructed is closely related to emotional reactions which serve to condition memory at later points in time as "somantic markers" (Lowenstein *et al.*, 2001:274). In this sense, emotional processes rooted within experience act to guide decision-making behaviour, based upon assessing the incentive choices that are available through the development of what Polanyi (1958, 1967) coined as context-specific tacit knowledge. However, the importance attached to prior experience in forming such tacit knowledge can be seen to be problematic when considering the *new* 'manufactured' ecological hazards which now dominate the current risk society. Harvatt (2011:66) notes that experience can be both "direct (personal) and indirect via social networks [and] media reporting". Research has shown that direct experience of hazards is a key factor in influencing an individual's perception of a risk, serving to increase personal salience whilst

heightening understanding and strengthening the propensity to take mitigating action (Zaleskiewicz *et al.*,2002; Keller *et al.*, 2006; Siegrist and Gutscher, 2008). By contrast indirect experience, particularly in the form of media coverage, has been shown to heighten public concern for only a limited period of time (Bostrom *et al.*, 1994; Bord *et al.*, 1998).

Loewenstein et al. (2001:279) attribute this short time frame of heightened awareness largely to the role of *fear*, which they observe is "highly dependent upon mental imagery". Indeed, in cases where people had not directly experienced the effects of a risky event, Harvatt et al. (2011:79) discovered that they perceived the threats posed to them as "largely insignificant". However, despite the importance attached to the role of previous experience in constructing risk perceptions, an absence of firsthand experience of a specific risk does not automatically equate to a vacuum in perception. Work by Visschers et al. (2007:710) found that respondents often appeared to construct information about unknown or new risks, that they had not experienced, by drawing upon risks which they had previously experienced "based upon a similarity of characteristics". Therefore, the unknown risk inherited the characteristics of the associated risk, providing a heuristic with which to formulate a perception. This also applies to risks that whilst not directly experienced, have been preserved in folk memory (Morris, 2006; Riley, 2008), providing the additional possibility of a cultural construction of risk through association. The accuracy of this heuristic approach however is highly variable, as the severity of the associated risk may be perceived as either greater or smaller than that of the unknown risk (Loewenstein et al., 1999; Terpstra et al., 2009). Nevertheless, understanding such an approach is particularly relevant when addressing the risks posed by estuarine flooding, a hazard that has been largely overlooked within academic literature.

Under the safety discourse of the first modernity, there was a prevalence towards the construction of hard engineered flood defence barriers to protect the UK coastline from tidal flooding (Brown and Damery, 2002; Winn *et al.*, 2003; French, 2004). It is therefore unlikely that people today have experienced estuarine flooding, as there has been only one large scale structural failure that occurred in 1953. Although Johnson *et al.* (2005:567-568) note that the 1953 North Sea tidal surge was not the largest on record, it "caused the greatest flooding in recent history" with over 1200 breaches occurring along 1370 miles of flood defences on the east coast of England. The flood event was the catalyst for a major sea defence upgrade programme (Steers, 1953) facilitated by the national government under the '1953 Standard for Coastal Protection' legislation. These very defences are still in place today, having successfully protected coastal communities for the last 58 years.

However, the uncertainties surrounding the extent of sea level rise caused by anthropogenic climate change means that the defences will no longer be adequate in maintaining the safety discourse of equal protection along the whole coastline, as was originally intended at the time when they were constructed (Environment Agency, 2003b; Environment Agency, 2005a). Ironically, the success of defences in preventing a history of flooding has now become problematic in terms of people lacking the memories to reflexively draw upon when thinking about future flood risk.

Freudenberg (2001:128) observes that scientific and technological achievements quickly become embedded within society as baseline expectations, resulting in a situation whereby we are "not so much in control of technology as we are *dependent on* technology (emphasis in original). This can be seen in the way that people have become accustomed to the sea defences which have effectively removed flood risk from the coast over the last half century. Although society can now be seen to have entered a period of *reflexive* modernity,

the confidence invested within engineered flood defences for universal protection (associated with the *first* modernity) still lingers on. Lange and Garrelts (2007:271) observe that a change in these perceptions will only be brought about when a "reality test" takes place in the future, whereby the flood defences are breached during an extreme event. This acts as a demonstration of the uncertain nature of the knowledge surrounding climate change, in addition to highlighting the futility of pursuing a safety discourse under which the risk posed by environmental hazards can be confidently calculated.

This means that, due to the absence of major breaches in UK coastal defences, tacit knowledge gained from firsthand experience of coastal flooding will be non-existent amongst those within society who were either very young or not yet born during the 1953 events. Even for those who experienced the 1953 storm surge, and therefore have a personal cognitive resource to draw upon in order to form a risk perception of coastal flooding, this tacit knowledge may have been diminished as time has passed since the event. Research by Pottier et al. (2005:4) has shown that individuals and organisations often overlook the significance of single floods within the distant past, with a presumption that they were "freak events in an unsophisticated and pre-modern era that will not recur, at least in their lifetime". Rupp-Armstrong and Nicholls (2007) highlight this in two contrasting case studies within Germany and England. Both countries were adversely affected by the 1953 storm surge, but whilst there were no further instances of large scale coastal flooding within England, Germany was hit by another storm surge in 1962. Occurring less than 10 years after the 1953 event, the repetition of damage served to reinforce the fear attached to coastal flooding amongst the German population. In England however, "the fear of the sea is less" (Rupp-Armstrong and Nicholls, 2007:1427), with the 1953 event being described as "largely forgotten" (*Ibid*). In such instances, when flooding has occurred it is generally interpreted as the result of human mismanagement. Conversely, an absence of flooding is

often attributed to improved mitigation and defence strategies pursued under the first modernity (Green *et al.*, 1991; Lange and Garrelts, 2007).

A lack of personal experience of coastal flooding amongst a large portion of the English population, coupled with the distinct likelihood of the 1953 flood being viewed as a freak event by those who were alive to experience it, suggests that there may be little useful tacit knowledge available upon which to construct accurate flood risk perceptions. Moreover, it would appear that due to the absence of a reality testsince 1953, the trust invested within existing coastal flood defences remains unshaken. However, whilst large scale coastal flooding has been conspicuously absent since 1953, the last decade is peppered with major pluvial flood events that have occurred across the UK. Mass media coverage of the inundations at Carlisle in 2005 and throughout Gloucestershire, Worcestershire and Yorkshire in 2007; served to ensure that pluvial flooding issues retained pertinence within society. Each of these flood events were caused by an abnormally high intensity of rainfall over a very short period of time, which overwhelmed drainage systems and caused heavy surface water flows that damaged both property and infrastructure (Posthumus *et al.*, 2009; Coulthard and Frostick, 2010).

Even if people are not able to transfer their experiences or knowledges of flood risk between time periods (due to the lack of flood events), they may develop flood knowledges by transferring experiences between different types of risk instead. Using Visscher *et al.*'s (2007) assertion that risk perceptions can be generated through associating an 'unknown' (not experienced) risk with a 'known' (experienced) risk based upon a similarity of characteristics, there may be an opportunity for knowledge transfer between different flood types. This could allow tacit knowledge gained from exposure to pluvial flooding to be used as a basis for constructing a perception of coastal and estuarine flooding in the

absence of direct experience. However, there is evidence to suggest that the immediate effects of estuarine flooding are likely to be more severe than those associated with pluvial flooding, involving greater damage and higher fatalities due to the volume and velocity of flood water associated with a storm surge flood event (Jonkman and Vrijling, 2008; De Bruijn and Klijn, 2009). As such, any transfer of knowledge from the experience of pluvial flooding may lead to an underestimation of the risk posed by estuarine flooding. More importantly however, the construction of risk perceptions in this fashion depends upon the person's ability to *associate* the 'unknown' estuarine flooding *with* the 'known' pluvial flooding. Loewenstein *et al.* (1999:593) explain that "potentially useful comparisons [between two situations] are easy to miss, even when the cases are juxtaposed". When comparing different types of flood events, the associations between pluvial and estuarine flooding may well be influenced by the way in which the risk for each event is framed. This would depend upon whether a reality testhas been experienced, which Lange and Garrelts (2007) advocate as having the potential to alter the stability of the tacit knowledge upon which risk perceptions are based.

Engineered drainage systems can be seen to have undergone such a reality testin 2007, where heavy rainfall across the UK served to highlight that the capacity of the drainage network cannot be accurately calculated (Coulthard *et al.*, 2007a). Maintaining a safety discourse is therefore simply not possible in the face of the uncertainty surrounding the projected increase in higher intensity precipitation, itself a feature attributed to anthropogenic climate change (Stern, 2006; Environment Agency, 2008a). Indeed, fieldwork by Convery and Bailey (2008:107) drew attention to the way in which victims of the 2007 pluvial flooding "spoke candidly about *when* future [pluvial] flooding *will* occur, and not *if* [it will]" (emphasis added), demonstrating that the confidence within the ability of the drainage system to cope with future extreme weather events had been adversely effected.

By contrast, the lack of a reality testfor coastal flooding since the 1953 storm surge may mean that sea defences have not been affected by a more general collapse of confidence in engineered flood protection (Wisner et al., 2004). Research by Terpstra et al. (2009:1142) has shown that the effectiveness of structural protection works, such as coastal flood defences are often overestimated, causing "unrealistically low" flood risk perceptions. Whilst the Oxford English Dictionary defines a flood as "an overflow of a large amount of water beyond its normal limits", which can be applied to both pluvial and estuarine flood events, the safety discourse surrounding the still-effective sea defences may not trigger an associated perception with existing experiences of pluvial flooding which have been experienced under a reality test. In this case, the possibility exists that tacit knowledge gained from pluvial flooding may not be transferable in its use as a heuristic for constructing a perception of estuarine flooding. However, such conclusions remain purely theoretical in the absence of empirical data. Although the nature of Lange and Garrelts' (2007) research is comprehensive in its analysis of separate fluvial and coastal flood risk perceptions, they fail to specifically address issues pertaining to the transfer of knowledge between a type of event which has undergone a reality testand a different event which has not. Despite a wealth of more general literature on tacit knowledge transfer (Loewenstein, 1999; Dhanaraj et al., 2004; Visschers et al., 2007), investigations into the recent pluvial flooding in the UK (Posthumus, 2009; Convery et al., 2010; Whittle et al., 2010) suggest that the way in which experience is gleaned from disasters is culturally, spatially and emotionally specific. However, Terpstra et al. (2009) observe that research concerning tacit knowledge transfer set within the context of natural hazards, such as flooding, is severely lacking – a void in the literature that this thesis specifically addresses.

Thus far in this chapter, risk perceptions have only been addressed through *experience* relating to a specific form of flooding. There is also the question of how knowledge and risk perceptions can transfer between places through the likes of media coverage, for example. Despite the widespread nature of the summer 2007 floods, many people within coastal zones were not directly affected at their homes and places of work. Harvatt et al., (2011:77) found that although "heavy and sustained media coverage of flooding" appeared to raise general awareness of flooding in other parts of the country, it did not sustain individuals' personal concerns sufficiently to raise *local* risk awareness and knowledge. Whilst people could see the effects of flooding in places such as Tewkesbury on their television sets, this knowledge did not appear to transfer in its application to their specific localities. As a result, tacit knowledge of flooding can be seen to be possessed only by "special subgroups of people" (Simmons and Walker, 1999:182), due to the spatially delimited nature of the risk. In such circumstances, it stands to reason that people outside this group would need to obtain knowledge from an alternative source in order to construct a risk perception. Because tacit knowledge derives from the background and experience of individuals, it is highly idiosyncratic and therefore difficult to separate from the people who possess it (Dixon, 2000; Roberts, 2000). Although (Morris, 2006:115) observes that these properties make tacit knowledge "difficult, if not impossible to communicate other than through personal interaction in shared experiences", knowledge can also exist in an explicit form (Dhanaraj et al., 2004). In contrast to tacit knowledge, explicit knowledge is highly codified and is therefore easier to transmit between different individuals due to the use of a formal, systematic language (Polanyi, 1967).

However, despite the observation by Jasimuddin *et al.* (2005) that the categorisation of knowledge into tacit and explicit subsets is well practised, the relationship between these two categories remains open to interpretation. Within an objectivist epistemological

framework, tacit and explicit knowledge are seen by Hislop (2002:166) to represent "two pure and separate forms of knowledge" which possess different characteristics and are shared in different ways.

By contrast, within a practice-based epistemology, tacit knowledge and explicit knowledge are mutually constituted (Tsoukas, 1996). In this sense, they can be thought of as existing in a continuum whereby the two categories of knowledge represent the two extreme points on a linear scale. Without a tacit understanding of the format or language being used to communicate the knowledge, it will merely be interpreted "as a somewhat random series of letters, numbers and images" (Hislop, 2002:169). Thus Polanyi (1969:195) concludes that there is no such thing as fully explicit knowledge, as all knowledge is "either tacit, or rooted in tacit knowledge". This assertion is explored in further detail within the next section through examining the role of explicit knowledge in the construction of flood risk perceptions, in addition to its epistemological positioning in relation to the role of tacit knowledge which has already been explored.

3.4 Explicit knowledge , the role of science and trust

Where personal knowledge is not readily available for people to form risk perceptions, other forms of knowledge may be offered instead. Morris (2006:115) suggests that the most "readily identifiable" type of explicit knowledge is scientific knowledge. In the context of 'new' ecological risks such as anthropogenic climate change, scientific knowledge has already been shown to be highly uncertain in its nature (Beck, 1992). However, this uncertainty has been embraced by the Environment Agency in its designated role as the strategic body for managing flood risk mitigation in England. Brown and Damery (2002:422) note that during the 1990s, the Environment Agency adopted new slogans such as "Flooding - You can't prevent it - You can prepare for it", representing a move away from a

safety discourse of universal flood protection. High profile annual campaigns run by the Environment Agency, such as 'Flood Action Week', have also sought to increase the flow of information to communities at risk from flooding. This has taken place alongside the distribution of regular newsletters and leaflets to people located around many of the low lying English estuaries (Jemmett, 1998; Environment Agency, 2008; Environment Agency 2009a; Lane *et al.*, 2011). The availability of such environmental knowledge is viewed as being essential by Eden (1998:435), as people "depend upon second hand non-experience" due to an inability to perceive risk through their normal senses. However, despite the codified nature of the knowledge which is being transmitted by the Environment Agency, it may still be open to interpretation by the recipient.

Brown and Damery (2002:422) emphasise that an assumption has been made by the Environment Agency that the public are "sufficiently intelligent to obtain, understand and act upon information about flood risk". Yet this is not always the case, with research by Cullman *et al.* (2009:306) drawing attention to the issue that "people are not used to interpreting the statistical meaning of [flood] return periods". Flood return periods are typically used by scientists as an indication of the standard of protection offered by coastal flood defences within specific geographical locations. Whilst these are based upon scientific calculations, allowances have been made for the uncertainty surrounding future sea level change. Consequently this information appears as a *guideline* flood return period within the codified knowledge distributed by the Environment Agency, with the aim of raising awareness and keeping the public informed of flood risk mitigation strategies around the country (Environment Agency, 1999b; Environment Agency, 2000; Environment Agency, 2008b). However, a key process of knowledge interpretation involves the "filtering of datainformation [to decide] what is relevant and what is not" (Hislop, 2002:171). If the recipient has problems in interpreting the meaning of the flood return period, it is highly likely that this piece of information will be ignored. As a result, this could severely jeopardise the rest of the codified information associated with the flood return period, as this value is required in order to provide the temporal context within which the knowledge is set.

The ranges involved within such flood return periods vary considerably. For example, defences protecting agricultural land would give a typical statistical flood return period of just 1 in 5 years, compared to a flood return period of 1 in 200 years for defences protecting a large urban area (Environment Agency, 2000:15). Therefore, if the recipient of the codified knowledge is unable to interpret the way in which the likelihood of the event is communicated, they are likely to end up with an inaccurate perception of the flood risk in their particular locality.

Nevertheless, Hislop (2002:169) states that there will always be an element of ambiguity in the transfer of explicit knowledge "no matter how explicit and well defined the rules are that may guide action". Recipients are therefore required to make inferences and judgments, highlighting that all knowledge has both tacit and explicit components that are not polarised but instead exist in the form of a 'continuum' (Tsoukas, 1996; Jasimuddin *et al.*, 2005). Smith and McCloskey (1998:45) observe that in cases where codified information is incomplete, the unarticulated and uncodified elements are filled with the individual's "own cognitive schema to understand, rationalise and formulate their own judgements". However, in the case of flood risk, if a recipient has no direct or associated tacit knowledge resources to draw upon, they may not be able to bridge the knowledge gap in such a manner. By contrast, those who do possess tacit knowledge of flooding may equally end up formulating an inaccurate risk perception as they draw upon knowledge of coastal flooding that occurred in the distant past, or an 'associated' event that may well have slightly different characteristics (Pottier *et al.*, 2005; Visschers *et al.*, 2007).

A particularly interesting situation arises when an individual receives explicit knowledge in *addition* to the cognitively- based tacit knowledge which they possess. In such circumstances, Yearley (1999) draws attention to the crucial role of trust instilled within the organisation delivering the codified knowledge in terms of whether it:

- 1) Replaces tacit knowledge;
- 2) Is integrated with the tacit knowledge;
- 3) Is rejected in favour of tacit knowledge.

Such judgments of trust are seen by Poortinga and Pidgeon (2003:963) to be primarily based upon whether "the other person or organisation shares the same values" as the recipient of the explicit knowledge. However, this is a particularly fragile construct, with Freudenberg (2001:127) noting that "trust is hard to create, but easy to destroy". As such, negative events which have resulted in a loss of trust remain far more pertinent within collective memory than those which have helped to build it up. Where people feel unsure whether to trust the institution charged with communicating risk through explicit knowledge, Masuda and Garvin (2006) suggest that there is a tendency to rely more upon their social networks than on official sources of information. This was demonstrated by Wynne (1989, 1992b) within his extensive research into the impact of radioactive fallout from the Chernobyl incident on sheep farming practices within the UK. Farmers were distrustful of the expert government scientists in this instance, primarily due to the scientists' inability to recognise that their bureaucratic model, in which "everything is assumed to be subject to standard rules, control, deterministic planning and formal evidence" (Wynne, 1989:37), was culturally and practically incompatible with the values used in hill farming. Research into agricultural land management practice has emphasised the importance of social and natural history, with Burgess et al. (2000:131) summarising that the "tradition of farming is that there has been 'no tradition'". Instead, each farmer has managed their operations drawing upon specific personal and cultural tacit knowledge, as

opposed to employing an industry-wide universal standard. In this sense, the complex cultural experiences related to the way in which people are attached to place allows the public (or in this case farmers) as "non-experts [to] see problems, issues and solutions that experts miss" (Fiorino, 1990:227). Such a framing of risk within a specific place or space, however, can lead to a marked variety of risk perceptions within a given geographical boundary.

Research by Burningham and Thrush (2004) and Parkhill et al. (2010) found that whilst negative features of a local place may be striking for those who do not live in the locality, they may simply be perceived as part of local experience for those people who are habituated to them. One example that has received extensive academic investigation is the perceived risk of nuclear sites by those who live in close proximity to them (Williams et al., 1999; Wynne et al., 2007; Parkhill et al., 2010). History has proven the destructive capability of nuclear technology through the well documented incidents at Hiroshima and Chernobyl, in addition to the more recent crisis at Fukushima Daiichi. Whilst these events have served to reinforce a wariness of nuclear technology amongst the general public, Wynne et al. (2007:26) note that those living locally to nuclear sites (where accidents have not occurred) are "more knowledgeable and more familiar with nuclear [technology] and its risk attributes". This is primarily due to the extensive resources which the nuclear industry have invested into programmes aimed at raising awareness amongst the public living in the vicinity of the plant. Where explicit knowledge from an official source is coupled with complimentary tacit experience, researchers found that in the case of those living near nuclear power stations "the risk that the power station represents is no more of a threat than (for example) using a mobile phone, driving a car or living near another industrial development" (Parkhill et al., 2010:47). However, an alternative academic hypothesis on low risk perceptions amongst residents living near 'risky' facilities concerns a refusal to

overtly criticise an existing facility due to the perceived economic benefits it brings to the area, particularly where a host community is economically marginalised or isolated (Blowers and Leroy 1994; Williams *et al.* 1999; Wynne, 2007). In such a sense, local people have a different sense of risk compared to outsiders because they rely upon the risky facility for their livelihood.

In both of the cases highlighted above, Tran (2009:154) highlights that perceptions of risk held by local people with long term ties to land and physical resources appear to be founded upon knowledge which "is essentially invisible to anyone but the knowledge holders themselves". This may help to explain why the objective and non-geographically embedded approach adopted by the expert scientists in Wynne's (1989) research discounted such non-expert local knowledge possessed by the farmers. When the farmerss then received instructions in the form of explicit knowledge transmitted by the scientists, the conflict in values led them to mistrust and disregard their official advice, causing them to revert back to their existing cognitively based tacit knowledge.

Such conflicts between non-expert and expert values as demonstrated within Wynne's sheep farming case study are far from uncommon. Simmons and Walker (1999:182) note that "sharply conflicting values and strongly divergent interests" typically characterise risk-based public controversies, coupled with low levels of public confidence in the government. However, a certain level of conflict is to be expected considering that private individuals have different decision making processes to the government, exhibiting a tendency to "focus on a narrower self-centred basis" (Tol *et al.*, 2008:436). This is particularly relevant within the context of estuarine flood defences, where there are substantial externalities involved. Brown and Damery (2002:423) note that generally the public appear to "have unrealistic expectations of what bodies like the Environment Agency can achieve" with its

limited public funding and wide ranging portfolio of responsibilities which must all be balanced. This is not helped by the traditional "paternalistic political culture" (Wynne, 1989:37) in the UK, where the government's role is seen primarily as one of assurance (under the guise of the pre-1980s Welfare State), thus helping to reinforce such high public expectations.

In the case of environmental risks, it is generally acknowledged that trust is attributed to the responsible institution on the basis of its perceived competence in carrying out its duty of care to society (Freudenberg, 1993; Johnson, 1999; Bickerstaff *et al.*, 2008). However, under reflexive modernity where flood protection can no longer be guaranteed, the Environment Agency's performance may generate "disappointments when floods continue to occur" (Brown and Damery, 2002:423). This has the potential to create public distrust of the Environment Agency in its role as a management body, as the explicit knowledge they are transmitting cannot be separated from the messenger. In such circumstances the public's willingness to accept the explicit information which the Environment Agency distributes to raise flood risk awareness could be severely dented.

Unlike the farmers within Wynne's (1989, 1992a) research, there is considerable ambiguity surrounding the accuracy of tacit flood risk knowledge, as has been demonstrated earlier within this chapter in terms of a lack of exposure to flood events. However, a comprehensive *tacit* flood risk knowledge is not always necessary in order to reject *explicit* flood risk knowledge. Richardson *et al.* (2003:3) highlight a case whereby the persistence of local rumours regarding the cause of a flood subsequently "undermined the efforts of the [Environment Agency] in communicating risk and addressing the [flood risk] issue effectively". Once the rumours began to circulate, they proved particularly difficult to stop, further degrading the trust between the public and the experts involved as other issues
became drawn into the arena. This situation resulted from the social amplification of risk whereby individuals, groups and institutions can act as "risk amplification or attenuation stations" (Masuda and Garvin, 2006:449), sharing risk perceptions via the communication channels embedded in everyday life. Kasperson (1992) notes that such risk signals can in turn influence the risk perceptions of others, regardless of their accuracy. This has severe implications for the institution embroiled in the process, in this case the Environment Agency, as the public engage in risk association through a semantic network model. Visschers *et al.* (2007:719) explain that if one risk concept is activated, the "activation spreads through the network of nodes and links so that other related concepts are activated". Other unpopular incidents which the Environment Agency has been involved in locally can therefore be brought to the surface, further damaging the trust held in the institution.

In order to avoid such situations, Richardson *et al.* (2003:3) recommend that a balance should be sought to simultaneously promote the "preparedness of the public and their potential for self and mutual assistance", whilst countering the likelihood of increasing feelings of anxiety, disempowerment and apathy. This focuses upon better methods of communication between the Environment Agency (in its expert capacity) and local (nonexpert) individuals. Since the early 2000s, the Environment Agency has placed considerable emphasis on consultation with those located in coastal areas where new strategies for flood risk mitigation have been put in place (Myatt *et al.*, 2003a; Myatt *et al.*, 2003b; Environment Agency, 2008b). This has been introduced alongside the existing approach of leafleting, which the Environment Agency employs as their primary method of explicit flood risk knowledge communication. Whilst Irwin (1995:87) sees the distribution of leaflets as a "model of informing rather than empowering the public", the provision of consultation sessions by the Environment Agency offers the individual in receipt of the information an

opportunity to become a 'participant' as opposed to a 'witness' of explicit knowledge. Evidence from research by Myatt et al., (2003a:580) has shown that whilst consultation is generally well received and presents a "good opportunity for the public to express their concerns... many residents [still] did not believe that they would experience catastrophic flooding in their lifetime". Harvatt et al. (2011:73) found similar results, where out of the total number of people who had seen the explicit knowledge provided by the Environment Agency "few seemed to be using it to determine their personal risk and none discussed the information in terms of personal preparation for floods". However, it was particularly interesting that in such cases the trust held in the Environment Agency did not appear to falter. In Harvatt et al.'s (2011:73) research, the majority of residents perceived that the Environment Agency should still be the primary source of risk information, with typical respondent comments such as "I don't see who else you could make responsible for this sort of specialist thing". As such, these findings suggest that the way in which the Environment Agency engage with the public can also influence the trust instilled in them, even when the uptake of the explicit knowledge that they are transmitting appears to be low.

The academic literature covered so far has served to outline a complex picture of the interrelations between tacit and explicit knowledge. However in doing so it has only outlined the perception of a *risk event*, as opposed to perceptions of the *consequences of* and the *recovery from* a risk event. These are also important in relation to the governance of flood risk in the way that they impact upon the vulnerability and resilience of society, two concepts which are examined in greater detail in the next section.

3.5 Vulnerability, resilience and recovery

Both vulnerability and resilience share an underlying fundamental principle whereby disasters are not merely seen as being a product of natural hazards alone. Indeed, when considered purely in their physical form which is isolated from the human world, Green (2004:324) highlights that occurrences of floods and droughts can be seen "simply [as] labels given to extremes in river flow". Wisner *et al.* (2004:4) emphasise that in addition to their natural properties, disasters are also caused by the product of social, political and economic environments due to the way in which these "structure the lives of different groups of people". In this sense, Miller *et al.* (2010:12) note that the concept of a 'socio-ecological system' is now commonly used in both vulnerability and resilience research to "stress the integration and linkages between social and ecological components of systems". However, the literature exploring the individual concepts of vulnerability and resilience, and indeed how they are related, is far from clear in its terminology.

In a similar vein to the concept of sustainable development that was explored in Chapter Two, vulnerability and resilience have been researched within a wide range of academic disciplines. This has resulted in a tendency for the different research communities to redefine concepts in terms of their own language, creating a conceptual 'fuzziness' which hinders understanding and communication (Walker, 2004; Gallopín, 2006; Miller *et al.*, 2010). Amongst the wide range of definitions that are provided for both vulnerability and resilience, I have selected the following two based upon their relevance to the issue of climate change and their clarity of explanation:

1) Vulnerability is conceptualised by Adger (2006:269) as "the degree to which a system is susceptible to and is unable to cope with adverse effects of climate change".

2) Resilience is defined by Walker *et al.* (2004:2) as "the capacity of a system to absorb disturbance and reorganise while undergoing change so as to still retain essentially the same function, structure, identity and feedbacks".

From these two definitions, a clear overlap in the use of key terms is shown with, Miller *et al.* (2010:3) highlighting that there is an "overriding concern with the response of systems to stress or perturbations" in both concepts. Some researchers have considered vulnerability and resilience to be the inverse of each other, whereby the two concepts are seen as occupying opposite poles on a continuum (Folke *et al.* 2002; O'Brien *et al.*, 2004). However, the relationship between vulnerability and resilience is not necessarily symmetrical or straightforward. Whittle *et al.* (2010:15) caution that a community could be considered *resilient* in the case of having a strong support network to enable it to deal with a crisis, "but nonetheless could find itself more *vulnerable* than other communities to the event of a crisis" such as the impact of a natural hazard caused by a failure in infrastructure.

Research concerning coastal flood events has primarily focussed upon the key concepts of "exposure, sensitivity, coping and adaptive capacity" (Miller *et al.* (2010:4) in determining vulnerability within a social-ecological system. Less economically developed countries (LEDCs) have featured widely in these investigations, as they are generally seen as being more vulnerable to flooding than more developed countries in terms of their geographical location within hazard-prone areas of the globe, coupled with limited resources to cope in the event of a disaster (Bankoff, 2001; Wisner, 2004; Lumbroso *et al.*, 2008; Rayhan, 2010). In the Philippines, Bankoff (2000:265) observes that hazard and disaster are "simply accepted aspects of daily life [in] what can be termed as *a frequent life experience*" (emphasis in original). Although Filipino communities are seen as being vulnerable in terms of having little in the way of resources to develop technological solutions to the hazard of

flooding, they have developed "coping practices" (Bankoff, 2000:268) based upon the observation that what has happened in the past is likely to happen again in the future. An example of one such 'coping practice' is the use of traditional farming techniques, whereby crop diversity is maintained in order to provide a secure food supply. This awareness of hazard and vulnerability has fostered an ability to *learn from* disasters, with Allen (2006:86) highlighting that community members "who perceive their lives or livelihoods to be especially vulnerable to hazards are more likely to cooperate in relevant disaster preparedness" than those who are not. As a result, although Filipino communities can be considered as vulnerable to flooding, the use of coping strategies demonstrates a form of resilience through Walker *et al.*'s (2002:4) definition of a "capacity to absorb disturbance" built upon a knowledge of the consequences of flooding.

By contrast, vulnerability and resilience to coastal flooding is very different in the UK. The absence of tropical storms, combined with technological solutions in the form of engineered defences, mean that flooding is viewed as an unusual experience as opposed to part of everyday life (Brown and Damery, 2002; French, 2004). Therefore the environmental governance of the past, whereby the state has shouldered much of the responsibility for flood protection under a safety discourse, can be seen to have undermined people's abilities to deal with environmental problems (Myatt *at al.* 2003a, 2003b). This has also been reinforced by the role of the insurance industry, whereby the current 'bundle' system of UK property insurance means that cover for flooding has traditionally been automatically included in policies, alongside other perils such as fires, storms and earthquakes (Crichton, 2008). As a result of this shielding, coping strategies for flooding have not developed amongst the UK population. This may well impact upon the vulnerability and resilience of coastal communities, as the effectiveness of technological solutions in preventing disaster is

no longer guaranteed in the face of increasingly severe and frequent flooding events brought about by climate change.

Recent research within this field in the UK has tended to concentrate upon *social* vulnerability and how this transfers into vulnerability to *flooding* (Fielding and Burningham, 2005; Walker *et al.*, 2006; Whittle *et al.*, 2010). Some 2 million homes (10% of homes within the UK) are currently at risk from coastal flooding (Clemo, 2008). Indeed, the majority of the population who were found to be most vulnerable to coastal flooding in the UK were shown by Walker *et al.* (2006) to be suffering from social and economic deprivation. This included social groups such as the elderly and ethnic minorities, who are vulnerable in the sense that they demonstrate a "lack of resources to protect, insure or repair property" (Whittle *et al.*, 2010:10), therefore affecting their capacity to adapt and recover from a flood. However, this situation is suggested to have been exacerbated by Planning Policy Statement 25 (PPS25) which, ironically, was launched by the government to *reduce* vulnerability through limiting development carried out in areas most liable to flooding (CLG, 2006b). Although Bosher *et al.* (2009:18) observe that PPS25 has helped to incorporate flood risk into the planning process, "it will still permit development in floodplains if there is nowhere safer to build".

The insurance industry warned the UK government and planning authorities that from the beginning of 2006, they would no longer be able to guarantee to provide quotes for any properties within areas where the flood return period is greater than 1 in 75 years, irrespective of whether new flood defences are constructed (AXA, 2006). As a result, Crichton (2008:125) explains that property developers are increasingly using areas prone to flooding "for social-rented housing for low-income families and the elderly", as they cannot sell new houses to private buyers in locations where they are unable to get insurance in

order to secure a mortgage. This practice therefore increases the vulnerability of coastal areas to the impacts of flooding, which in turn may have a knock-on effect on the local economy. Convery and Bailey (2008:101) emphasise that peoples' needs are grounded in the nature of their lives before the impact of a disaster, notably in terms of their "employment status, financial resources, social supports, legal entitlements and housing situation". With businesses often proving crucial for social cohesion in deprived areas (Crichton, 2008:125), companies (predominantly SMEs) are following customers into locations where they are in turn increasing their own exposure to flooding. Along with their neighbouring customers, Clemo (2008) and Zhang (2009) observe that small-scale businesses are often ill-equipped in terms of resources to draw upon in the event that their business premises are flooded. These matters are not helped by the fact that 90% of SMEs were revealed to be 'under-insured' for flood damage to their properties in 2005 (Clemo, 2008:111). However, with over 70% of the same SMEs also reporting that they were "not concerned that flooding would affect them" (*Ibid*), there appears to be lack of recognition of their own vulnerability to flooding.

Although it has already been established that there are issues pertaining to the recognition of the hazard of flooding due to flood risk perceptions based upon tacit and explicit knowledge, Coulthard *et al.* (2007a:7) note that an understanding of vulnerability/ resilience is also required in the construction of risk as determined by the following equation:

Risk = (Vulnerability/Resilience) x Hazard

Whilst Fielding and Burningham (2005:383) observe that vulnerable actors within society are likely to be "less aware" of explicit flood risk information, Walker (2006:71) suggests

that this can be tackled through targeting vulnerable groups such as the elderly "with a range of initiatives to improve awareness of flooding". However, this may be problematic as Polanyi (1969) asserts that there are limits to the amount and type of information that can be shared, with some concepts remaining incommunicable.

This is particularly salient in research examining the vulnerability and resilience within the recovery processes involved in recent pluvial flooding within the UK. Research by Whittle et al. (2010:129) emphasised the considerable "lack of space given to people during the [flood] recovery process to talk about and share their experiences", highlighting that this type of knowledge is not easily transferred or stored. The effects of pluvial flooding were seen to percolate into peoples' everyday routines for a prolonged period of time after the waters had subsided, with Convery and Bailey (2008:100) remarking that flooding "did not represent the 'big bang' incident" that emergency planning managers had been expecting. Whittle et al. (2010:46) explain that those who were flooded were not affected so much by the floods themselves, but what happened afterwards in terms of the "struggles with insurers, loss adjusters and builders" that caused real problems in their emotional and mental wellbeing. Additional long-term responsibilities were created in dealing with these issues, on top of managing the usual tasks associated with work, school and home life. Zhang (2009:43) notes that damage to dwellings can cause victims to "move into temporary housing for lengthy periods of time", or may even force a permanent relocation, causing problems not only for those directly affected by disasters such as flooding, but also those *indirectly* affected such as employers.

The plethora of tasks which need attention in such circumstances mean that the general recovery process of those who were flooded was also shown to be far from linear, as in the sense that things progressively improve until the affected person can be observed to have

returned to a sense of normality. Instead, a participant in Whittle *et al.*'s (2010:54) research described the process of recovering from a flood as more like "a frustrating game of snakes and ladders", whereby apparent progress can be followed by devastating setbacks, and vice versa". Although this was particularly stressful for all those involved, people who were more socially vulnerable were seen to encounter additional problems due to their lack of resources, reliance upon others and an inability to take personal control of the recovery process. In turn this served to damage trust in institutions, with Whittle *et al.* (2010:106) giving one example of a council tenant in her 70s who "felt so let down by the local authority that she said she would not be voting in the 2008 local elections for the first time in her life".

The emotions evoked through the experience of *recovering* from pluvial flooding were seen to have a major impact upon the risk perceptions of those affected, supporting Masuda and Garvin's (2006:449) assertion that risk perceptions are "based upon complex cultural experiences related to how people are attached to place". This is a far cry from Beck's (1992) 'boomerang effect' which advocates that all actors within society will be equally exposed to new ecological risks stemming from the process of modernisation. Instead, it can be seen that the perception of flooding does not simply depend upon whether the event takes place, but upon what people do (or can do) in the way of preparation and recovery. This can make the resulting damage more or less severe, which in turn is particularly important in establishing flood risk perceptions. However, a paradox exists in such circumstances, with Hoffman *et al.* (2009:257-258) noting that without awareness there will be no concern, and without concern there will be no adaptation.

The ensuing economic and social damage that may be caused through vulnerability and a lack of resilience to flooding has led to governance becoming a central concern to each of

the two concepts (Folke *et al.*, 2005; Miller *et al.*, 2010). Where human settlements have been developed, there is generally a large inertia against relocation when substantial levels of investment have been made (Wisner et al., 2004), placing an increased emphasis on loss reduction strategies to help reduce risk. In this instance, Klein (2003:112) notes that responses to environmental change are "shaped by what is likely to be politically palatable in the near term, rather than by the nature and the scale of the threat itself". Therefore, the governance of flood risk mitigation can be seen less as responding to an emergency and more about a strategy of building resilience, which is defined by Medd and Marvin (2005:45) as "the ability at every relevant level to detect, prevent, and if necessary, to handle and recover from disruptive challenges". However, resilience is not always in the interest of all stakeholders, as adaptive capacity to climate change requires economic wealth, technology and infrastructure and the sharing of information and skills between institutions (Klein, 2003; Miller et al., 2010). Whilst some individuals may want to reduce flood risk through private measures, others may not, as risk judgements vary between different groups due to "different intuitive behaviour and... specific power constellations and positions of interest" (Messner and Meyer, 2006:152). The implications of translating resilience into policy and practice within the current tri-partite system of governance comprising the public, private and voluntary sectors therefore requires further examination.

Having provided a general overview of how flood risk perceptions are constructed, the next section addresses the specific way in which flood risk is perceived by businesses

3.6 Risk in a business specific context

Although research has been undertaken to examine the ways in which environmental policy can impact upon business operations (Patton *et* al., 1994; Tilley, 1999; Petts, 1998; Petts *et al.*, 1999, Brunnermeier and Levinson, 2004), there is a gap in the academic literature

examining *business perceptions* of environmental risk. Zhang *et al.* (2009:38) note that disaster research has been "disproportionately focused on units of analysis such as families, households and government agencies"; with little consideration of the effects disasters may have upon businesses. As such, the risk perception literature covered so far within this chapter has examined the much wider body of research related to the *public* perception of risk. Although those who work within businesses are ultimately members of the public, it has been shown that geographically embedded knowledge generated from the experience of everyday life (Wynne, 1992a and 1992b; Irwin *et al.* 1999) can influence perceptions of risk. This therefore raises the possibility that business people may perceive flood risk differently to the public in terms of their habituation to the various risks involved in overseeing the day to day running of a company.

Romilly (2007:474) observes that risk is a pervasive feature in business decision-making, with a need to deal with "political, commercial, macroeconomic and external risk" as a part of core business operations. Although *all* economic actors have to deal with risk and uncertainty, the approach that companies adopt in doing so has been observed to differ depending upon business size. In some companies the practice of 'scenario analysis' is used, whereby long term strategic plans are drawn up in a bid to cope with any unexpected changes that may arise in the future corporate environment (Foster, 1993; Bradfield *et al.*, 2005). Whilst forecasts are "based upon the belief that the future can be measured and controlled... scenarios are based on the belief that it can not" (Beck, 1982:18), and rely upon complicated modelling techniques such as intuitive logics, trend-impact analysis and crossimpact analysis. However, these techniques require extensive company resources and long strategic planning horizons, with the use of 'scenario analysis' being most prevalent amongst large multinational "capital intensive industries" (Bradfield *et al.*, 2005:804), such as the oil, automotive and utilities sectors. Although these companies play an important

role in terms of inward investment (as discussed in Chapter Two), they only comprise a small fraction of the total number of businesses operating within the economy, many of whom do not use similar methods to address their business risks.

In the UK, 99.9% of all private enterprises are SMEs (Small-Medium Enterprises²), with 96% of these classed as 'micro' companies employing less than ten people in total (DBIS, 2009). Understanding the way in which these businesses deal with risk is particularly important within the context of this project, due to the emphasis that Regional Economic Strategies place upon the role of SMEs in promoting economic development throughout the UK (Jonas *et al.*, 2002; Berry and Perren, 2003; Beaver and Prince, 2004; Reijonen and Komppula, 2007). Smaller businesses are largely unable to employ scenario analysis methods in dealing with risk, due to the technical nature of the exercise and the resources required. Moreover, Needle (2004:150) observes that within the USA, Canada and the UK, small businesses tend to follow "short term strategies" rather than the long term planning favoured by business managers in countries such as Japan, Singapore and South Korea. Foster (1993:123) suggests that this framing of SMEs as "reluctant planners" is attributable to the way in which managers are often too busy with concerns related to the immediate work involved in running the business to bother with long term planning.

It can be seen that the smaller the organisation is, the more holistic the task of the manager becomes, with the self employed business owners representing an extreme in being omnipresent in every part of the business operation (Hill and McGowan, 1999; Gibb, 2000). The pressure to manage short-term business operations amongst SMEs is highlighted in research by Van Praag (2003:1), which found that out of every "100 SME start ups, only 50

² An SME is defined by the DBIS (2009) as a company with less than 250 employees

firms survive the first three years". The most prominent reason for business failure has repeatedly been identified as the company's inability to earn enough money, coupled with poor trading conditions in the economy (Watson et al., 1998; Van Praag, 2003; Van Gelderen et al., 2006). However, even amongst SMEs which are making enough money to continue operating, the primary focus of owner managers still appears to be fixed firmly upon daily business operations. Needle (2004:232) explains that this is largely due to the way in which most small businesses can be typified as "lifestyle firms", whereby the business person is not pursuing dynamic growth. Instead, being self-employed is viewed as a preferred alternative to working for someone else. Many small business owners therefore run their companies in order to maintain an adequate level of income, with very little consideration for planning future expansion or diversification of the business. In the context of managing the economic and political risks associated with SME business operations, Needle (2004:106) suggests that most managers "tend to be reactive as opposed to proactive" in their approach. In the absence of instruction from above, SME owners can be seen as having to "learn on the job" (Van Praag, 2003:13) from mistakes which they make in the absence of prior experience. Whilst such a lack of experience can initially prove detrimental, in terms of the company failing through poorly informed decision making, once a business has "survived the first few years its chances of failing are significantly reduced" (Everett and Watson, 1998:358). In this sense, once established, the average owner manager of an SME is likely to remain in place for a long period of time (Gibb, 2000), allowing them to build up a tacit business knowledge based upon the personal experience of the consequences of their decisions. Sarasvathy (1998:217) observes that this allows entrepreneurs "to accept risk as a given and focus on controlling outcomes" framed within their personal cognitive values. However, whilst experience is particularly effective in developing a capacity to learn as a business, it does pose a potential problem if the business

is taken over or transferred to another person, as the "displacement of people translates into a loss of tacit knowledge" (Boiral, 2002:296).

Nevertheless, this can also be seen to be a business risk control mechanism. Knowledge in its tacit form is particularly important within the business arena, as the main source of competitive advantage between businesses is determined by the operational knowledge held within each organisation (Dhanaraj *et al.*, 2004; Jasimuddin *et al.*, 2005). Therefore, there is general reluctance to share knowledge within the economy due to the fear of losing power and status (Szulanski, 1996). Keeping business knowledge in a tacit format is seen as "secure and strategically significant" (Jasimuddin *et al.*, 2005:105), since other organisations would find it difficult to understand and imitate. In this sense, the knowledge locked within the tacit experiences of the current owner manager of an SME may result in the "beliefs, preferences and expertise of the entrepreneur" being reflected as those of the enterprise itself (Reijonen and Komppula, 2007:692). This could carry important implications in terms of forming flood risk perceptions, as owner managers' experience may also include encounters with environmental risk alongside the more commonplace economic and political risks dealt with by the business.

The tacit knowledge of coastal flooding amongst individual business people may well be considerably less than that of the general public. Although Gray (2005:4) notes that "retirement ceilings do not apply to the self employed or to the owners of small firms", research shows that many owner managers begin to implement their retirement plans not long after turning fifty. This would mean that in many cases, the older members of society who may still possess tacit knowledge of the 1953 floods (irrespective of whether this is now viewed as a freak event) are no longer part of the business community. Despite the observation that sole traders were often found to want to close their business upon

retirement, those operating firms with employees other than themselves were more likely to want to either sell the business or pass it on to a member of their family (Gray, 2005). However, the way in which tacit knowledge has been shown to be locked in to owner managers within businesses may well (intentionally or unintentionally) limit the retiring owner in passing on their business experiences (which could include that of coastal flooding) to the *new* owner.

This issue of lost knowledge may also exist in relation to pluvial flooding, although perhaps to a lesser extent as new people taking over such businesses may bring their own personal experience to the company from events which are still within recent memory. In any case, such tacit knowledge transfer requires further investigation, especially in terms of any variations that may be apparent between different industries. The only industry specific literature currently available on this subject, concerns the transfer of tacit knowledge within the agricultural sector. Although not considered a typical SME for the "generation of the enterprise economy" (Beaver and Prince, 2004:34) due to the traditional nature of its operations and considerable barriers to entry, agricultural businesses still fall into the SME classification in the way that they typically employ far less than 250 people. Within this sector, Riley (2008:1283) notes that a large majority of farmers have a long family history on their farms with "a narrative of continuity that accentuated the long-term, continuous and unchanging nature of their occupancy and management". Therefore, the sharing of tacit knowledge through history can be seen to have blurred the boundaries between the past and the present with the two becoming inseparable in terms of practices used in farming the land (Morris, 2006; Riley, 2008). However, this approach may well be due to the way in which agriculture is geographically embedded within the rural environment, which may in turn result in a greater awareness of environmental risks.

Linnenluecke (2011:124) observes that when considering the operations of an (urban) business, firms are often assumed to be operating within an economy "disconnected from the natural environment". Indeed, research by Husted (2008:18) concluded that the SME sector is "oblivious to the importance of sustainability and difficult to reach, mobilise or engage in any improvements to do with the environment". However, this appears to be far from the case amongst larger businesses. Companies which have major technological activities can be seen to be far more conscious of the environment than their fellow SMEs due to "explicit legislative requirements" (Patton and Baron, 1995:42). The introduction of COMAH (Control of Major Accidents Hazards) legislation in the UK in 1999 for example, contains stringent guidelines on regulating high hazard industries, such as the petrochemicals sector, in order to avoid cases of environmental contamination (HSE, 1999). This includes the need to mitigate flood risk at the site involved, therefore incorporating *external* environmental risks with *internal* risks concerned with the physical operations occurring at such sites.

In addition to the heavy legislation governing some larger industries, there is a propensity towards a greater environmental consciousness due to the firm's "self impact on the environment" (Patton and Baron, 1995:42). The issue of company image is paramount in markets where stakeholders and customers are becoming increasingly environmentally aware, as demonstrated by the corporate identity damage caused by the Exxon Valdez and the more recent Deepwater Horizon incident in the Gulf of Mexico. Through the use of environmental audits and the adoption of Corporate Social Responsibility (CSR) firms can seek to improve their environmental image, thus accomplishing "social benefits" (Husted, 2005:177) and strengthening the traditional economic gains which the firm seeks through an opportunity "to expand and grow in the future" (Kogut, 1991:21). The impact of both legislation and CSR upon larger companies is likely to ensure that environmental risks

remain on business radars. However, these practices may be of little relevance to SMEs, therefore serving to keep environmental risks low on their agenda with perceptions firmly rooted within tacit experience.

Petts *et al.* (1999:16) note that contrary to larger firms, "the majority of SMEs are subject to no direct or permit-based regulation" due to their small scale operations. CSR is also likely to be a lower priority due to the scale at which SMEs operate, coupled with the increased control the owner manager has over the firm in place of the role of shareholders and stakeholders (Tilley, 1999; Husted, 2008). Nevertheless, this is not to suggest that SMEs have no desire to operate in an environmentally responsible manner. Petts *et al.* (1999:19) found that 84% of SME managers "were 'concerned' about the environment", which correlated closely with results from surveys targeted at the general public. However, many owner managers foresee no threats to their companies from the environment (Tilley, 1999). This may well pose future problems, as climate change poses novel risks with Linnenluecke (2011:125) asserting that "firms might not be able to withstand [these] impacts by using traditional practices" to adapt which are rooted within their tacit knowledge.

The integration of any environmental mitigation strategies for environmental risks into SMEs is further hampered by findings that self-regulation within businesses is not only dependent upon the owner manager's motivation, but also upon "skills, money, knowledge and feasibility" (Petts *et al.*, 1999:16). As SMEs have already been demonstrated to be preoccupied with the short term issues involved with the day to day running of their businesses, non-essential planning tasks are likely to be ignored, especially when investment within hazard mitigation is likely to "decrease short term profitability" (Zhang, 2009:52). This is supported by Petts *et* al.'s (1999) observation that environmental risks are

often framed by SMEs within terms of compliance with regulations³. In this sense, regulation concerning environmental risks may well be required to encourage innovation, with SMEs being more likely to take action when threatened by "strong external forces such as prosecution" (Tilley, 1999:241).

Such reliance upon regulation may not bode particularly well for raising flood risk perceptions within SMEs, as currently the only legislation that applies in terms of decreasing the vulnerability of businesses to flooding is that of PPS25. However, weaknesses within PPS25 have been highlighted by Bosher *et al.* (2009), whereby SMEs may still be able to locate within higher risk areas as they are drawn to locations based upon factors such as the proximity to customer bases, access to local amenities and proximity to the owner manager's home (Mazzarol and Choo, 2003). Even though SMEs are unlikely to have an accurate flood risk perception due to their reliance upon tacit knowledge, research by Ashcroft *et al.* (2009:1085) have shown that "individuals who indicate a willingness to take risks are more than one and a half times likely to be self-employed". This raises the possibility that even if SME owner managers have accurate perceptions of flood risk, they may be less averse to locating in flood risk prone areas than the other groups within society.

Brouwer *et al.* (2004) suggest that small firms may be more adaptable in terms of their business locations than larger firms, as they have less demanding premise requirements and less capital investment to write off should they have to relocate. By contrast, Zheng (2009) views larger firms with greater fixed assets as having a lower mobility, which could result in more extensive damage during a disaster such as a flood event. However, whether these observations manifest themselves in business flood risk perceptions is unclear, as a lack of

³ The regulations in this instance also apply to other members of society, and are not industry specific (waste disposal, recycling etc.) as opposed to the likes of COMAH.

tacit knowledge concerning flood risk may mean that the business managers are unaware of their vulnerability. Although planning legislation such as PPS25 and COMAH may well impact a larger firm in its ability to locate in certain areas, Brunnermeier and Levinson (2004:7) conclude that "environmental regulations have little effect on locational decisions" due to the compliance costs being relatively small. With foreign multinational companies ultimately investing in production facilities "to take advantage of the foreign countries' endowment of resources and geographical positions which create locational advantages" (Friedman *et al.*, 1992:406), these factors may outweigh any costs involved with environmental regulations.

However, whilst assumptions can be drawn between general environmental risk and business location, further research is clearly needed to determine whether business flood risk perceptions are formulated in a similar manner. This in turn will allow the governance process of flood risk mitigation to be understood through the ways in which businesses may or may not relate to the issues under discussion, as well the implications this may have on economic development.

3.7 Summary

This chapter has highlighted how risk encountered within society has been reconceptualised from a factor that can be controlled by expert knowledge and engineering under the safety discourse, to a factor which is uncertain and unavoidable under reflexive modernity. Parallels with the neoliberal shift in economic policy discussed in Chapter Two have been drawn, whereby state control of risk has been relaxed and responsibility has been distributed amongst other sectors within society. However, the safety discourse can be seen to have left a gulf in the public experiences of risk which are crucial for the formation of accurate perceptions related to coastal flooding. Although experiences of recent pluvial flooding events may allow for the rudimentary construction of a perception of coastal flood risk through a process of 'risk association', the accuracy of such an approach, and indeed whether coastal and flooding risks are even deemed to share similar characteristics is unclear.

Institutions such as the Environment Agency have attempted to raise awareness of flood risk by addressing the gap in experiences through the distribution of explicit knowledge. However, issues of trust between the recipient of explicit knowledge and the institution transmitting it have been shown to be crucial in such situations. Where the trust in the institution distributing the risk information has been damaged, people have been shown to revert back to their tacit knowledge, irrespective of its accuracy. Nevertheless, even in instances where trust has developed between the public and the environment agency, the uptake of flood risk information has been shown to be low.

This could be due to the way in which explicit knowledge is still dependent upon tacit understanding in terms of establishing the context of such information. Although risk perceptions are constructed in relation to the understanding of the hazard in question, in this case coastal flooding, they also depend upon the vulnerability of the person or social group who may be affected. However, whether such individuals or groups see themselves as vulnerable is questionable. Whilst residents of LEDCs may be thought of as more vulnerable to disasters such as flooding than those in the UK, their habituation to flood hazard develops coping strategies which can help to promote resilience. Within the UK where there is little tacit understanding of estuarine flood events, individuals may have difficulty judging how they will be affected, as well as demonstrating a limited capacity to adapt in the form of resilience. The role of insurance in reducing vulnerability and bolstering resilience has also be shown to be problematic, in terms of the way in which the cover

currently held by people and businesses is often inadequate. This is a particularly salient point for small businesses, as literature has shown that they may well lack the resources necessary to recover in the event of a flood. Whilst larger businesses have been shown to have a higher environmental awareness, which may in turn lead to higher perceptions of flood risk, smaller businesses have been shown to rely upon tacit knowledge in creating risk perceptions. The lack of environmental regulation applicable to SMEs, and the preoccupation of owner managers with running their daily business operations, is in turn likely to result in a low environmental awareness which could therefore lower flood risk perceptions. This is especially likely in the way in which tacit knowledges appear to be locked in to specific owner managers, coupled with the high probability that older members of society who experienced earlier coastal flooding are no longer employed within businesses. However, these observations are drawn upon literature examining general business risk attitudes and the way in which environmental risk features within them.

Throughout the chapter a number of shortcomings in existing literature have been identified including; the way in which tacit knowledge transfers between different flood events, the way in which resilience to flooding translates into policy and practice; and the transfer of tacit knowledge between owner managers within their individual businesses. A specific examination of business perceptions of risk is also required in order to boost the existing literature relating to more general economic, political and environmental risks which businesses deal with. This is addressed in the next chapter which lays out the methodology for answering the research questions (listed in Chapter One) designed to explore these issues further.

Chapter Four Research Design and Methodology

4.1 Introduction

This chapter details the methodological approach I adopted to address the research questions identified in Chapter One. A complete overview of the research design used to gather the empirical data is provided, starting with the rationale behind the study area in Section 4.2. After examining the methods used in other prominent risk perception research, I decided to collect my data using a mixed methods approach which is explained in Section 4.3. Section 4.4 discusses the sampling methods I used, whilst Section 4.5 introduces the quantitative aspect of the research in the form of a large-scale postal questionnaire survey. The questionnaire survey consequently provided a sampling frame for the qualitative phase of the research, through self-selection for semi-structured in-depth interviews. Section 4.6 discusses the principles for self-selection sampling and the format that I followed when conducting the semi-structured interviews. Risk and ethical considerations arising from the research design are addressed in Section 4.7, whilst Section 4.8 discusses the weaknesses and limitations of the research methods used. The chapter concludes with a brief summary presented in Section 4.10.

4.2 Project study area

The Humber estuary is home to the largest ports complex in the UK in terms of tonnage handled (Humber Economic Partnership, 2010a) with major facilities at Immingham, Hull, Grimsby and Goole (Figure 4.1).



Figure 4.1 - Map of the Humber estuary region Source: Digimap[®] Carto

Port related activities have long played a key role in the Humber economy, with trading links between Hull and northern Europe dating back to the medieval era. On the north bank of the estuary, Hull retained its importance as a major whaling centre up to the mid 1800s, by which time emphasis had shifted more towards deep sea trawling. The fisheries industry was also a major economic staple on the south bank of the Humber, with Grimsby landing over 20% of Britain's fish up until the 1970s, (Yorkshire Futures, 2008:

<u>http://www.lmihumber.co.uk/where i_live/</u>). However, the Icelandic cod wars saw the start of a major decline in the fisheries industry and led to diversification in port related activities from the late 1970s onwards.

The main urban areas around the Humber estuary are Hull (population: 258, 700), Grimsby-Cleethorpes (population: 140,000), Scunthorpe (population: 73,000), Goole (population: 19,000) and Immingham (population: 11,000). Four unitary authorities cover the Humber region: East Riding of Yorkshire Council, Hull City Council, North Lincolnshire Council and North East Lincolnshire Council (Figure 4.1), each of which is responsible for planning policy within their geographic boundaries. Collectively their outer boundaries mirror the now defunct county council of Humberside, and delineate the Humber 'sub' region from the wider Yorkshire and Humber region which came under the auspice of the Yorkshire Forward, the Regional Development Agency (RDA). At the time that this research took place, all four unitary authorities worked closely with Yorkshire Forward and each other to ensure the coordination of economic development within the Humber region through the common 'Hull and Humber City Region' economic policy. The Hull and Humber City Region was one of three distinct city regions within the Yorkshire Forward RDA's boundaries, and after much deliberation over whether the four unitary authorities should continue to work together on both sides of the estuary (Bentley et al., 2010), a Humber LEP was eventually formed which mirrored the borders of the Hull and Humber City Region under the now defunct Yorkshire

Forward RDA, retaining the same constituent local authorities and businesses. The objectives of the new Humber LEPs are still dominated by the 'Global Gateway UK' portbased development programme, which is part of the wider governance-based Northern Way strategy initiated by John Prescott in 2004 and previously overseen by Yorkshire Forward.

The largest of the four ports on the Humber is Immingham, followed by Hull, then Grimsby and finally Goole, which is the smallest port and the furthest from the estuary mouth. Associated British Ports (ABP) own all four port sites and have invested heavily in new infrastructure and facilities to improve their facilities as the importance of the old staple fishing trade has declined. The year 2000 saw the opening of the Humber International Terminal at Immingham, providing specialist handling capabilities for the importation and transfer of bulk solid fuels, whilst further east Grimsby's special vehicle handling facility is now home to Volkswagen's northern UK distribution centre, with over 350,000 cars being imported each year (Commerce and Industry, 2009:13). The unique facilities offered by the Humber ports, in conjunction with the availability of vast quantities of flat, cheap land adjacent to the estuary, have attracted other large scale industries to the region from the 1960s onwards (Bache, 2000; Dijkema, 2005). Much of this has been facilitated by local government-led inward investment initiatives, resulting in a large cluster of chemical and oil refining plants on the south bank of the Estuary between Immingham and Grimsby. Although such redistributive economic policy had some success at quelling the high levels of unemployment caused by the collapse of traditional fishing and heavy industries in the region, it can also be seen to have created an unusual situation where the transition towards a Post-Fordist economic model has not been as fully realised as in other areas of the UK. Crone and Watts (2003:17) explain that although inward investment can stimulate the host economy by promoting job growth "among regional suppliers and acting as a

conduit for knowledge transfers", Gibbs *et al.* (2007:348) suggests that such practices may well have played a role in the "weakness of Small and Medium Enterprises (SMEs) in the [Humber] region".

SMEs play a pivotal role in the economic development policies of Post-Fordism, with the Yorkshire Forward RDA (and its successor Humber LEP) both pursuing the further development of such businesses within an expanding knowledge economy focussed on specialist products (Haughton and Counsell, 2006; Yorkshire Forward, 2006). However, the Humber regional economy (in its present guise) is unique in having a relatively high manufacturing base; employing 17% of the regional workforce as opposed to the national UK average of 10% (Humber Economic Partnership, 2010b:2). Although service sector growth in the region during the 1990s "mirrored the national pattern" (Gibbs *et al.*, 2001:109), due to the much lower base from which it started, the current overall representation of the service sector in the Humber region still remains low. For example, only 24% of Humber businesses are in financial services, as opposed to the national average of 34% (Humber Economic Partnership, 2010b:10). The Humber economy can be seen to demonstrate the typical characteristics associated with a Northern region in the UK, namely in not having embraced the transition from traditional industry towards a more entrepreneurial economy to the same extent as areas in the south east of the country (Haughton and Counsell, 2003). This is reflected in the Humber region's economic performance in terms of Gross Value Added per capita of £15,426 which is substantially lower than the national average of £20,046.

With a regional unemployment rate of 8.5% compared to the UK average of 7.9% (Office for National Statistics, 2011: http://www.ons.gov.uk/ons/rel/subnational-labour/regional-labour-market-statistics/august-2011/rft---lm-reg-tab-1-11-york-humb-august-2011.xls),

continued economic development and diversification around the Humber estuary is of paramount importance to ensure the area's future prosperity. Areas within the region such as Grimsby, Hull and Scunthorpe have received targeted economic support within the last decade from EU structural funding under 'Objective 2' status, as the Humber-sub region as a whole has ranked among the 35 poorest metropolitan areas within the European Union (McCarthy, 2000). Yorkshire Forward's 2006-2015 Regional Economic Strategy (which the Humber LEP have adopted for the time being) aims to bolster the economic performance of the region by increasing service sector jobs by 6%. The manufacturing sector is expected to lose jobs overall, although it is also predicted to increase its' output due to the regional specialisation that exists in this business sector (Yorkshire Forward, 2006).

Much of the future economic growth for the region focuses on the area covered by the Humber estuary floodplain, 80% of which is currently agricultural land (Humber Economic Partnership, 2010a:3) interspersed with large market towns and smaller villages. Over 300,000 of the Humber region's population of 887,500 live or work within the floodplain, with the net worth of homes and businesses in this area being estimated to exceed £7 billion (Humber Economic Partnership, 2006:9).

As well as a site for industry, the Humber estuary is a haven for wildlife, and attracts birds protected under Annex I and Annex II of the EU Habitats Directive (1992), such as the Lapwing and Golden Plover species. The estuary's large tidal range means it boasts some 4.5% of the UK's total intertidal mud flat habitat (Edwards and Winn, 2006:168) which acts as an important resource to migrating wildfowl using the east Atlantic flyway. With such a wealth of species depending upon the fragile ecosystem, curbing environmental pollution has long been a concern on the Humber. Industrial activity along the Humber shoreline dates back to Roman times where brick and tile manufacturing was prominent at a number

of sites along the south bank. Combined with a raft of later industries including shipbuilding, cement production, power generation, chemical production and intensive agriculture, a range of pollutants still remain locked within the dense estuary sediment.

The launch of the European Habitats Directive saw the introduction of Special Protection Areas (SPAs) and Special Areas of Conservation (SACs) to protect both wildlife habitat and the endangered species themselves. Although this legislation offered protection for specific areas around the Humber estuary, Natural England and the RSPB have long campaigned for a blanket SAC status to cover the whole of the estuary. Although a formal blanket SAC designation did not come into force until December 2009 (Humber Management Scheme, 2010), the potential limitations to business activities in and around the estuary posed by this new SAC status prompted a swift response from the larger industries along the shoreline soon after its original announcement. For example, the Humber Industry and Nature Conservation (HINCA) was formed in 2000, and now includes 21 major businesses located along the estuary shoreline as well as voluntary nature protection agencies and representatives from the four Humber unitary authorities. The HINCA is primarily a support system to "ensure that [estuarine] development activities would continue in partnership with and not at the expense of the environment" (Jonas et al., 2002:15). A testament to its success is the classification of over 97% of the Sites of Special Scientific Interest (SSSIs) on the Humber estuary as in a 'favourable condition' in 2006 (Humber Management Scheme, 2006:6), demonstrating that partnerships between different industrial players in the region can prove successful.

In terms of flood risk, the Humber estuary is particularly susceptible to storm surges where reduced atmospheric pressure and strong winds can cause a "temporary increase in the sea level above expected tide levels" (Wells, 1997:395). The effects of the storm surge can be

"amplified" landwards (Nicholls, 1993:5) as water is forced up an ever narrowing passage from the estuary mouth to the head, increasing wave height with distance travelled and therefore the potential for severe flooding upstream. Brown and Damery (2002:412) observe that flood management policy in the UK has traditionally favoured "technological solutions" to hazard reduction through the construction of hard-engineered coastal defences. This is evident on the Humber estuary, where some 894 km² of land is below the 5m contour and therefore protected by coastal defences (Cave *et al.*, 2003:40). The perimeter of almost all the Humber's flood defences was established more than 100 years ago (Environment Agency, 2005a:7), although much of these were subject to the rebuilding scheme that followed the 1953 east coast storm surge. Over fifty years later, many of these defences are nearing the end of their design lives and will subsequently require more frequent and costly maintenance to maintain their effectiveness, or eventual total replacement.



Figure 4.2 - Condition of flood defences in the Yorkshire and Humber region Source: Environment Agency (2006)

Figure 4.2 shows the flood defences on the tidal Humber to be in a good condition compared to other areas throughout the Yorkshire and Humber region, with less than 2% being rated as poor or very poor. The smallest defences protecting the Humber floodplain are relatively low earth banks, and range upwards in sophistication through various forms of walls and reinforced barriers, to the high-tech Hull tidal surge barrier which is lowered to protect the River Hull from tidal surges.

In 1992, the Department of Environment released Planning Policy Guidance (PPG) Note 20: Coastal Planning, recommending that estuary managers work in conjunction with local stakeholders to produce Estuary Shoreline Management Plans (ESMPs). These voluntary management plans sought "to bridge the gap between existing statutory frameworks and initiatives" (Smith, 1997:1) which have a bearing on the use and management of an estuary. Work on the Humber ESMP began in 1993, and although a wide range of issues associated with the estuary are contained within the ESMP, a common concern amongst all stakeholders in the Humber region is how to approach the expected increase in flood risk over the next century. Sea levels have been rising at an average rate of 1mm pa⁻¹ over the last 4000 years, but this rate has "almost doubled within the last century" (Environment Agency 2005a:8), being further compounded by the 'tilting' effect as the landmass responds to isostatic change resulting from the last Ice Age (Smith, 1997:10). With Lowe and Gregory (2005: 1322) suggesting a severe 17-fold increase in extreme storm surge water levels by the 2080s at Immingham, major changes to defences will be required to maintain an effective level of flood protection.

The first set of 31 national ESMPs is currently under revision, with the revised Humber ESMP2 originally scheduled for release in late 2012 (these plans have still not been released at the time this thesis was printed). Although technically separate documents, the Humber Flood Risk Management Strategy (HFRMS) draws upon much of the original ESMP modelling and research. The HFRMS was released for consultation in 2006, before its full launch in March 2008, and contains a comprehensive flood risk management strategy for the estuary spanning the next 100 years using the principles of sustainable management. This coincided with DEFRA's announcement that the Environment Agency was to assume a strategic role for all flood defence and coastal erosion management throughout England, paving the way for a fully integrated flood risk management framework. The HFRMS splits the estuary into 30 different areas within which flood defence plans can be more easily micro-managed (Figure 4.3).





Flood areas

Flood defence work carried out by the Environment Agency is financed by the National Flood Defence Budget, with applications granted on the merit of cost-benefit analyses. In 2005, just three years before the launch of the HFRMS, residents of Kilnsea in East Yorkshire were consulted by Environment Agency officials over the difficulties surrounding the justification of rebuilding of local estuarine flood defences on economic grounds (Environment Agency, 2005b:7). This was evident of a wider sea-change within the Environment Agency at the start of the 21st Century, where the flood mitigation stance made a transition from defence to risk reduction methods, emphasising that flood risk cannot be eliminated, but can be reduced. Corresponding approaches were also noticeable within the Agency's public flood awareness campaigns, following on from "Planning for the Rising Tides" newsletters sent out in the late 1990s and including radio and television adverts broadcast with explicit messages such as "Floods: We can't prevent it. You can prepare for it" (Environment Agency, 2003a:15). There has also been a greater emphasis on early warning systems, with the Environment Agency's Floodline telephone service now providing automated warnings to all properties and business premises in the event of a flood, unless the property owner chooses to opt out.

Current legislation does not place the Environment Agency under any obligation to either provide or maintain coastal flood defences, except in cases relating to protected conservation areas under the Habitats Directive. As such, if flood defences are withdrawn from a specific area, landowners are unable to claim any compensation, although they may continue personal maintenance of any existing defences in compliance with the Environment Agency's local byelaws. Reports covering the launch of the latest (2008) HFRMS within the regional media (BBC News, 07.03.2008; *Hull Daily Mail*, 03.09.2008; *Grimsby Evening Telegraph*, 17.09.2009) provoked angry reactions to the revelation that the Environment Agency will not protect all areas within its flood risk management strategy (Figure 4.3). However, the reasons for this are not limited purely to the constraints in the National Defence Budget. The Humber estuary is expected to respond to sea level rise by "accreting and eroding in different parts so that it seems to rise and move landward, or 'roll over'" (Environment Agency, 1999a:20). Many of the current flood defences on the Humber are fronted by mudflats and saltmarsh which are intertidal; being exposed at low tide, and submerged during high tide when the water level can reach the flood defence barrier. The current total inter-tidal area of the estuary is approximately 110km² (Environment Agency, 1999a:24), but is expected to decrease drastically in the event of future sea level rise. As mean water levels increase, foreshore levels remain static, as fixed flood defence barriers prevent the intertidal habitat from moving landward and 'rolling over' to higher ground. Trapped between the flood defence and higher water levels, the intertidal habitat gradually becomes submerged more frequently within the tide cycle, and will eventually succumb to complete submersion. This process is termed 'coastal squeeze' (Figure 4.4).

Figure 4.4 - Coastal squeeze process Source: Author drawn



The magnitude of coastal squeeze is difficult to estimate, but the Environment Agency calculate that it could lead to a "total reduction in intertidal habitat by up to 70km² over the next 50 years, or just under 7% of the present inter-tidal area" (Environment Agency, 1999a:21). This loss of SAC and SSSI protected habitat contravenes the EU Habitats Directive and would therefore prevent an estuary-wide replacement of the existing defences, even if flood defence budgets were generously increased to accommodate such a project.

However, there are some alternatives to hard engineered flood defences which can help to reduce flood risk without amplifying coastal squeeze. Saltmarsh has the ability to dissipate wave energy and act as a storage 'sponge' during high water levels, providing a potential natural alternative to hard-engineering solutions such as sea walls and embankments (Leafe et al., 1998; Myatt et al., 2003b; Environment Agency, 2003b). This principle underlies the strategy of 'managed realignment' which has been proposed for certain shoreline management cells on the Humber, whereby the deliberate breaching of existing flood defences allows specific areas of land to flood when the water level in the estuary becomes high. Using a soft-engineering approach has the advantage of providing low maintenance flood defence in the form of 'overflow' areas, with the potential to offset the process of coastal squeeze in compliance with EU wildlife protection directives (Environment Agency, 2008). However, the Environment Agency observes that much of the land around the estuary is too low for saltmarsh to develop naturally if defences were strategically breached. In such instances, mud or sand flats will develop instead, and major earthworks would be required to raise ground levels adequately to allow saltmarsh to take hold (Environment Agency, 2000). This could make managed realignment costly to roll out on a large scale, especially when considering the vast quantities of land bordering the estuary that will be required to offset the process of coastal squeeze. An additional concern is the opportunity cost posed by using existing productive agricultural land or land that could facilitate further economic development in the region for such purposes.

Despite these obstacles, managed realignment has been successfully implemented in certain areas around the Humber estuary, with Alkborough Flats in North Lincolnshire currently representing the UK's largest example of such a scheme. Here, over 400 hectares of low-lying former agricultural land now acts as an overflow area during periods of high water levels on the estuary, after the existing perimeter defences were deliberately breached in 2006. The capacity of the managed realignment site at Alkborough is so great that it has the potential to decrease high tide water levels in the upper estuary by up to
150mm (Environment Agency, 2011: http://www.environmentagency.gov.uk/homeandleisure/floods/38511.aspx).

However, Edwards and Winn (2006:172) explain that a comprehensive flood risk strategy will "involve[e] raising floodwalls and embankments, as well as providing managed realignment sites". Unlike the rural setting of Alkborough, larger urban areas lack the necessary empty space required to create managed realignment sites due to their proximity to the estuary shoreline. As such, existing hard engineered lines of defence around Hull, Grimsby and Cleethorpes will need to be maintained. The funnel shape of the estuary also limits the locations along the shoreline that are suitable for managed realignment as "...the high and low water levels [are] more extreme within the estuary than at the mouth" (Smith, 1997:9). Due to this physical trait, managed realignment sites seaward of the Humber Bridge will have a limited impact on lowering water levels, whilst sites in the inner estuary will be more efficient per hectare in this respect. There are currently four managed realignment sites which are complete on the Humber estuary, with a further six sites that may be developed in the future. Out of this total of ten sites, only four are within the inner estuary, inland of the Humber Bridge (Table 4.1).

	Inner estuary	Middle estuary	Outer estuary
Existing sites	AlkboroughChowder Ness	Paull Holme Strays	Welwick
Proposed sites	GooleFlixborough	• Goxhill	Donna NookKeyinghamSkeffling

Table 4.1 - Location of existing and future planned managed realignment sites (as of 2012)

In 2006 ABP unveiled proposals for a new £27.5m roll on roll off facility and a £59.5m extension of the Humber International Terminal at Immingham Docks. During consultations for the granting of planning permission, the HINCA expressed concern that ABP's expansion projects on the shoreline were likely to exacerbate coastal squeeze and therefore cause a loss of habitat within a designated SAC area (Humber Management Scheme, 2006). Planning permission was ultimately granted to ABP, but only subject to a clause requiring the company to create additional habitat on the estuary to replace that which would be damaged by the expansion of the port facilities. This resulted in two new managed realignment sites being created at Chowder Ness, near Barton upon Humber, and Welwick, east of Hull, comprising 12 and 54 hectares of new intertidal habitat respectively. This cost ABP over £3.5m, and although it demonstrates a better integration of economic and environmental issues within the region than has been the case in the past, it is a large scale solution that few other regional economic stakeholders would be able to match in order to secure future business expansion.

Flood risk can be seen to have entered a new era on the Humber, with substantial changes to the way in which economic and environmental assets are addressed within defence mitigation plans. Of particular significance is the introduction of managed realignment sites, which can be seen to be a considerable step forward in sustainable flood defence management. However, Orford and Pethick (2006:1629) view managed realignment as "no more than coastal setback...within the perceived magnitude of the shoreline and related areas within the coastal zone as it already exists". They suggest that a 'rolling' approach to managed realignment is required, where the creation of new habitats should be regarded as temporary amidst the uncertainty of how far sea levels will actually rise in the future. The Stern Report echoes calls for such an approach, with the recommendation that policies should "adapt to changing circumstances as the costs and benefits of responding to climate

change become clearer over time" (Stern, 2006:18). Although current managed realignment sites may require future expansion on a scale far beyond current projections, there is a major difficulty in changing the planning of sustainable habitats from a space-based concept to a "time-based" concept as Orford and Pethick (2006:1638) advocate. The Humber shoreline has changed dramatically over the last century due to the huge strides made in both technology and logistics. With the looming prospect of fossil fuel exhaustion, and the importance of the Humber as a major site for proposed tidal stream power in the UK (Hardisty, 2008), the concentration of industry in the Humber may undergo yet further rapid evolution in the near future. It is due to these uncertain and changing temporal and spatial dimensions of flood risk management that it is imperative to understand how businesses perceive flood risk. However, bridging differences between the timescales involved in societal development and the timescales at which natural estuarine processes operate means that a spatially based flood risk mitigation planning policy currently remains the most practical option for the Humber shoreline.

Planning Policy Statement 25 (PPS25) was originally released in 2006 to guide local planning authorities in England on development and flood risk, using sequential and exception tests to dissuade non-essential development on land prone to flooding (CLG, 2006b). Once again, the Environment Agency plays a vital role as a statutory consultee, with the power to block planning permission if defences in the desired area do not offer a suitable level of protection to the development. The Environment Agency also has the power to lodge an application to the Secretary of State if a compromise cannot be reached with the local planning authority and the applicant. This has important implications for managed realignment sites, which unlike hard-engineered barriers, will not be easy to modify when they have been put in place. Although areas in the inner estuary are most suitable for such schemes, this land is transected by major transport routes that link the port complexes to the national rail and

road networks. These routes also serve as a potential corridor for future business development linked to the economic opportunities presented by the ports, with the proposed establishment of business parks with good road access on vacant land next to the estuary. Juxtaposing such competing economic and environmental objectives in a climate of uncertainty presents a major challenge for flood risk mitigation on the estuary, requiring the careful balancing of interests of the private, the public and the voluntary sector. Solutions that may benefit one group of stakeholders, such as nature conservationists, may well prove detrimental to other groups such as business people who would naturally want the best protection available for their property as well as the possibility of site expansion if their business grows.

However, the Environment Agency can be seen to have taken some of these issues into consideration, despite new powers which effectively allow them to steer economic development using environmental regulation (Burby and Dalton, 1994, Handmer, 1996). With the Humber port complex acting as the main powerhouse for Yorkshire Forward's regional economic development strategy, the Environment Agency has acknowledged the "…need to ensure the sustainable economic development of the Estuary's ports, wharves and industrial base" when considering long-term flood defence measures to within the HFRMS (Environment Agency, 1998:6). Building on the requirement of the original ESMPs to provide comprehensive plans for estuary management that involve all stakeholders on the estuary, the recent HFRMS has created a flurry of stakeholder involvement in Environment Agency flood risk mitigation plans.

So far, such communication between stakeholders has been sporadic. The *"Tides News"* flood risk management newsletter (superseding *"Planning for the Rising Tides"*) was originally intended for distribution as a quarterly newsletter. Nevertheless, only six issues

were produced in total between 2001 and 2005. Publication then ceased until the newsletter was revived again in 2007, which saw the release of three further newsletters at quarterly intervals. These newsletters were distributed to all domestic and commercial addresses within the area shown in Figure 4.5.



Figure 4.5 - Tides News distribution area Source: Environment Agency Humber Strategies Office (2008)

In addition to *"Tides News"* which detailed general progress with flood risk mitigation on the Humber estuary, the Environment Agency held several community meetings and drop in sessions in villages close to the proposed managed realignment sites (Table 4.1) between 2008 and 2009. Environment Agency officials were pleased with the turnout at these events which attracted a mix of the general public, local government representatives and voluntary agency representatives, but the Humber Strategies team have found it especially difficult to establish a dialogue with smaller local businesses who are not members of organisations such as the HINCA.

Poor representation from local businesses may well result in the implementation of plans that are detrimental to their current and future needs, therefore impacting upon both local and the wider regional economic development. The Environment Agency were therefore keen for me to analyse how businesses construct and perceive flood risk issues around the Humber estuary due to the potential conflict between the sophisticated flood risk mitigation plans and the wider regional economic development strategy being pursued by Yorkshire Forward.

Although there has been no wide-scale *estuarine* flooding on the Humber estuary since 1953, unusually heavy rainfall (over 6mm per hour) between 8am and 5pm led to extensive *pluvial* flooding in the region in 2007. Coulthard *et al.* (2007a) observe that over 7208 residential properties and over 1300 businesses suffered some form of damage, with the city of Hull bearing the brunt of the disruption the flooding caused. Surface water levels quickly rose as the city drainage system was unable to cope with the sheer intensity of rainfall, a problem that appeared to be exacerbated by blocked roadside gully pots. Though pluvial flooding on such a scale is as infrequent as estuarine flooding (June 2005 was the wettest month on record since 1882) within the Humber region, the events of 2007 may have influenced flood risk perceptions of business people in terms of providing an 'experience' of something they have not encountered before (Lange and Garrelts, 2007; Visschers *et al.*, 2007; Convery *et al.*, 2010; Whittle *et al.*, 2010).

Local geographic factors meant that "some wards or even roads within neighbourhoods were much more severely affected than others" (Coulthard *et al.*, 2007b:8), causing a patchwork of exposure within certain areas of Hull. Combined with other (less severe) localised flooding in areas around the estuary, the variation of exposure to a recent flood event needs to be taken into consideration when examining perceptions related to *estuarine* flood risk management on the Humber itself. This is particularly important in terms of the role of 'knowledge transfer' (or a lack of it) in formulating risk perceptions,

which was exposed as being a grey area within the literature examined in Chapter Three (Terpstra *et al.*, 2009; Harvatt *et al.*, 2011).

In order to examine the multitude of issues which may impact upon business flood risk perceptions, I chose a mixed methods approach to gather empirical data from the Humber case study area which is discussed in the following section.

4.3 Mixed methods approach

Research methodology is dictated by the theoretical lens through which the subject of interest is being investigated. Sayer (1992:16) considers it imperative that the "production of knowledge" is considered as a social activity. With such a variety of stakeholders involved in the mitigation of flood risk on the Humber estuary, the social construction and sharing of flood risk knowledge cannot be ignored. Indeed, people's "roles and identities are often internally related" (Sayer, 2000:13) so that the actions of one object within a system can influence their relations with others. Critical realism provides a useful framework within which to examine the interconnections between flood risk mitigation and economic development on the Humber estuary, as it concerns itself with uncovering the "structure of relations between social objects" (Peet, 1998:172). However, this does not necessarily render the economic aspect of the research irrelevant amongst the range of other social objects. Harvey (1973:30) reminds us that when society is viewed in its totality, "ultimately everything has to be related to the structures in the economic basis" with particular attention to the way in which they are produced and reproduced.

Chapter Three has already demonstrated the lack of available literature addressing *business* perceptions of general external environmental risks. Considering that this gulf also extends into business perceptions of flooding, I chose a mixed methods approach for data collection.

This used extensive research methods (a questionnaire), which generated descriptive and representative generalisations, and intensive research methods (face-to-face interviews), which generated causal explanations related to specific objects or events.

Sayer (2000:22) is somewhat critical of the exclusive use of extensive research, citing its "minimal explanatory value". However, as a method for establishing common themes and general patterns within a population it does have an advantage over intensive methods which are concerned with exploration as opposed to representativeness. Sivo *et al*. (2006:352) observe that quantitative data collection in the form of a questionnaire survey is relatively easy to administer, and can efficiently gather large amounts of data at a low cost to the researcher. An additional benefit of this is that such large scale survey research also avoids "interviewer bias" (Sivo *et al.*, 2006:532) with delivery systems such as post, email or facsimile allowing the questionnaire to be self-administered.

In the related field of public risk perception many researchers have successfully used quantitative techniques. For example, Myatt-Bell et al. (2002) collected data on public perceptions of managed realignment using a questionnaire posted to over 200 households in Lincolnshire. The survey successfully contacted a large number of respondents to gather basic data for an issue of which no prior knowledge existed, but simultaneously generated problems due to its closed question format: many respondents opted for 'neither agree nor disagree' when asked for their opinions towards the Environment Agency (Myatt *et al.*, 2003b:177). This shows the difficulties of measuring risk opinions using extensive research methods. Eden (1996:193) describes the concept of a 'second-order science' which can acknowledge and embrace those high-risk problems due to the presence of 'extended facts'. Such 'extended facts' include beliefs and feelings which are more often than not implicit, and by their very nature would be hard to quantify within a questionnaire format. Masuda

and Garvin (2006: 400) cite Geertz's (1973) concept of '*thick description*' (emphasis in original), where qualitative research may complement traditional quantitative risk research by "providing experiential substantiation or offering insight into possible new directions of theories, models, and frameworks". Indeed, such intensive research methods are seen by Sayer (2000:22) to be far stronger proponents of "causal explanation and meanings in context".

The use of intensive methods to uncover the reasoning behind such quantitative patterns is also widely favoured within the field of public risk perception. Sayer (1992:3) observes that particular processes within society cannot easily be isolated, and therefore following up extensive research with intensive interview techniques may uncover perspectives which were either originally overlooked, or not addressed by more rigidly formatted quantitative questionnaires. Research by Posthumus *et al.* (2009:183) into the effects of the 2007 pluvial floods on UK agriculture used structured questionnaires to collect information on the nature of flooding, impact on crop type and livestock enterprises, types and cost of damage and the attitude and perceptions of farmers regarding flood risk management. This basic quantitative dataset uncovered specific issues to be examined in greater depth using qualitative interviews. Although the agricultural sector is not the sole focus of this thesis, I considered Posthumus *et al.*'s (2009) two stage approach to be advantageous within the empirical design of my research due to the high quality data they gathered in their interviews through the identification of emotive issues within the questionnaire survey.

Such a mixed methods approach allowed me to use extensive methods to sample a large number of companies for basic flood risk information and to measure general flood risk perceptions. I then used triangulation through intensive methods of interviewing to uncover the reasons behind these opinions.

Clark (1998:334) views hazard awareness as a basic prerequisite for flood risk management and Hill and McGowan (1999:10) advocate a case-study approach for examining such hazard perceptions. Given the different flood risk mitigation strategies along the Humber estuary, intensive interviews at different case study sites allowed respondents to be questioned regarding flood risk issues that were specific to their location. This was particularly beneficial in examining the cognitive biases that Van Gelderen *et al.* (2006:321) see as enabling entrepreneurs to confidently take risks based upon implicit beliefs, without realising they are doing so.

Sayer (2000:23) advocates that "explanation requires mainly interpretive research to discover actors' reasoning and circumstances in specific contexts". This has been suitably addressed by my use of a mixed methodology where extensive research has helped to focus the subsequent intensive research at multiple points within the network of flood risk mitigation on the Humber. The next section discusses the sampling frame which was used to carry out the extensive research in the form of a predominantly quantitatively-based postal questionnaire survey.

4.4 Business selection for quantitative research

To determine a sampling strategy, I first had to uncover both the number of businesses located within the study area and their characteristics. Fielding and Burningham (2005:393) suggest that census data should be avoided in this instance due to its tendency to age quickly, recommending that local information, which is often informal, should be used in its place. However, this proved somewhat problematic. Local directories such as the Yellow Pages and Thomson Local are published annually, providing an up to date list of businesses. However, I was not able to easily discern the business categories these directories use due to their non-uniform classification systems. They also offered no indication of business size or whether the company was local or part of a chain with a head office registered elsewhere. The paper format of the directories meant that a computer database of companies could only be created by manual data entry or scanning techniques, both of which would have been impractical considering the time limitations of the project. Although rudimentary electronic versions of Yellow Pages and Thomson Local directories are available online, they are designed for public use and therefore lacked a search function sophisticated enough to list all businesses within a specific geographic area.

Consequently, I approached both the Humber Economic Partnership and the Humber Chamber of Commerce. Unfortunately neither were willing to share their list of members citing data protection issues. The Humber Chamber of Commerce offered to provide a paper directory of their members, but again this presented problems not only in the transfer of data to a computer, but also because their membership was skewed disproportionately in favour of larger companies. In a bid to find a more suitable directory, I contacted the four unitary authorities that cover the Humber estuary region. All four were able to provide a business directory covering their administrative area. Although these were available in electronic format, they relied upon local companies voluntarily signing up to the directory, thus providing an unrepresentative dataset that was of little use to me.

A common problem with all the business directories detailed above concerned their area of coverage. Typically following local authority boundaries, the geographic areas covered expand far inland from the estuary, making it difficult to isolate businesses which lay in the flood risk zones closer to the Humber shoreline. Lewis *et al.* (2007:158) acknowledge that this is not an unusual situation, with a key issue facing researchers being that of gaining access to lists of firms that are up to date and which include the sort of data that is of value to researchers. Fortunately I found a solution to this problem in the form of the Van Dijk

Financial Analysis Made Easy (FAME) database. This database provides a fully searchable live electronic listing of all companies currently operating in the UK, their postcodes, their business category using Standard Industrial Classification (SIC (2003)) codes and an indication of company size through turnover and number of employees. This addressed the limitations I found in the other business directories. However, there was a complication whereby mostly larger companies registered elsewhere in the UK with satellite operations within 3km of the Humber estuary could not be easily identified through FAME. This meant that large numbers of smaller companies were included within the sample, as only large companies registered at an address within the study area could be included in a mass data extraction. This was not only important because smaller businesses are seen as key in advancing future economic prosperity (Yorkshire Forward, 2006) but also because they are likely to be less resilient to flood risk, as discussed in Chapter Three. Tomasskovic-Devey et al. (1994:444) also suggest the likelihood of survey response from businesses is inversely proportional to business size, so using the FAME database would ensure a sample which was more likely to yield a healthy number of responses through its comprehensive listing of smaller companies.

The incomplete and dynamic nature of the business data meant that I had to develop a sampling frame through several stages. First, I created an accurate study area using ESRI's ArcMap GIS package to select all business postcodes in the FAME database within 3km of the shoreline. This was carried out in 500m intervals, creating six distance zones (Figure 4.6).





This 3km study zone included all businesses at high risk from storm surge flooding on the estuary. Each postcode area is mapped to its centroid. This meant that the software was programmed to include the whole of a postcode into a specific zone if the centroid of the postcode polygon was in that zone, resulting in a ragged appearance (Figure 4.6). Under the circumstances, without a way of determining specific geographic coordinates for each business around the Humber estuary, this was the most accurate method of selecting businesses that was available to me. The first stage of sampling produced 7,925 locally registered companies within the 3km study zone, which are listed in Table 4.2 by their parent SIC (2003) code.

Table 4.2 Companies registered within 3km of Humber Estuary, classified by SIC (2003)code, as of April 2008

SIC (2003) code	Number of companies within 3km zone
A: Agriculture, forestry and hunting	91
B: Fishing	34
C: Mining and quarrying	11
D: Manufacturing	633
E: Electricity, gas and water supply	10
F: Construction	1094
G: Wholesale and retail	1135
H: Hotels and restaurants	228
I: Transport, storage and communication	407
J: Financial intermediation	108
K: Real estate and renting	2635
L: Public administration and defence	8
M: Education	96
N: Health and social work	190
O: Other community, social and personal	604
P: Private households and undifferentiated	145
Not Classified	496
Total	7925

Bhojraj *et al.* (2003) highlight that the use of SIC (2003) codes remains widespread amongst researchers as a way of classifying businesses, despite several shortcomings relating to unusual and outdated categories within its subclass structure. However, as I only used the top tier section letter code to differentiate between the main industrial categories, I avoided this particular issue whilst gaining a uniform standard that was not available in the other alternative business directories. I used purposive non-random sampling to establish a questionnaire distribution list by selecting SIC (2003) codes based upon those containing the greatest number of businesses. However, despite the paramount importance of large numbers of potential questionnaire respondents within similar business categories, other

important company characteristics also had to be accounted for which in turn influenced the sampling frame.

In terms of the geographic location of businesses, I identified a general pattern whereby overall business density within the 3km study zone decreased with distance from the estuary shoreline (Figure 4.7).



Figure 4.7 - Distribution of total number of businesses within the 3km study zone as of April 2008

When deciding which businesses to sample, it was necessary to consider the distribution of companies within the SIC (2003) code within the 3km zone to ensure that I could determine whether flood risk perceptions alter according to distance from the estuary shoreline. This helped to determine the role of any tacit knowledge gained from previous flooding experiences, as well as gauging the effectiveness of any codified flood risk information distributed by the Environment Agency.

Business age was also considered when establishing the sample frame. The oldest business within the 3km study zone was listed as starting in 1864, and the newest in 2008, giving a total 'age' range of 144 years. However, the mode for the total number of business start up dates was 2003, with an average value of 1998, showing that the majority of businesses had started trading within the last decade. I therefore wanted to ensure that the selected SIC (2003) codes contained businesses with a wide range of start-up dates to examine the temporal role of tacit knowledge as explored within Chapter Three. This was based upon the premise that businesses which had been operating for longer within the area would have greater local tacit knowledge than those which were more recently established (Van Praag, 2003; Jasimuddin *et al.*, 2005; Riley, 2008).

Although FAME could also provide information on financial turnover and employee numbers, this information was sporadic. Many of the businesses within the 3km study area were missing records in either one of both of these fields, so this information could not used in determining the sample of businesses for questionnaire distribution. However, the database was able to identify those businesses within the SIC (2003) codes that were classed as 'holding' companies. These companies do not produce any goods or services themselves, with their only purpose being to hold shares of companies located elsewhere. As holding companies do not have any physical operations at the premises that they are registered at, exploring the opinions of business people within SIC (2003) codes who are not actively engaged in economic activity at operational sites in the 3km study zone would create inaccurate results.

Taking these different factors into account, the 7925 businesses as represented by the 17 SIC (2003) codes (Table 4.2) are explored below in terms of their suitability for inclusion within the sampling frame for questionnaire distribution.

SIC (2003) code 'K: Real estate and renting' was the largest group within the 3km zone with 2635 businesses, but many of the businesses listed were actually holding companies that would not be subject to the disruption that a flood event would bring to a business producing goods and services at a specific site within the 3km study zone. Another complication within this SIC code was that the large number of private landlords it included were often registered to their own residential addresses instead of to the address of the property which they were renting out. This would have posed a targeting problem, as the business asset in the form of the house being rented may well have been in a different area of the 3km zone, or even outside it. For these reasons SIC (2003) code 'K' was not included within the survey sample set.

SIC (2003) codes 'G: Wholesale and retail' (1135 businesses), 'F: Construction' (1094 businesses) and 'D: Manufacturing' (633 businesses) were the next three largest within the 3km zone. All three sectors followed the broad pattern of business concentration shown in Figure 4.7 and all had a business start-up date range of at least 99 years. The manufacturing sector had a slightly higher range of 124 years with an average start-up year of 1998, reflecting a higher proportion of more established businesses than SIC (2003) codes 'G' and 'F'. Unlike SIC (2003) code 'K', companies within these three codes produced goods and services at specific premises with capital assets that could suffer substantial damage during a flood risk event. As such SIC (2003) codes 'G', 'F' and 'D' were all included within the survey sample set.

The 5th largest group was SIC (2003) code 'O: Other community, social and personal services' with 604 businesses. Although business within this code closely followed the total business distribution pattern in Figure 4.7 and also exhibited a wide range of start-up dates, there were a substantial number of holding companies and membership organisations which did

not produce any specific goods and services. For these reasons, SIC (2003) code 'O' was excluded from the sample set.

The 6th largest group contained 496 companies without a specific SIC (2003) code. Many newer companies are not assigned an SIC (2003) code until they have registered their full first year of company accounts, which was reflected in the mode start-up year of 2008. For unknown reasons, there were several companies which had never been assigned a code, with one such undesignated business dating back to 1875. These businesses were excluded from the sample set on account of their unclassifiable nature.

The 7th largest business group was SIC (2003) code 'I: Transport, storage and communication' with 407 companies. The constituents of this group mirrored the total business concentration pattern shown in Figure 4.7 and had a business start up range of 100 years with a mode of 2003, comparative to that of SIC (2003) codes 'G', 'F' and 'D'. With a mixture of logistics and storage operations, the businesses within this code were especially interesting to my investigation. The nature of business operations meant that both the company's own capital assets as well as capital being handled, belonging to other companies, were at risk from potential flood events. SIC (2003) code 'I' was therefore included in the sample set as the fourth largest suitable industrial category.

Three smaller industrial categories were also retained for the survey sample set. SIC (2003) code 'A: Agriculture, forestry and hunting' (91 businesses) was included because it possessed the oldest mean start-up date of 1987. Its inclusion allowed responses to be contrasted between these businesses with a longer 'business life' (and therefore a potentially greater tacit knowledge) with other industrial codes with a shorter mean 'business life'. The overall concentration of businesses was similar to that displayed in Figure

4.7, although the number of businesses 2500m from the estuary was actually 5% higher than at 2000m, representing a slight deviation in the general trend of business numbers decreasing with distance from the estuary shoreline.

SIC (2003) code 'E: Electricity, gas and water Supply' (10 businesses) was chosen at the request of the Environment Agency for a specific case study into whether perceptions of risk within the 'essential utilities' sector differed from those within other business categories. The small number of firms in this category and the case study nature rendered the skewed business distribution within the 3km zone less relevant. Interestingly, this industrial sector had the lowest range of business start-up dates at just 32 years; primarily due to recent privatisation within the utilities industries. The inclusion of this sector also provided an opportunity to see whether tacit knowledge held by those in the former public utility bodies had been carried through to the new privatised companies.

Hair and beauty companies, a specific sub-category of SIC (2003) code 'O', were also included at the request of the Environment Agency. This provided a case study of small scale businesses with both mobile and fixed operations, which Andrew Baron of the Environment Agency (project partner) felt was a type of business that had been totally absent from flood risk mitigation consultations so far. SIC (2003) code 'O' exhibited a company distribution pattern similar to that in Figure 4.7, as well as a substantial range in start-up dates of 117 years. In summary, the following seven SIC (2003) codes were selected for the business sample frame:

- 1) 'A: Agriculture, forestry and hunting'
- 2) 'D: Manufacturing'
- 3) 'E: Electricity, gas and water supply'
- 4) 'F: Construction'
- 5) 'G: Wholesale and retail'
- 6) 'I: Transport, storage and communication'
- 7) 'O: Specific subcategory of hair and beauty companies'

With the sampling for businesses by SIC (2003) code complete, the third stage of the sampling process could begin. I re-ran the seven chosen SIC (2003) codes through FAME, cross referencing them with the 9604 postcodes within the 3km study area. This was particularly important, as I was now able to add larger non-local companies with operations in the study zone into the sample. This was not possible during the earlier stage of sampling due to the limitations of the search facility within FAME. However, with only seven SIC (2003) codes to manually search through, the inclusion of larger companies became feasible which provided further opportunity for comparing flood risk perceptions on the basis of company size.

Although I expected the addition of the non-locally registered companies to increase the grand total of companies within each sampled SIC (2003) code, in some cases the opposite effect occurred. When sorting through the companies by specific postcode, I was able to identify businesses which were registered solely to accountancy firm addresses. These were removed from the dataset, as it was impossible to ascertain the location of the actual business site from the data provided. I also identified and discounted businesses which were dormant, inactive, classed as holding companies or had missing address data. In some cases,

multiple companies were registered to the same manager at the same address with the same SIC (2003) code. These were also removed to avoid harassing participants unnecessarily. The sample database was completed in August 2009. Between this date and April 2008 when the scoping stage was carried out, some of the companies that were initially identified would also have folded. However, others which did not have an SIC (2003) code would have gained one since submitting their accounts, subsequently altering business numbers slightly during this time period. Taking all these issues into account, the inclusion of non-local companies, and the 'cleaning up' of the database, 3475 companies were identified within the seven sampled SIC (2003) codes in the study zone as shown in Figure 4.6. Although the number of businesses within each SIC (2003) code are different to those at the scoping stage, the size of the industrial categories relative to each other remain exactly the same, with 'G; Wholesale and retail' remaining the largest sector' and 'E: Electricity, gas and water supply' remaining the smallest sector.

Table 4.3 - Sampling frame of companies within 3km of Humber estuary classified by 9	SIC
(2003) code as of August 2009	

SIC (2003) Code	Number of companies within 3km zone
A: Agriculture, forestry and hunting	88
D: Manufacturing	592
E: Electricity, gas and water supply	12
F: Construction	742
G: Wholesale and retail	1377
I: Transport, storage and communication	357
O: Other community, social and personal	307
Total	3475

With the sampling frame in place, a questionnaire could now be sent to each of the 3475 companies listed in Table 4.3.

4.5 Quantitative research design

There are several options available by which to distribute a questionnaire survey. Although considerably cheaper than using the postal service, email and fax distribution were not considered in this project. Jobber & O'Reilly (1998:105) cite the difficulty of obtaining personal email addresses, and also the non-universal ownership of fax machines within businesses as being a limiting factor of such a distribution system. Coupled to this, research undertaken by Kaplowitz *et al.* (2004:970) showed a "significant age difference in response rates to mail and Web surveys", with a decline in the response rate of persons over the age of 24 when compared to identical mail surveys. In order not to exclude the majority of business managers who fall into such older age group categories, as well difficulties in obtaining email and fax addresses from FAME, I opted for questionnaire delivery using Royal Mail.

Dennis (2003:291) cites Dillman's (2000) Tailored Design Method (TDM) as a highly successful template for achieving high response rates from surveys distributed by mail. Sivo *et al.* (2006:365) lists the five essential elements of TDM as:

- 1) A respondent friendly questionnaire
- 2) A five-contact strategy (pre-notification, survey distribution and 3 reminders)
- 3) A return envelope with real first class stamps
- 4) Personalized correspondence
- 5) Token prepaid financial incentives.

Lewis *et al.* (2007:157) acknowledge that in the case of research involving businesses of any size " you are effectively imposing upon the time and life of other human beings" in order to progress the project. Jobber (1986:192) sees this as a major difference between surveys directed at a business audience and those directed at the general public, and one to be ignored at the researcher's peril, with the typical industrial respondent likely to be "much

more sensitive to the length of questionnaire and the time taken to complete it than a member of the general public completing it at home". Therefore, in order to make the questionnaire as respondent friendly to business people as possible, I limited the survey to 20 questions which were spread over four pages. In line with the research methods of Myatt *et al.* (2003b), the questionnaire (Appendix A) was structured to reflect the research questions and broken down into four different sections comprising:

- 1) Basic descriptive data about the company
- 2) Questions relating to flood risk issues from the past
- 3) Questions relating to current flood risk issues
- 4) Questions relating to future flood risk issues.

The question format consisted predominantly of tick boxes and Likert scalings for ease of analysis using uniform coding, as well as making the questionnaire quick and easy to fill out. A Flesch readability analysis also was run using Microsoft Word, which scored my questionnaire at 50.4 on a scale ranging from 0 (representing very difficult reading) to 100 (representing very easy reading). Research by Ganassali (2008) recommends a target Flesch score of between 40 and 60 to produce a survey that is easy to read, without being too simplistic or patronising.

A project website, funded using a grant from the Northern Leadership Academy, was used to host an electronic version of the postal questionnaire during the data collection phase. Research by Kaplowitz *et al.* (2004:100) suggested that web-based surveys can achieve a "comparable response rate to a questionnaire delivered by surface mail if the web version is preceded by a surface mail notification". I therefore decided to offer respondents a choice of responding either via the freepost envelope or via the website. This was explained within the covering letter of the postal questionnaire (Appendix A). The electronic questionnaire formatting was identical to that of the paper questionnaire, although it had the advantage

of providing cost savings by eliminating the charge of a freepost return and by providing data ready-coded and in an electronic format. To prevent bogus online survey entries, the company business code provided on the original questionnaire was required before the survey could be submitted.

Although Olsen (2009:593) advocates the use of web-based surveys "in target populations with very high internet usage percentages", such as businesses, he also warns against the propensity of internet respondents to provide "quick and dirty responses" (*ibid*:607) through a lack of time spent considering personal preferences compared to mail survey respondents. However, this did not pose a major problem for my research considering that the questionnaire consisted mostly of closed questions. In any case the reasoning behind my decision to include a choice of response method was to try and encourage responses amongst a population of respondents, who are often hard pressed for spare time. Although considerable importance was attached to making the questionnaire as user-friendly as possible, the relevance of the topic is also important. Local topics can feel more relevant than national ones, and the topic of attitudes to flood risk is not beyond business people's expertise or comfort zone, helping to give relevance to the questionnaire and raising the likelihood of a return.

The questionnaire was also designed to collect information with which to classify respondent businesses by size, for use in later analysis. Brooksbank (1991:18) states three main quantitative criteria to determine size:

- 1) Number of employees
- 2) Sales turnover
- 3) Total assets

As there is no hard and fast method pertaining to company size classification, I decided to include questions to ascertain both the number of employees and sales turnover. Total assets were not included in the questionnaire, as Freisner *et al.* (2006:80) observe that business executives, particularly those from small enterprises, are "loath to disclose" such information publicly when it is not necessary to do so. A common definition of an SME is a "business with fewer than 250 employees" (Crone and Watts, 2003:717). Because many companies in the sample were likely to fall into this category, a question about turnover was included for more detailed classification and comparison during the data analysis stage. Tomaskovic-Devey *et al.* (1994) suggest that response rates to organizational surveys may be considerably higher when financial information is not required or can be collected by some other means, such as from corporate reports. Unfortunately the FAME database did not contain financial information for many of the companies within the sampling frame, meaning that it was necessary to include question 4 regarding annual turnover for 2007-2008.

Pilot research for the questionnaire was carried out at the Hull and Humber Chamber of Commerce Business Exposition in July 2009. With over 104 business stands (Hull and Humber Chamber of Commerce, 2009: <u>http://www.hull-humber-</u>

chamber.co.uk/341/events/2008/11/chamber-expo-2009.aspx), the two day event provided a chance to pilot the survey on a wide range of companies of varying sizes. I chose to directly administer the questionnaire survey for pilot research due to the high response rates observed by Baruch (1999), and the small number of surveys that required distributing. A total of 15 companies were given the questionnaire survey at the Exposition event to examine and improve it. The only significant alteration resulting from the piloting of the questionnaire was that the word 'Humber' should precede references to business site. This was considered useful for companies who operated from multiple premises, but

equally would not adversely affect those businesses operating from a single site in the Humber region.

Some company representatives from the pilot survey stated that they did not have access to certain information, such as company turnover, whilst others indicated that they were not allowed to divulge such information. This emphasised the need to address the survey to the correct person within the company (as discussed in later in this section), as asking for information which some participants may not freely wish to divulge may reduce response rates. However, as has already been discussed, there is no simple rule for categorising company size, making it necessary to ask for company turnover if relationships between risk perceptions and company size are to be explored within the project.

The five contact strategy (part of the Tailored Design Method) consisting of pre-notification and reminders was unfortunately not possible within my research due to both budget limitations and the sensitive nature of the enquiry. The Environment Agency were particularly keen to avoid creating a sense of panic amongst respondents, and argued that repeated contact relating to business flood risk issues could cause alarm amongst the sampled population and lead business people to think that their property is disproportionally at risk from flooding. As such, the surveys were sent out 'cold' with a covering letter explaining the nature of the research. This may not be a handicap in itself however, as a comparison of survey methodologies by Dennis (2003) found that prenotification only increased response rates significantly in one study, whereas it did not in three others. Although in "an ideal situation, the researcher persuades non-respondents through follow-up contacts to participate in the mail survey" in order to increase response rates (Sivo *et al.* 2006:364 - see also Jobber 1986; Groves *et al.*, 1992; Jobber & O'Reilly 1998; Dennis, 2003), this can be prohibited by cost, time, and the lack of access to nonrespondents. Indeed, Dennis (2003) acknowledges that such steps can also be harassing, which in the case of this particular project would more than likely cause problems for the Environment Agency as the project sponsor, and risk jeopardising the later qualitative phase of the research.

In an attempt to counter the effect of not following up original questionnaire distribution, the questionnaire was designed so that the covering letter prominently showed the logos of both the 'Environment Agency' and 'The University of Hull'. Research by Groves et al. (1992) has shown that people are more likely to comply with a request for information if it comes from a properly constituted authority. However, Lewis et al. (2007) conversely observed that members of their research team were often asked who had sponsored the project research, with participants revealing that had the work been government funded, they would probably have declined the invitation to participate due to cynicism regarding research executed by government agencies. This is a moot point, which may or may not have influenced response rates on the questionnaire survey. From an ethical point of view it was necessary to inform participants of the project sponsor, even if it may have negatively impacted response rates for the survey. The presence of 'The University of Hull' logo may have helped reassure businesses that the research is unthreatening, in line with Jobber & O'Reilly's (1998:102) observation that proprietary information disclosure would not be compromised by an academic institution. In general, Newby et al. (2003:164) found that university sponsorship increases response rates when compared to an absence of a sponsoring partner, which in this study may go some way to offsetting the lost opportunity to increase response rates with reminder letters and second waves of questionnaires.

Dillman's (2000) third TDM requirement of providing an envelope with a real first class stamp was not feasible for this project on financial grounds. Although Jobber (1986:187)

found that the increases in return rate far outweighed the cost of wasted non-returns, this procedure would have more than doubled the cost of the survey. A freepost envelope was included for the questionnaire return, which Jobber and O'Reilly (1998:100) suggest may have reduced return rates by "7%" compared to that of an envelope sporting a first class stamp. However, this still ensured response rates were much higher than if respondents had had to pay for return postage themselves.

The use of the FAME database allowed envelopes and covering letters to be personalised with the name of the owner/ managing director/ operations director/ environmental manager of the firm. The target contact within the business depended upon company size, and the specific contact listings provided within the FAME database, as different companies have different structures and different job titles. Tomaskovic-Devey *et al.* (1994:441) highlight the importance of getting the survey to the top company official, who if necessary can "delegate the task to another official", thus minimising survey non-response. Dennis (2003) also supports such an approach, arguing that an impersonal mailing may lead the receiver to attach less importance to the survey subsequently impacting upon the response rate. Conversely, Jobber (1986) cautions that in anonymous surveys using respondents' names can cause respondents to question the level of anonymity involved. As personalisation of mail and the promise of anonymity were both used, they may well present a contradiction to the respondent which in turn impacts negatively upon response rates.

However, the covering letter on the questionnaire went to great lengths to stress the anonymity of the responses (Appendix A), which Jobber (1998) notes can improve response rates compared to a situation when no assurance was given. The questionnaire return instructions also asked the participant to detach the covering letter when returning the

questionnaire. This ensured that personal details were removed, leaving only the assigned survey ID number in the top left hand corner of the first page. This additional consideration of anonymity has also been shown to increase return rates in research carried out by Roth and BeVier (1998). The Survey ID number consisted of two letters, the first representing distance zone from the estuary shoreline and the second representing the industry as per chosen SIC (2003) codes, followed by 3 unique numbers representing each individual company. To make the survey easier for me to code and understand, the original SIC (2003) code letters were replaced with the following business industry codes:

- A) Construction
- B) Wholesale and retail
- C) Manufacturing
- D) Transport, storage and communication
- E) Agriculture
- F) Hair and beauty
- Z) Utilities

The fifth and final element of Dillman's (2000) TDM involves token prepaid financial incentives. However, such an incentive was simply not possible within my limited research budget.

Whilst this section has attempted to explain how the survey was designed to achieve high response rates, it is important to acknowledge that this will not always be successful. Indeed, Baruch (1999:423) draws attention to the fact that in one research project examining non-response amongst firms, 22% of non-respondents cited their lack of participation as following "company policy which was not to complete surveys". There is no way to gather this type of information before distributing questionnaires, and as a result it must be acknowledged that response rate is never wholly under the control of the researcher. Dennis (2003) notes that average response rates from business surveys are often well below 25%, whilst Baruch (1999) emphasises that there is no agreed norm as to what is or what may be received as an acceptable, reasonable response rate. Indeed, Sivo *et al.* (2006:359) acknowledge that in some published research, response rates dip below 10%. In this study the overall response rate was 12%, with 377 questionnaires being returned largely completed and 200 surveys being returned as undeliverable. Table 4.4 shows the number of surveys returned as undeliverable by business industry codes.

Business industry code	Number of surveys distributed	Number of surveys returned as undelivered	% of surveys returned as undelivered
A - Construction	742	42	6%
B - Wholesale and retail	1377	86	6%
C - Manufacturing	592	45	8%
D - Transport, storage and communication	357	17	5%
E - Agriculture	88	1	1%
F - Hair and beauty	307	7	2%
Z - Utilities	12	2	17%
Total	3475	200	6%
n = 3475			

Table 4.4 - Number of surveys returned as undeliverable by business industry code

The utilities industry yielded the highest number of surveys which were returned as undeliverable at 17%. However, due to the low number of surveys distributed to this industry the resulting value is misleadingly high. Out of the other six industrial categories, manufacturing yielded the highest group percentage of undeliverable surveys at 8%, followed by both wholesale and construction at 6%, transport, storage and communication at 5%, hair and beauty at 2% and agriculture at just 1%. Although the percentages of undeliverable questionnaires among the largest four sectors are within a range of 3%, the more marked differences between the smaller other services and agricultural sectors lend evidence to support existing research that business type can influence response rate indirectly through reducing the base of potential respondents. The dynamic nature of the economy also highlights the speed at which the information held within business databases can become obsolete. The FAME database is automatically updated as company financial reports are processed, but a lag time can still exist as the new data is processed, posing a problem for researchers. Table 4.5 shows the survey response rate by business industry code, whilst Table 4.6 shows survey response rate by flood zone.

Business industry code	Number of surveys distributed	Number of surveys returned	Response rate %	
A - Construction	700	68	10%	
B - Wholesale and retail	1291	123	10%	
C - Manufacturing	547	104	19%	
D - Transport, storage and communication	340	41	12%	
E - Agriculture	87	24	28%	
F - Hair and beauty	300	16	5%	
Z - Utilities	10	1	10%	
Total	3275	377	12%	
n = 3275				

Table 4.5 - Survey response rate by business industry code

Table 4.6 - Survey response rate by flood risk zone

Flood Risk Zone	Number of Surveys Distributed	Number of Surveys Returned	Response Rate %
1 - 0m-500m	1157	143	12%
2 - 501m-1000m	661	71	11%
3 - 1001m-1500m	529	59	11%
4 - 1501m-2000m	345	40	12%
5 - 2001m-2500m	328	34	10%
6 - 2501m-3000m	255	30	12%
Total	3275	377	12%
n = 3275			

Table 4.5 shows that the highest response rates came from the agricultural industry with 28%, followed by manufacturing with 19% and transport, storage and communication with 12%. Excluding utilities due to the low number of surveys distributed, Table 4.5 also shows that both construction and wholesale and retail achieved a below average response rate at 10%, followed by hair and beauty which achieved a poor 5% response rate. Table 4.6 shows little difference in response rates with distance from the estuary shoreline, which was good news for comparing flood risk perceptions in relation to this variable. With the quantitative phase of research complete, the qualitative interview phase began, as outlined in Section 4.6.

4.6 Qualitative research design

Oppenheim (1992:67) describes the purpose of an in-depth interview as one "*not* of data collection, but [of] *ideas* collection" (emphasis in original), providing a way in which to understand how people "experience and make sense of their own lives" (Valentine, 2005:111). Unlike the sampling process for the questionnaire survey, the greater emphasis on personal perceptions within the interview process means that representativeness is not a key aim. However, Oppenheim (1992:68) recommends that "a good spread of respondent characteristics is included" in order to involve different probable respondents from a range of backgrounds.

In the case of this research project where interviews were preceded by a questionnaire survey, a method of self selection can be used to quickly generate a group of willing interviewees. The final field on a questionnaire survey could ask respondents to indicate whether they would be willing to participate in an interview to discuss issues covered within the questionnaire in greater detail by providing their name and a contact number. Specific interviewees can then be chosen on the basis of their characteristics, as revealed by the responses they have given within the initial survey. An advantage of this approach is that the interviewer can get to know the interviewees' views on the topic before talking to them, which "can help to shape the interview cues" (Valentine, 2005:115). Although this makes the interview schedule easier to design, self selection methods do have a drawback in that only certain groups of people may come forward to be interviewed.

Alternatives to self selection methods include other non-probability samples such as snowball samples. Czaja and Blair (1996:111) advocate the employment of snowballing when the sample units "are rare or hard to find", working on the underlying assumption that people with similar characteristics are likely to know each other. However, this method is still subject to the limitations associated with self-selection where certain groups of people may be excluded, particularly through Burgess's (1984:48) concept of "gatekeepers". Gatekeepers can be described as representatives of organisations charged with the power to grant or deny access to people or situations for the purposes of research. In the scope of this research project, gatekeepers within specific business associations pose a danger in that they may divert attention to " a narrow selection of the members (probably their friends) and discourage you from talking to others" (Valentine, 2005:116). However, more frequently a gatekeeper is present in the form of a receptionist or secretary who may restrict access to individuals suitable for interviewing, irrespective of the sampling method used.

There is an additional complication with the use of snowballing as a sampling method for my research, as it would require me to contact survey respondents personally to ask for a follow-up interview. With patchy information regarding telephone and email contacts for the companies within the original sample frame, further research using directories or alternatively sending out requests by post would have been prohibitively time consuming

and expensive. The issue of multiple contact also has to be considered, as the Environment Agency stipulated that the research must comprise a low-profile survey that would not panic respondents on what is seen as a sensitive subject.

In light of these issues, I chose to sample for interviews using a self-selection technique. Question 20 of the questionnaire survey asked respondents to provide contact details if they would be interested in participating in a follow up interview to discuss business flood risk issues further (Appendix A). Table 4.7, Table 4.8 and Table 4.9 show the number of respondents who had self-selected for interviews by business industry code, by flood zone and by business size⁴.

Business industry code	Willing to be interviewed	Unwilling to be interviewed	Total number of respondents	% Willing to be interviewed
A - Construction	14	54	68	21%
B - Wholesale and retail	22	101	123	18%
C - Manufacturing	25	79	104	24%
D - Transport, storage and comm.	16	25	41	39%
E - Agriculture	9	15	24	38%
F - Other services	4	12	16	25%
Z - Utilities	0	1	1	0%
Total	90	287	377	24%
n = 377				

Table 4.7 - Respondents' self selection for interview by business industry code

⁴ Business size was defined using European classifications based upon 'number of employees' (European Commission, 2005)

Flood zone	Willing to be interviewed	Unwilling to be interviewed	Total number of respondents	% Willing to be interviewed
1 - 0m-500m	36	107	143	25%
2 - 501m-1000m	19	52	71	27%
3 - 1001m-1500m	12	47	59	20%
4 - 1501m-2000m	6	34	40	15%
5 - 2001m-2500m	9	25	34	26%
6 - 2501m-3000m	8	22	30	27%
Total	90	287	377	24%
n = 377				

Table 4.8 - Respondents' self selection for interview by flood risk zone

Table 4.9 - Respondents' self selection for interview by company size

Company size	Willing to be interviewed	Unwilling to be interviewed	Total number of respondents	% Willing to be interviewed
1 – Micro	48	162	210	23%
2 – Small	29	103	132	22%
3 – Medium	8	19	27	30%
4 – Large	5	1	6	83%
Undisclosed	0	2	2	0%
Total	90	287	377	24%
n = 377				

With 24% of the questionnaire survey respondents self selecting for the interview process, a reasonable number of potential interviewees were available. There were considerable differences in the number of respondents willing to be interviewed by business survey code, with 39% of transport, storage and communication respondents self selecting, as opposed to just 18% of respondents in wholesale and retail (Table 4.7). There was little difference in the number of respondents willing to be interviewed within the different flood risk zones, although the percentage of respondents self selecting was lowest in the 1501m-2000m flood risk zone at just 15% (Table 4.8). However, the largest differences in self selection for interviewing was apparent between the different business sizes, with 83% of larger

companies willing to be interviewed, compared to under 30% of micro, small and medium businesses (Table 4.9).

Due to time and budget constraints, it was not possible to interview all the business people who had self selected using the questionnaire survey. I therefore carried out a cluster sample on the 90 respondents who had expressed an interest in being involved in a followup interview. Oppenheim (1992:40) describes cluster sampling as taking "advantage of the fact that most populations are structured in some way or could be divided into sub-sections according to certain characteristics". In order to compare the different flood risk management cells around the Humber estuary, I decided to conduct clusters of interviews in four locational clusters. The aim was to have a large company and several smaller companies in each cluster to compare their perceptions.

However, many respondents who had expressed an interest in being interviewed later changed their mind when they were contacted, with the most common reason being that they were too busy. With much perseverance I managed to form four interview clusters by first finding a large business willing to be interviewed, which would act as a geographical anchor. The nearest smaller businesses that were willing to cooperate in the interview process were then selected to form a cluster around the large business. This gave a sample of 20 interviewees in 4 separate clusters:

- 1) North Lincolnshire Cluster
- 2) West Hull Cluster
- 3) Hull River Cluster
- 4) North East Lincolnshire Cluster

The four clusters are actually spread across several flood risk zones due to the postcode centroid issue and the number of respondents who were willing to be interviewed (Table
4.10). However, this gave me the additional advantage of speaking to contacts at different distances from the shoreline, allowing me to examine a greater range of perceptions in relation to this variable.

Table 4.10 - Cluster samples of interviewees from self selection process

Cluster	Company Size	Business Survey Identification Code	Interview Pseudonym	Survey SIC (2003) code	Flood Zone
1 - North Lincolnshire Cluster	Medium (Anchor)	VC002	Tony	C - Manufacturing	4 - 2000m
1 - North Lincolnshire Cluster	Small	CB107	Mandeep	B - Wholesale and retail	1 - 500m
1 - North Lincolnshire Cluster	Micro	CE005	Robin	E – Agriculture	1 - 500m
1 - North Lincolnshire Cluster	Micro	JE001	Chris	E – Agriculture	2 - 1000m
1 - North Lincolnshire Cluster	Micro	YE001	Kelly	E – Agriculture	5 - 2500m
2 - West Hull Cluster	Large (Anchor)	PD004	Carson	D - Transport, storage and comm.	3 - 1500m
2 - West Hull Cluster	Medium	DD027	Morgan	D - Transport, storage and comm.	1 - 500m
2 - West Hull Cluster	Micro	1B043	Drew	B - Wholesale and retail	5 - 2500m
2 - West Hull Cluster	Micro	1F009	Jackie	F - Hair and beauty	5 - 2500m
2 - West Hull Cluster	Micro	1F010	Avery	F - Hair and beauty	5 - 2500m
3 - Hull River Cluster	Large (Anchor)	VC026	Max	C - Manufacturing	4 - 2000m
3 - Hull River Cluster	Small	PC053	Sandy	C - Manufacturing	3 - 1500m
3 - Hull River Cluster	Micro	CA031	Pat	A – Construction	1 - 500m
3 - Hull River Cluster	Micro	JB206	Ashley	B - Wholesale and retail	2 - 1000m
3 - Hull River Cluster	Micro	JC005	Jamie	C - Manufacturing	2 - 1000m
3 - Hull River Cluster	Micro	PC009	Ceri	C - Manufacturing	3 - 1500m
4 - N.E Lincolnshire Cluster	Medium (Anchor)	UD002	Sam	D - Transport, storage and comm.	4- 2000m
4 - N.E Lincolnshire Cluster	Medium	IC008	Alex	C - Manufacturing	2 - 1000m
4 - N.E Lincolnshire Cluster	Micro	CC063	Leslie	C - Manufacturing	1- 500m
4 - N.E Lincolnshire Cluster	Micro	JA050	Sidney	A – Construction	2 - 1000m

Table 4.10 also shows the pseudonyms I gave to the interviewees. This helped to make the findings easier to write, as opposed to using the survey codes, whilst also preventing the reader from identifying the participants.

The major advantage of using interviews as a research method is that it allows the researcher to delve into the experiences of the participants using a fluid form which varies according to the thoughts and views of the interviewee. Valentine (2005:111) sees this as a major asset as "it allows respondents to raise issues that the interviewer may not have anticipated". However, successful interviewing requires careful planning in order to get interviewees to talk openly and with a degree of insight about what Oppenheim (1992:67) terms as their "formative experiences".

Before any interviews took place, participants were informed of the Environment Agency's sponsorship of the research and what the data I was collecting would be used for. This did not cause any concern amongst the interviewees however, as the questionnaire that was answered prior to the interview had already explained these details in the covering letter. I pressed respondents to accept face to face interviews wherever possible, with 19 out of the 20 interviews being conducted in this manner. The remaining interview was conducted over the telephone, simply due to need to form a cluster anchor with a large company that was willing to be interviewed. Czaja and Blair (1996:42) explain that "long and detailed answers are not elicited as often in telephone surveys as in face-to-face surveys", creating interviews that are substantially shorter and therefore potentially providing less in-depth observations. Another advantage of face to face interviewing compared to that of telephone interviewing, is that the researcher can see the interviewee and observe body language. As such, the interviewer can be "more sensitive to [the interviewee's] responses"

137

(Valentine, 2005:122-123) and avoid pressuring them to talk about anything they are not comfortable with, helping to ensure that the interview is successful.

As my research involved interviewing business people, the interviews were conducted on company premises. Although Valentine (2005:118) acknowledges that this is often unavoidable, she notes that the "[business] setting often contributes to a more stilted formal interview". However, all face to face interviews were conducted in private offices away from other employees to prevent what Oppenheim (1992:94) terms as "guarded responses" which are sometimes given when the interviewee is concerned about being overheard by others.

With business people being constrained by time pressures during the interview process, I made sure that I was dressed smartly to create a good first impression. The establishment of mutual respect is important to gain the interviewee's full cooperation as Valentine (2005:114) notes that business people often "have the upper hand by controlling access to knowledge, information and informants", as well as potential experience in interview techniques with knowledge of how to "subvert interviews, control them or deny interviewer access to key information" (*Ibid*:121).

An interview guide was prepared (Appendix B) to ensure that all the areas of interest were covered. These were grouped under four areas:

- 1) Where does flood risk stand within current business priorities?
- 2) Where do you get your knowledge about flood risk from?
- 3) How suitably is your business protected under the Environment Agency's current flood risk mitigation policies?
- 4) Are there any wider implications of flooding for business operations or decisions?

The interview guide used open questions which Foddy (1993:127) sees as essential to "allow respondents to say what is really on their mind without being influenced by suggestions from the researcher". In keeping with the recommendation of Dixon and Leach (1974), I did not force interviewees to stick to my order of questions, as each interview typically follows its own individual pattern. Instead I followed the train of thought of the interviewee to maintain the spontaneity of the interview, marking off what was covered on the interview guide as the conversation progressed. I also paid close attention to the wording of the questions in the interview guide to avoid 'loaded' words which are emotionally charged and could unduly influence the interviewee's response. Oppenheim (1992:121) sees each question as having a "covert function", namely that of motivating the respondent and maintaining their cooperation. Consequently, questions that appear abstruse or inconsiderate could not only jeopardise the response to that particular question, but also influence responses to the remaining questions and the overall success of the survey.

The interviewer also has the potential to jeopardise the responses to questions from inappropriate probing. Czaja and Blair (1996:194) highlight the dangers associated with inferring answers from the respondent's comments which can "put words in the respondent's mouth". I tried to follow the advice of Dixon and Leach (1977:34) when such situations arose in the interviews, by keeping probing as neutral as possible and by "first of all repeating the original question which the respondent may have misheard".

By researching the potential pitfalls of the interviewing process and taking steps to avoid these, I did not experience any significant problems during data collection. Table 4.11 shows the details of each interview that I carried out.

Cluster	Interview Pseudonym	Interview Type	Interview Time
1 - North Lincolnshire Cluster	Tony	Face to Face	21 minutes 44 seconds
1 - North Lincolnshire Cluster	Mandeep	Face to Face	11 minutes 10 seconds
1 - North Lincolnshire Cluster	Robin	Face to Face	68 minutes 28 seconds
1 - North Lincolnshire Cluster	Chris	Face to Face	20 minutes 12 seconds
1 - North Lincolnshire Cluster	Kelly	Face to Face	19 minutes 25 seconds
2 - West Hull Cluster	Carson	Face to Face	14 minutes 25 seconds
2 - West Hull Cluster	Morgan	Face to Face	15 minutes 45 seconds
2 - West Hull Cluster	Drew	Face to Face	13 minutes 52 seconds
2 - West Hull Cluster	Jackie	Face to Face	12 minutes 19 seconds
2 - West Hull Cluster	Avery	Face to Face	10 minutes 52 seconds
3 - Hull River Cluster	Max	Telephone	9 minutes 35 seconds
3 - Hull River Cluster	Sandy	Face to Face	37 minutes 57 seconds
3 - Hull River Cluster	Pat	Face to Face	43 minutes 22 seconds
3 - Hull River Cluster	Ashley	Face to Face	21 minutes 30 seconds
3 - Hull River Cluster	Jamie	Face to Face	22 minutes 56 seconds
3 - Hull River Cluster	Ceri	Face to Face	60 minutes 13 seconds
1 - North East Lincolnshire Cluster	Sam	Face to Face	12 minutes 6 seconds
1 - North East Lincolnshire Cluster	Alex	Face to Face	17 minutes 45 seconds
1 - North East Lincolnshire Cluster	Leslie	Face to Face	16 minutes 52 seconds
1 - North East Lincolnshire Cluster	Sidney	Face to Face	20 minutes 33 seconds

Table 4.11 - Details of the 20 semi-structured interviews conducted

There is quite a range within the length of the different interviews; the longest one being over 1 hour and 8 minutes long with Robin and the shortest being 9 minutes and 35 seconds with Max. Smaller companies seemed to spend more time with me discussing their flood risk perceptions, as they appeared to have more local knowledge than some of the interviewees I spoke to at the larger companies. They were also more willing to discuss their business operations, which seemed more personally influenced and tailored into a specific daily routine than some of the interviewees from larger businesses. Some of the smaller business owners such as Robin, Sandy and Ceri also had a lot to talk about, as they said they often felt that people didn't want to listen to their opinions.

I used the interview guide to ensure that all subject areas were covered no matter how little or how much time the interviewee was able to spare. This meant that even the shorter interviews still managed to glean substantial insights into the interviewees' perceptions and constructions of flood risk knowledge, which can be used to support the existing quantitative dataset from the questionnaire survey. The next section explains the ethical considerations associated with my research methodology, and the risk assessment for the different activities involved.

4.7 Ethical considerations and risk assessment

As the project involved human participants, an ethical assessment of the research methodology (Appendix D) was required in conjunction with a risk assessment (Appendix E). Surveying business people meant that none of the participants were under the age of eighteen, but full consent was still required from all participants. The covering letter of the questionnaire survey outlined the nature of the project (Appendix A) and advised participants as to how returned data would be handled and stored. With no obligation to respond, businesses that completed and returned the questionnaire were deemed to have fully consented to taking part in the research. For those taking part in the semi-structured interviews, a consent form was provided before the discussion began that provided details on how the data would be handled and stored (Appendix C). This also included the option to receive a copy of the interview transcript after the analysis stage.

No other sensitivities were identified under the ethical guidelines used by the Department of Geography for this study. However, both the quantitative and qualitative research methods required approval from the Environment Agency due to their role as project sponsor. This was especially the case with the questionnaire survey, as the Environment Agency logo was used on the covering letters distributed to sampled businesses. Although Section 4.5 discussed the drawbacks of research affiliation with such official bodies, I decided that it would be unethical to conceal the project sponsor and partner from participants. Approval was sought from Andrew Barron, the project CASE partner at the Environment Agency, for the use of this logo on the questionnaire survey. Louise Turner from the Environment Agency's Regional Communications Office also reviewed both the questionnaire survey and the interview schedules to ensure that Environment Agency ethical values were fully satisfied. These efforts are likely to have contributed towards increasing response rates whilst also ensuring that no negative feedback was received by the Environment Agency or the University of Hull.

During the analysis chapters, business codes and interviewee pseudonyms will be used to ensure company confidentiality, as I was not granted permission by any of the companies that were surveyed either by questionnaire or by interview to reveal their true identity. Both the business survey codes and the interview pseudonyms are unique and untraceable by the reader. During interviews where respondents referred to specific issues or

142

neighbours that could easily lead to their company being identified, transcriptions have been appropriately edited.

The overall risk level of conducting the research was low, with minor issues only arising for the qualitative interviewing component. The vulnerability of working alone was offset by carrying a mobile phone in case of an emergency. Adhering to health and safety regulations and remembering to sign in and out at business sites minimised personal risk whilst visiting participants in the interview process. Whilst journeying between sites, I ensured that I scheduled interviews at appropriate intervals to allow sufficient time to negotiate traffic and unfamiliar areas. These simple precautions helped to ensure that research was successfully completed without incident.

4.8 Weaknesses and limitations of research methods used

By selecting research techniques that were appropriate to the theory framing the research project and using a mixed methods approach to glean the benefits of both extensive and intensive research, the only weaknesses I was able to identify lay within the implementation of the data collection methods themselves.

The weaknesses within the questionnaire sampling methods as discussed in Section 4.4 were due to the limitations associated with the business listing databases which were available to me, rendering the issue somewhat out of my control. A great deal of time was put into getting the most out of the FAME database, and despite the slight spatial inaccuracies generated by using postcodes, the sampling was as accurate as practicable given the available resources. The distribution of the surveys went smoothly, and the response rate was adequate considering the lack of reminders that were issued, which again, was beyond my control (Section 4.5).

143

One substantial weakness that was not discovered by the pilot questionnaire was the positioning of question 4 on the quantitative survey, regarding company turnover. It is more common to put such a question nearer the end, so that people are not put off from completing the survey by questions asking for sensitive information at an early stage (Tomaskovic-Devey *et al.*, 1994; Freisner *et al.*, 2006). Some surveys were returned with remarks such as "why does this matter?" scrawled across the answer space, although in such cases the rest of the questionnaire was still largely complete. In other cases however, the positioning of this question may well have impacted upon response rates as other people with similar opinions may have disposed the survey at this point rather than persevere with it. Asides from this controversial question, there were no other issues identified with the rest of the questionnaire survey.

The qualitative research process also ran smoothly, with interviews providing useful indepth insights into how entrepreneurs conceptualise flood risk. As the qualitative phase was not concerned with being representative of the Humber business population, differences in the length of each interview do not pose any significant problems. As is expected within the field of business research, many people are extremely constrained for time, and as such I had to adjust the way in which I worked to get the best insights from the interviews as possible. The only minor limitation to the interview dataset was the phone interview which was conducted with Max. Although useful data was gathered from the interview, I felt that the telephone format limited my ability to read the interviewee and fully engage and react to his responses. However, due to the limited number of large companies which were willing to be surveyed, I was limited for options considering the interviewee's repeated unavailability when site visits were arranged. Although some minor limitations have been exposed in the research methodology, a highly useful basic quantitative dataset and an insightful qualitative dataset were generated. The next section explains the techniques I used to analyse both the raw quantitative and qualitative datasets.

4.9 Data analysis techniques

The questionnaire survey generated mostly quantitative data that I analysed using a number of different statistical techniques within IBM's SPSS software package. The simplest techniques that I used for data analysis were cross tabulations that allowed me to display the information collected in a summary format. Descriptive statistics related to the location of a set of numbers within the data set, such as the mean, the median and the mode, were also used to gain an initial picture of the data. These basic forms of data analysis were very useful in quickly identifying areas of interest within the large raw data set that more advanced statistical tests could explore in greater detail. More powerful statistical tests were carefully selected depending on the following three factors:

- The type of test I wanted to carry out on the data groups that had been collected in terms of either:
 - a test for difference to establish whether responses within one data set were statistically different to another;
 - b) or a test for correlation to establish whether responses within one data set demonstrated a statistically significant relationship to another.
- 2) The category of the data within the groups that I wanted to analyse:
 - a) Nominal data data which represents categories that cannot be ordered. An example from the questionnaire survey is question 5 which asks the respondent

to tick the boxes next to any organisations that have deemed their property to be at risk from flooding.

- b) Ordinal data data with loosely ordered values that represent categories with some intrinsic value. An example from the questionnaire survey is the Likert scales used within questions 17, 18 and 19 which denoted the respondent's perception of the importance of flood risk. The majority of the questionnaire survey dataset comprised ordinal data.
- c) Scale data data with a meaningful metric that can be measured. An example from the questionnaire survey is question 4 which asks the respondent to estimate company turnover during the financial year 2007-2008.
- 3) The distribution of the data in terms of whether it is parametric or non-parametric. Dytham (2011:142) explains that certain tests "make assumptions about homogeneity of variances or normal distribution". As such, selecting a test without considering the parametric or non-parametric properties of the data could result in extreme values disproportionately influencing test results and giving inaccurate conclusions. Before choosing a statistical technique to test for either difference or relationship, I used SPSS to run a Kolmogorov-Smirnov test. This delivered the probability that the distribution of data differs from a normal distribution within the specific data group that I wanted to analyse.

The interesting sample groups within my data sets that I wanted to analyse in greater detail happened to comprise ordinal data. The Kolmogorov-Smirnov test also showed these ordinal data sets to be non parametric in their distribution. This determined the statistical tests that I used as shown in Table 4.12.

Statistical Test	Purpose of Statistical Test	Type of Data Required	Key Assumptions
Kruskal-Walis test	Tests the null hypothesis that two	Ordinal	>2 sample
for difference	or more groups come populated	data	groups, non
	with the same median		parametric data
Mann-Whitney U	Tests the null hypothesis that	Ordinal	2 sample
test for difference	two groups come from the same	data	groups, non
	distribution		parametric data
Spearman's Rank	Tests the range of associations	Ordinal	2 sample
test for correlation	between two groups from	data	groups, non
	perfect negative correlation to		parametric data
	perfect positive correlation		

Table 4.12 – Statistical tests used for qua	antitative data analy	sis
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Although Dytham (2011) notes that the Kruskal-Walis test for difference is somewhat unusual in that it is not widely used compared to the more common one-way ANOVA (Analysis of Variance) test, it is adequately powerful and more suitable and accurate for analysing non parametric data. The Kruskal-Walis test does, however, share the same limitation as the one-way ANOVA test in that a significant result simply indicates that at least one pair of factors are significantly different from each other. As the test does not indicate which pair the difference lies between, "pairwise Mann-Whitney U tests must be carried out to highlight this (Dytham, 2011:145). The Mann-Whitney U test is the non parametric equivalent of the independent samples t-test, although it is more widely used than the Kruskal-Walis test.

I used the Spearman's rank correlation as a non parametric equivalent of the Pearson's product-moment correlation. This is more suitable for producing an accurate analysis of my dataset but unlike the Kruskal-Walis test, Spearman's rank is widely used (Dytham, 2011). All of the tests shown within Table 4.120 are supported within the SPSS software package and were successfully carried out using the built-in analysis functions.

In order to analyse the qualitative data collected from the questionnaire survey and from the large semi structured interview dataset, I established a coding framework using QSR's NVIVO analysis software. This is shown in Table 4.13.

Master Code	Sub Code(s)		
Business contingency planning			
	Flooding issues		
Business location	Initial setup		
	Non flood related		
	Attitude to non flooding risks		
Business risk perceptions	Position of flooding within daily risks		
	Business and local authority		
Communication	Business to business		
Communication	Involvement in policy process		
	Who to contact		
	Company specific issues		
Economic resilience	Reliance on wider regional industry		
	Role of forums		
	Awareness		
	Information sources		
Flood risk mitigation	Personal opinions		
	Scale		
	Timescales		
Floodline subscription			
Future flooding	Wider impacts off site		
	Coverage and claims		
Insurance	Essential modifications		
	Zoning		
Planning expansion and flood risk			
	Actual site damage		
	Changes after flooding		
Dravieve fleeding	Disruption to business practices		
Previous nooding	Impact at home		
	Reactions		
	Reasoning behind flooding		
Reality test and flooding experience			
Regional planning			
Sources of flooding	Responsibilities		
Specific business operations			
Trust in agencies or local authorities			

Table 4.13 – Qualitative data analysis coding framework

The data coding allowed me to break down the qualitative dataset into manageable sections and extract useful information that helped to provide depth to the conclusions from the quantitative data analysis. The NVIVO software also allowed me to construct spider diagrams and mindmaps which helped to group elements of the qualitative data within their respective categories, providing a useful visual aid. The next section provides an overview of the methodology chapter before leading on the discussion and analysis of the research results.

4.10 Summary

This chapter has outlined the economic and environmental issues regarding economic development and flood risk mitigation in the Humber region, and discussed the sampling method used to generate the quantitative and qualitative data which will be used to analyse these issues further. The mixed methods approach I employed has been argued to be both appropriate and successful, having produced an extensive primary dataset consisting of 377 questionnaires and 20 clustered semi-structured interviews within the project study area. Considerable background research was carried out on how to best implement both the quantitative and qualitative aspects of the research which helped to ensure that the appropriate information was gathered in order to address the research questions listed in Chapter Three. Although both the questionnaire and interview techniques used were subject to some limitations, these have been identified and justified accordingly.

More importantly the research was carried out in a safe manner whilst adhering to ethical guidelines issued by the university to ensure that the confidentiality of the participants was preserved in each step of the research process. This is particularly important considering the sensitive nature of the research and the potential repercussions for the Environment Agency as the project sponsor. The data analysis techniques were carefully chosen to ensure that they were accurate for the data that was collected and the analyses were run using purpose built computer software. This ensured that the dataset was not compromised by poor analysis which could lead to inaccurate conclusions being drawn from the project. The next three chapters will explore the primary data collected within the context of the literature discussed within Chapter Two and Chapter Three.

<u>Chapter Five</u> Exploring How Businesses Currently Perceive Flood Risk In The Humber <u>Region</u>

5.1 Introduction

This chapter will look at how businesses construct and perceive technical understandings of flood risk within the Humber region, using the data collected from the questionnaire and interviews described in the previous chapter to identify the main trends and differences. Section 5.2 investigates whether businesses perceive risk to differ with the specific type of flooding that may affect their business. Section 5.3 examines whether flood risk perceptions vary depending upon whether businesses have suffered negative effects from previous flooding, whilst Section 5.4 looks at whether the flood risk perceptions vary according to the distance of the business site from the estuary shoreline. Section 5.5 compares flood risk perceptions between the different industrial categories of respondent businesses, in order to assess whether businesses with similar operations view flood risk in a similar way. The significance of the business 'life' (in terms of the number of years the business has been trading for and the number of years the respondent has been working at the company) is examined in relation to flood risk perceptions in Section 5.6. Variations in business flood risk perceptions are examined according to company size in Section 5.7. Section 5.8 looks at whether flood risk perceptions alter between businesses located within the different local authorities in the study area, whilst Section 5.9 presents a summary of the findings concerning the way in which businesses currently perceive flood risk within the Humber estuary region.

5.2 How do businesses perceive flood risk from different flood sources?

Although the main focus of my thesis concerns the impact of estuarine flood risk upon economic development, this cannot be explored in isolation from other types of flooding

151

events. Businesses within the study area still remain at risk from fluvial and pluvial flooding, in addition to the anticipated increase in the severity and frequency of storm surge events on the estuary due to climate change (Environment Agency, 2008b). Previous research has shown peoples' perceptions of risk to be shaped by both codified and tacit knowledge gleaned from a wide range of sources, as was discussed in Chapter Three (Kasperson, 1992; Wynne, 1992a, 1992b; Morris, 2006; Riley 2008). In order to explore business participation within estuarine flood risk governance, it is helpful to get a feeling for how businesses perceive flood risk from sea water overtopping estuary defences in relation to other types of flooding. This will help to distinguish risk perceptions and consider their transferability, or lack of it, between different sorts of flood experiences.

Question 11 from the quantitative survey asked businesses to indicate what they perceived the risk of five different flood types to be with regards to their Humber company premises. These were:

- 1) Backflow within drainage systems
- 2) Sea water overtopping estuary defences
- 3) Flooding caused by land relief (eg. water pooling in low areas)
- 4) Rising ground water
- 5) River bursting its bank

These five types of flooding are listed by the Environment Agency (Construction Industry Research and Information Association (CIRIA), 2003:5) as having the potential to cause damage to properties. However, due to variations in geography, some types of flooding may be more likely to occur at certain locations than others. It is notable that although the Environment Agency regards the five types of flooding within question 11 as 'distinct' (*Ibid*), these classifications of flooding type are actually interrelated and may occur simultaneously depending upon weather conditions. Flooding caused by backflow within drainage systems, land relief and rising ground water levels is reliant upon an abundance of surface water, the root cause of which could be either one or a combination of estuarine, fluvial or pluvial flooding. Similarly, river bank bursting could be attributable to periods of heavy rainfall, or alternatively from a storm surge event forcing water up river channels connected to the estuary.

Sea water overtopping estuary defences however is unique, with its sole cause depending upon a combination of atmospheric pressure and wind and tidal conditions (Wells, 1997:395). In the questionnaire, perceptions for all five types of flooding were recorded as either 'high risk', 'medium risk' or 'low risk' (Figure 5.1). The total number of responses across all five flood types is shown in Table 5.1.

Figure 5.1- Question 11 from the quantitative survey



Table 5.1 - Aggregate flood risk perceptions for all five flood types

Risk category	Aggregate flood risk perceptions for all five flood types	Aggregate flood risk perceptions for all five types as %
High risk	293	18%
Medium risk	547	33%
Low risk	820	49%
Total	1660	100%
n = 332	·	

Table 5.1 shows that only 18% of responses across the five flood types perceived 'high risk', whilst 33% of responses perceived 'medium risk' and 49% perceived 'low risk'. This suggests that most businesses in the Humber region are not particularly concerned about flood risk at their premises in general. Although this finding would appear to support Crichton's (2008) observation that businesses generally appeared to be reticent towards flood risk, some interesting variations were found between the five different flood types. Table 5.2 shows the mean risk perceived for each flood type listed, where 3 represents respondents ticking 'high risk', 2 'medium risk' and 1 'low risk'.

Flood type	Mean risk value	
Backflow within drainage systems	1.89	Highest
Rising ground water when the water table is high	1.70	
River bursting its banks	1.69	
Land relief, e.g. water pooling in low areas	1.61	•
Sea water overtopping estuary defences	1.59	Lowest
n = 332		

Table 5.2 - Mean risk attributed to different flood type in rank order

Table 5.2 shows that business respondents perceive backflow within drainage systems as the highest risk flood type, with a mean risk perception value of 1.89. Respondents ranked rising ground water as the second most perceived flood type with a mean risk perception value of 1.70, whilst river bursting ranked as the third most perceived type with a value of 1.69. Business people ranked land relief as the fourth most perceived flood type with a mean perception value of 1.61, whilst the least perceived flood type was sea water overtopping estuary defences with a mean perception value of 1.59. The overall range between the highest and lowest mean risk perception value is 0.30. This range is quite small, and mostly due to the large difference of 0.19 between the mean values of backflow within drainage systems and rising ground water when the water table is high. The flood types associated with the highest and the lowest mean perception values are especially interesting. Backflow within drainage systems, despite being one of four flood types that may be associated with pluvial flooding, exhibits a risk perception value 10% higher than rising ground water, which is itself ranked second within Table 5.2. However sea water overtopping estuary defences, the only type which cannot be attributed to pluvial flooding, is ranked at the bottom of Table 5.2. In order to explore this finding in more detail, a breakdown of perceived risk by flood type is shown in Table 5.3.

	Flood type				
Risk perception category	Backflow within drainage systems	Rising ground water when the water table is high	River bursting its banks	Land relief, e.g. water pooling in low areas	Sea water overtopping estuary defences
High risk	27%	15%	16%	18%	12%
Medium risk	35%	30%	38%	32%	28%
Low risk	38%	55%	46%	50%	60%
Total	100%	100%	100%	100%	100%
n = 332					

Table 5.3 - Breakdown of business flood risk perceptions for the five different flood types

Table 5.3 shows a similar pattern in flood risk perception levels to that found in Table 5.1, with 'low risk' being most commonly chosen for all flood types. However, there are some variations across the five flood types. 27% of respondents perceived flooding from backflow within drainage systems as a 'high risk', compared to just 12% for flooding from sea water overtopping estuary defences, 15% for rising ground water, 16% for river bank bursting and 18% for land relief. Similar patterns were reflected for 'low risk', with the percentages of respondents perceiving rising ground water, river bank bursting and land relief as a 'low risk' at 55%, 46% and 50% respectively.

However, just 38% of respondents perceived backflow within drainage systems as a 'low risk', compared to 60% for sea water overtopping estuary defences. With a range of 22% between these two outliers, the pattern found within the percentage of respondents perceiving flooding as a 'high risk' is mirrored and inverted here for the percentage of respondents respondents perceiving flooding as a 'low risk'.

Overall, it can be seen that respondents perceive a higher risk from flooding caused by backflow within drainage systems than any other flood type, and that they perceive the lowest risk from flooding caused by sea water overtopping estuary defences. This could indicate difficulties for the Environment Agency's policy of steering estuary flood risk mitigation strategies through a framework of governance, as low risk perceptions of estuarine flooding from the private sector are likely to jeopardise the willingness and motivation of businesses to involve themselves in such plans.

The remainder of this chapter therefore looks in detail at the contrast between flood risk perceptions associated with just two of the above flood types: backflow within drainage systems and sea water overtopping estuary defences. This allows me to explore whether recent experience gained during the 2007 pluvial floods is transferable to flooding from sea water overtopping estuary defences, which has not occurred in the Humber region since 1953. It also allows me to address Terpstra *et al.*'s (2009) concern that knowledge transfer, within the context of natural hazards, has so far been largely overlooked within academic research.

The next section begins this process by exploring the role of experience by looking at whether businesses which have suffered negative effects from previous flooding at their

156

premises exhibit different flood risk perceptions to those who have not experienced flooding before.

5.3 Does previous flood risk experience impact upon business flood risk perceptions?

Although extreme rainfall caused extensive pluvial flooding within the Humber region in 2007, adversely affecting over 1300 businesses within Hull alone (Coulthard *et al*, 2007a:3), Question 8 from the business survey revealed that only 13% of respondents had suffered some form of negative effects from previous flooding at their premises. Table 5.4 explores the role of suffering negative effects from previous flooding in shaping flood risk perceptions related to backflow within drainage systems.

		Backflow within drainage systems			
Business suffered negative effects from previous flooding at premises		High risk	Medium risk	Low risk	Total
Yes	Count	20	13	11	44
	%	45%	30%	25%	100%
	Count	69	105	112	286
No	%	24%	37%	39%	100%
n = 330					

 Table 5.4 - Risk perceptions of backflow within drainage systems by businesses'

 experience of negative effects from previous flooding at their premises

Table 5.4 shows that more respondents who have suffered negative effects from previous flooding at their premises perceived flooding from backflow within drainage systems as a 'high risk', at 45%, with 30% perceiving this as 'medium risk' and 25% as 'low risk'. This was particularly interesting, as this contrasts with the aggregate data in Table 5.3 where 'low risk' perceptions dominated. By comparison, 39% of respondents who had *not* suffered negative effects from previous flooding perceived backflow within drainage systems to be a

'low risk', with 37% perceiving it to be a 'medium risk' and just 24% perceiving it to be a 'high risk'.

As such, the data suggests that previous experience of flooding at the company premises is shown to increase flood risk perceptions associated with flooding from backflow within drainage systems. However, these risk perceptions contrast markedly with those associated with flooding from sea water overtopping estuary defences (Table 5.5).

Table 5.5 - Risk perceptions of sea water overtopping estuary defences by businesses'experience of negative effects from previous flooding at their premises

		Sea water overtopping estuary defences			
Business suffered negative effects from previous flooding at premises		High risk	Medium risk	Low risk	Total
	Count	6	19	19	44
Yes	%	14%	43%	43%	100%
	Count	34	75	177	286
No	%	12%	26%	62%	100%
n = 330					

Table 5.5 shows that only 14% of respondents who have suffered negative effects from previous flooding at their premises perceived flooding from sea water overtopping estuary defences as a 'high risk', compared to 12% of respondents who had not experienced previous flooding. The remainder of the business people were equally split between perceiving such flooding as either a 'medium' or a 'low' risk, at 43% each. However, previous experience of flooding still seems to have a noticeable effect. Table 5.5 shows that 26% of respondents who had not experienced prior flooding perceived sea water overtopping estuary defences as a 'medium risk', compared to 43% of those who actually had experience of prior flooding. It can be seen that flood risk perceptions associated with sea water overtopping estuary defences are higher on average for those respondents that have experienced previous flooding at their business premises than for respondents who have not, although the variations are much less prominent than those exhibited for flooding caused by backflow within drainage systems. To see whether these observations were statistically significant, I tested for difference using a Mann-Whitney U test (Table 5.6).

Perception of flood risk
from backflow within
drainage systemsPerception of flood risk
from sea water
overtopping estuary
defencesnPrevious negative
effects from flooding at
business site0.007*0.036*330* denotes significant difference at p value of 0.050.050.05

 Table 5.6
 - Mann-Whitney U tests for difference between flood risk perceptions and previous negative effects from flooding at business premises

Table 5.6 shows that business flood risk perceptions are significantly different between those businesses which have suffered negative effects from previous flooding at their premises and those businesses which have not. The difference is more significant for the backflow within drainage systems flooding at 0.007 (>99% probability), compared to 0.036 (>95% probability) for flooding caused by sea water overtopping estuary defences.

The statistical tests therefore confirm the observations identified from Table 5.4 and Table 5.5 concerning the effects of previous experience on flood risk perceptions. This also supports research findings by Rupp-Armstrong and Nichols (2007) and Whittle *et al.* (2011) which suggested that previous experience of, and exposure to, a flood event heightens flood risk perceptions through the generation of new tacit knowledge.

The results also suggest that there is a 'shock' aspect to flooding that lingers after the flood event has taken place, highlighting the importance that Lowenstein *et al.* (2001) attach to the role of fear in risk perception. Suffering previous negative effects of flooding at company premises can be seen to have dramatically altered business perceptions through exposure to a reality test(Lange and Garrelts, 2007:274). In such instances, an event can be seen to destroy the psychological perception of flood protection previously satisfied under an engineered safety discourse. As such, the perceived risk of flooding is drastically altered as the engineered system (in this case the drainage system) is exposed as being limited in its ability to prevent flooding, subsequently catapulting flood risk back onto people's radars. This is supported by the data in Table 5.4, where 21% more respondents whose business suffered negative effects from previous flooding perceiving backflow within drainage systems as a 'high risk' than those who had not.

However, Table 5.5 suggests that the potential shock factor from previous flooding had less impact on perceptions of flooding from sea water overtopping defences than for perceptions of flooding from backflow within drainage systems. This finding could be due to a lack of tacit knowledge within the business concerning estuarine flood events. This is supported by data from the Office for National Statistics (2007:14-15) showing that in 2005, 77% of the total population within the Unitary Authorities of the East Riding of Yorkshire, Hull City Council, North Lincolnshire and North East Lincolnshire were either under 7 years old, or not born at the time of the 1953 floods which were caused by sea water overtopping estuary defences. The remaining 23% of the population who are currently over 60 years old are less likely to be within the current working population, and hence sampled for the survey in this thesis. This means that people with experience of the 1953 floods are unlikely to be represented in the results reported here. In contrast, approximately 58% of the Humber population were of working age at the time of the June 2007 floods which caused backflow within drainage systems (Office for National Statistics, 2007: 14-15), so the business people sampled are far more likely to have experienced this type of flooding. 34 out of the 44 businesses which had suffered negative effects from previous flooding answered the question about when they were affected. Table 5.7 shows that all but 3 respondents were flooded after 1953, with the vast majority of these occurring during the pluvial floods of 2007.

Year business suffered negative effects of previous flooding	Number of respondents
1947	1
1953	2
1978	1
1980	1
1984	1
1989	1
2000	1
2006	2
2007	23
2008	1
Undisclosed	10
n = 44	

Table 5.7 - Year that businesses suffered previous negative effects from flooding at their premises

'High risk' perceptions influenced by the shock factor associated with flooding from backflow within the drainage system is supported by the finding that over 52% of businesses suffering negative effects from previous flooding had exposure to this type of flooding during 2007. By comparison, the lack of exposure to flooding from sea water overtopping flood defences has not posed a reality test(Lange and Garrelts, 2007) to the safety discourse surrounding estuarine flood risk management. As the flood defences in place around the Humber have not been breached for over 58 years, respondents appear to be less aware of the risks associated with storm surge flooding than for those related to backflow within drainage systems. Although Visschers *et al.* (2007:719) suggest that people often relate information about an unknown risk to a cognitive scheme for a known risk "based upon similarity of characteristics", this does not seem to have occurred in this particular instance.

The different characteristics which influence the perceived risk for the two different flood types appear to hamper a transfer of knowledge, which is demonstrated by data gathered within the interview process. Drew (Wholesale and retail, previously flooded, West Hull) experienced negative effects from flooding at his business premises in 2007 and said: "The only reason we flooded was because the drains in the ten foot don't work. You see an odd drain cleaner out now which you didn't see before so that's going to help. You know there's no two ways about it. At some point it'll happen again won't it? Everybody will be in the same mess again". Max (Manufacturing, previously flooded, Hull River) also reflected similar concerns about the drainage system which caused flooding affecting him in 2007. He said "So as the rain started to build up, the water wasn't flooding away and was blocking up so to speak. The other thing which they need to do, which I see them doing [now] is, one of the big issues is that they weren't bloody cleaning the drains out proper [sic] were they?"

Throughout my conversations with both Drew and Max, they both appeared oblivious to other types of flooding apart from that directly related to causing backflow within the drainage system, highlighting the pitfall of relying upon heuristic risk association between directly and indirectly experienced events in terms of identifying and acting upon a range of ambiguously 'similar' characteristics in this instance (Loewenstein *et al.* 1999, Terpstra *et al.* 2009).

When questioned on whether he was aware of any of the current defence schemes on the Humber estuary Drew said: "I know there's talk it's only going to last so long before they have to do something with it. No, it hasn't really crossed my mind, hasn't that. Like I say where I am, I'd probably be alright anyway. And I would think we'd probably be alright here. I would have thought I'd be very unlucky if it affected me [sic] business." According to the questionnaire he filled in, Drew perceives his premises to be at a 'high risk' of flooding from backflow within drainage systems, and at a 'low risk' from sea water overtopping estuary defences. Likewise, Max was also unaware of flood mitigation works on the estuary shoreline, perceiving his premises to be at a 'medium risk' of flooding from backflow within drainage systems, and at a 'low risk' from sea water overtopping estuary defences.

However, both Drew's and Max's premises are in an area classed as liable to flood 1 in every 200 years by the Environment Agency, which is the most severe out of the two flood risk zones around the Humber estuary. Despite their businesses' exposure to pluvial flooding in the form of backflow within drainage systems in 2007, the resulting shock factor has not appeared to increase their awareness of other types of flooding such as sea water overtopping estuary defences. A lack of concern for sea water overtopping defences could be seen to support Pottier *et al.*'s (2005) theory that floods which occurred in the distant past are seen within society as 'freak events'. As such an event which has not occurred for many years, and indeed not within either Drew's or Max's lifetime, may also be responsible for preventing their tacit knowledge gained from flooding caused by backflow within drainage systems from being 'transferred' to formulate perceptions of risk for flooding caused by sea water overtopping defences.

Some of the other interviewees I spoke to had not experienced negative effects from flooding before. Morgan (Transport, storage and comm., no prior flood experience, West Hull) talked about the impact that previous experience of flooding would have on his own thinking and said: "You know it's like cars. Like driving a car, you know. If you have an accident you're more, you're more prone to be a bit more careful in future aren't you? But then if you don't, you're a little more blasé. And that's how I'd like to think people act and react". Again, this serves to demonstrate the key role that experience plays in establishing flood risk perceptions as advocated by prior research (Zaleskiewicz *et al.*, 2002; Siegrist and Gutscher, 2008; Harvatt *et al.*, 2011).

However, in terms of knowledge transfer, my findings suggest that businesses do not see different types of flooding as sharing similar characteristics. Therefore experience of one type of flooding does not mean that any tacit knowledge gained is readily transferable to shape perceptions associated with other types of flooding. The knowledge and experience gained from businesses caught up in the last major flooding incident in 2007, triggered by backflow within drainage systems, appears to have been locked in to its causal event. This is shown by the prominence of 'medium' risk perceptions regarding flooding from sea water overtopping estuary defences compared to the prominence of 'high risk' perceptions related to flooding caused by backflow within drainage systems.

This supports findings from Lowenstein *et* al. (1999) which highlight the role of 'framing' for knowledge transfer between such events. Even though similar events are juxtaposed, the way in which they are framed may mean that useful comparisons are missed. This finding is particularly pertinent for flood risk mitigation through a system of governance, as if the construction of risk perceptions of estuarial flooding are based predominantly upon previous experience, business involvement within the process of governance is likely to be uneven. Difficulties in getting businesses to involve themselves within flood risk mitigation plans may also be exacerbated further as experience does not seem to transfer across different flood types particularly well. Although the majority of businesses surveyed have no tacit knowledge of flooding (of either backflow within drainage systems or sea water overtopping estuary defences events), the geography relating to the distribution of tacit

164

knowledge has not yet been examined. The next section explores the relevance of the location of business site to the estuary, to see whether this has an impact upon flood perceptions.

5.4 Do flood risk perceptions vary according to the distance of the business from the estuary shoreline?

Previous research suggests that proximity, place and geographical embeddedness are key components in knowledge formation within specific local areas (Fiorino, 1990; Wynne, 1992a; Tierney, 1999; Tran *et al.* 2009; Parkhill *et al.* 2010). Examining this embeddedness may help to provide context to the importance of previous experience in forming risk perceptions by focusing upon the two flooding types of backflow within drainage systems and sea water overtopping estuary defences.

Table 5.8 shows the mean business risk perception values for the flood types of backflow within drainage systems and sea water overtopping estuary defences in relation to the proximity of the company premises to the Humber estuary, based upon numerical values of 3 for respondents ticking 'high risk', 2 for 'medium risk' and 1 for 'low risk'.

	Flood type		
Distance from estuary shoreline	Backflow within drainage systems	Sea water overtopping estuary defences	
0 -500m	1.76	1.61	
501 - 1000m	1.84	1.56	
1001 - 1500m	2.00	1.49	
1501 - 2000m	2.00	1.32	
2001 - 2500m	2.11	1.41	
2501 - 3000m	2.03	1.54	
n = 332			

 Table 5.8 - Mean risk attributed to different flood types in relation to distance of business premises from estuary shoreline

Based upon the proximity of businesses to the risk posed by the estuary, I expected risk perceptions associated with sea water overtopping estuary defences to offset risk perceptions associated with backflow within drainage systems nearer to the estuary shoreline. Conversely, as distance from the estuary shoreline increases I expected flood risk perceptions associated with sea water overtopping estuary defences to be offset by backflow within drainage systems. However, the data show less clear-cut patterns. It can be seen from Table 5.8 that mean risk perceived from a flood caused by backflow within drainage systems appears to increase with distance from the estuary shoreline. Mean perception values start at 1.76 for the 0-500m distance group and continue to increase with every distance group up to 2.11 for the 2001-2500m distance group. However this trend trails off for the 2501-3000m distance group, with a lower value of 2.03. Mean risk perception levels for sea water overtopping estuary defences appear to decrease with distance from the shoreline between the 0-500m distance group at 1.61 and the 1501-2000m distance group at 1.32. However, the values then increase between the 2001-2500m distance group at 1.41 and the 2501-3000m distance group at 1.54. Findings from Sections 5.2 and 5.3 have both indicated that flood risk perception levels associated with sea water overtopping defences are substantially lower than those associated with backflow within drainage systems, rendering the initial results in Table 5.8 somewhat surprising. However, a closer inspection revealed a more confused picture. Table 5.9 shows the different risk perceptions associated with backflow within drainage systems in relation to distance from the estuary shoreline.

		Flooding from backflow within drainage system			
Distance from estuary shoreline		High risk	Medium risk	Low risk	Total
0-500m	Count	25	43	55	123
	%	20%	35%	45%	100%
501-1000m	Count	17	20	27	64
	%	27 %	31%	42 %	100%
1001-1500m	Count	16	21	16	53
	%	30%	40%	30%	100 %
1501-2000m	Count	10	17	10	37
	%	27%	46%	27 %	100%
2001-2500m	Count	11	8	8	27
	%	40%	30%	30%	100%
2501-3000m	Count	10	9	9	28
	%	36%	32%	32%	100%
n = 332					

Table 5.9 - Risk perceptions of backflow within drainage systems by distance of business premises from estuary shoreline

The shading in Table 5.9 indicates that 'low risk' is the modal response from participants within the 0-500m group and the 501-1000m group for flooding caused by backflow within drainage systems, at 45% and 42% respectively. However, 'medium risk' is the mode for the 1001-1500m and 1501-2000m groups with values of 40% and 46% respectively. In the 2001-2500m and 2501-3000m distance groups 'high risk' is the mode at 40% and 36% respectively. There is a sharp contrast with risk perceptions for flooding caused by sea water overtopping estuary (Table 5.10), where the mode is overwhelmingly seen as 'low risk' by all groups.

		Flooding from sea water overtopping estuary defences				
Distance from estuary shoreline		High risk	Medium risk	Low risk	Total	
0- 500m	Count	20	35	68	123	
	%	16%	29%	55%	100%	
501-1000m	Count	4	28	32	64	
	%	6%	44%	50%	100%	
1001-1500m	Count	8	10	35	53	
	%	15%	19%	66%	100%	
1501-2000m	Count	2	8	27	37	
	%	5%	22%	73%	100%	
2001-2500m	Count	3	5	19	27	
	%	11%	19 %	70%	100%	
2501-3000m	Count	3	9	16	28	
	%	11 %	32%	57%	100%	
n = 332						

Table 5.10 - Risk perceptions of sea water overtopping estuary defences by distance of business premises from estuary shoreline

However, there is no clear correlation between perception levels and distance from the shoreline. 'Low risk' perceptions dominated, comprising 50% of the 501-1000m group, 66% of the 1001-1500m group, 73% of the 1501-2000m group and 70% of the 2001-2500m group.

The apparent lack of impact on risk perceptions in relation to distance from the shoreline was most surprising. I checked to see if the patterns identified in Table 5.9 and Table 5.10 were statistically significant. As the data was not normally distributed, this required a non-parametric Spearman's Rank test (Table 5.11).

	Perceptions of risk of flooding from backflow within drainage systems	Perceptions of risk from flooding from sea water overtopping estuary defences	n				
Correlation coefficient	0.154	- 0.104	332				
Р	0.005*	0.058					
* denotes significant difference at p value of 0.05							

Table 5.11 - Spearman's Rank tests for correlations between flood risk perceptions and distance from estuary shoreline

Table 5.11 shows a small but statistically significant correlation between flood risk perceptions and distance from the estuary shoreline for flooding from backflow within drainage systems. Although this correlation is statistically significant at the 95% confidence level, with a positive value of 0.154, the correlation is weak. Table 5.11 also shows a weak negative correlation attributed to flooding from sea water overtopping estuary defences that is not statistically significant.

Although the statistically significant but weak positive correlation is in line with what I would have expected, whereby businesses further from the estuary would perceive themselves to be of greater risk from flooding caused by backflow within drainage systems, this was not matched by a statistically significant negative trend for flood risk perceptions related to sea water overtopping estuary defences. The results confirm findings from Section 5.3 that businesses as a whole do not seem to be registering flood risk from sea water overtopping estuary defences. Research by Freudenberg (2007:128) has examined the concept of expectancy where "scientific achievements quickly become part of our baseline expectations". In relation to flood defences on the Humber estuary, it would appear that defences which have prevented estuarial flooding since 1953 have become part of baseline expectations within Humber businesses. Masuda and Garvin (2006:483) observe that "risks are situated within the social experiences and interactions of individuals, groups and institutions", therefore implying that the risk of sea water overtopping defences may not be present within local businesses as the defences have almost been *too* effective in their purpose of preventing flooding since they were installed.

Additional support for this reasoning was found within the data gathered from interviews with questionnaire respondents. Morgan (Transport, storage and comm., 0-500m distance band, West Hull) can see the estuary banks from his office window. He said: "I mean we have the docks over there obviously. They're spending a lot of money on building up the defences anyway, so they control the water going in, the water going out. You know we've got access to the dock if we want to see the levels of the water. Even at even at high tide it never goes high. But then other people come in and inspect it. And our insurers and everybody else who'd want to put our premiums up tend to use the dock as an excuse, shall we say, to put premiums up because it's near water"

Even though Morgan's insurers regard his proximity to the estuary as a flood risk, he does not personally appear to consider his business site to be at risk due to the trust he has placed in the estuary flood defences. Alex (Manufacturing, 501-1000m distance band, North East Lincs) whose business is also located close to the estuary shoreline shared similar views. He said: "I know they have been working along the kind of sea wall area. They're actually being seen to put steps in to improve those, then we can [be] comfortable, well be fairly comfortable".

However, there were also some more unexpected opinions from businesses close to the estuary shoreline. Unlike his other business neighbours, Ashley (Wholesale and retail, 501-1000m distance band, Hull River) said: "Unfortunately there is Prince's Quay, Prince's Dock. Which is, I think that's linked to the marina isn't it somehow? And there is no way they can
block the end of that off should that rise. So it's a matter of having to accept the risk of where we are unfortunately. My adage is why worry about something if it might never happen".

Ashley's view came as a surprise. Even though he doesn't realise that there *are* in fact sea defences in place along the area he is describing that could 'block the end' safely, he still does not acknowledge the risk from estuarine flooding, having rated his premises at 'low risk' from sea water overtopping defences on the quantitative survey. Similar views reflecting Ashley's understanding of timescales and the likelihood of flooding were also expressed by other respondents. Jamie (Manufacturing, Hull River) also had premises within the 501-1000m distance band from the estuary shoreline. He said: "I would say that clearly if sea levels do rise. If sea levels say rose a metre, probably this city would be flooded. If they were to rise say a foot you could probably cope with that. Then there's the timescale over which that happens. Obviously if it's a metre over a century, well I'll be long gone and pushing up daisies by then it doesn't really matter."

It therefore appears that the distance of the business premises from the estuary shoreline does not influence flood risk perceptions relating to flooding from sea water overtopping estuary defences. Estuary defences seem to be so embedded in geographical locations close to the estuary shoreline that they have become a 'norm'. Whilst some respondents are seen to be comfortable with the location of their business due to the trust placed in estuarine defences, others seem to have forgotten that the defences are even there or are completely unaware of them. Ultimately, even concerns regarding any timescales for the likeliness of flooding come down to the understanding and knowledge of estuary defences, which are engineered to provide protection against floods with a return period of 1 in 200 years (Environment Agency, 2000). The data collected suggests that estuary defences do not seem

to be visible within the local knowledge of firms due to the high number of years the defences have now been present on the shoreline, and their subsequent lack of exposure to a reality testsince their construction. This also presents a problem in terms of the current governance model being used to tackle flood risk mitigation. With the Environment Agency seeking the involvement of local businesses in policy related to flood risk matters along the estuary shoreline, there may be considerable barriers to be overcome as businesses closer to the estuary shoreline do not perceive themselves to be at any greater risk of estuarine flooding than businesses further inland. A flood risk mitigation plan on the Humber estuary that is run through governance will therefore need to find another way of communicating flood risk to businesses due to the combination of a lack of current experience upon which businesses can formulate accurate risk perceptions, the lingering sense of security from a bygone safety discourse and the apparent lack of transferability of tacit knowledge from pluvial flooding. Without action to counter these three issues, it will be difficult to attain the objective of including all private Humber firms within the flood risk mitigation governance process.

Although distance from the estuary shoreline does not appear to effect business perceptions of estuarine flood risk, the different opinions given by the four different interviewees and the perceived level of flood risk they attach to flooding from sea water overtopping estuary defences was particularly interesting. This may suggest that that business practices and specific business characteristics may also influence flood risk perceptions. The next section explores whether business flood risk perceptions differ between the industrial sector the firm operates within.

5.5 Do flood risk perceptions vary according to industrial sector ?

Although there is no prior body of research examining how *flood* risk perceptions differ between industrial categories, literature from business studies states that distinct differences exist in *economic* risks between businesses within different industrial categories (Patton and Baron, 1995; Bradfield *et al.*, 2005). An example of such a difference is that the economic risks involved with manufacturing are inherently higher than those associated with service industries due to the amount of investment required in capital and assets (Van Gelderen *et al.*, 2006:332). These differences in economic risks could possibly be transferred into environmental risk perceptions due to the impact that a flood event could have on a company's capital assets. Whilst any flood event is likely to cause severe disruption to a business, a service business with little specialist equipment will find itself in a different position to a specialist manufacturer in terms of the amount of damage caused to core company assets (Crichton, 2008).

For the purpose of representativeness, the utility sector was excluded from the analysis in this section, as it was represented by just 1 out of the 377 business questionnaires that were returned. This left six different industrial categories comprising: hair and beauty, wholesale and retail, construction, manufacturing, transport, storage and communication; and agriculture. The mean risk perception level for each of these industrial categories is shown in Table 5.12, based upon 3 for respondents ticking 'high risk', 2 for 'medium risk' and 1 for 'low risk'.

business category			
	Flood	l type	Backflow within
	Backflow within	Sea water overtopping	drainage systems <i>Minus</i> sea water

drainage

systems

2.29

1.97

1.82

1.86

1.74

1.76

estuary

defences

1.64

1.45

1.37

1.60

1.54

1.95

Table 5.12 - Mean risk perceptions	attributed to different flood types in relation to
business category	

Industrial category

Hair and beauty

Construction

Agriculture

n = 331

Manufacturing

Wholesale and retail

Transport, storage and comm.

Table 5.12 shows that, on average, all sectors perceive backflow within drainage systems as a higher flooding risk than sea water overtopping estuary defences, apart from agriculture where the mean risk for sea water overtopping estuary defences was 0.19 higher than the mean risk perception for flooding from backflow within drainage systems. The patterns displayed are quite mixed, with both hair and beauty and wholesale and retail exhibiting large differences between the mean risk perception values of the two types of flooding under investigation at 0.65 and 0.52 respectively. The transport, storage and communication industry sector showed the smallest differences between risk of backflow and of sea water overtopping.

These confusing patterns seem to suggest variations between different industries which need to be examined in further detail by breaking down the risk perceptions associated with each flood type. Table 5.13 displays the risk perception levels associated with backflow within drainage systems.

sea water

overtopping

estuary defences

0.65

0.52

0.45

0.26

0.20

-0.19

		Flooding from backflow within drainage systems			
Industrial category of business		High risk	Medium risk	Low risk	Total
Hair and beauty	Count	6	6	2	14
	%	43%	43%	14%	100%
Wholesale and	Count	34	36	37	107
retail	%	31 %	34%	35%	100%
Construction	Count	14	19	24	57
	%	25%	33%	42 %	100%
Manufacturing	Count	22	39	35	96
	%	23 %	40%	37%	100%
Transport, storage	Count	8	10	17	35
and comm.	%	23 %	28%	49%	100%
Agriculture	Count	4	8	9	21
	%	19%	38%	43%	100%
n = 331					

Table 5.13 - Risk perceptions of backflow within drainage systems by industrial category of business

The shading within Table 5.13 shows that the modal response for backflow within drainage systems is a 'low risk', apart from hair and beauty and manufacturing which both buck the negative trend in risk perception levels shown by the other four industries. For hair and beauty, 'medium' and 'high' risk perceptions are on an equal footing of 43% each whereas 40% of manufacturing respondents rate backflow as a 'medium risk'.

Overall, there do not appear to be substantial differences between the different industries in their flood risk perceptions for flooding caused by backflow within drainage systems. However, a breakdown of perception levels related to flooding from sea water overtopping defences revealed more interesting findings (Table 5.14).

		Flooding from sea water overtopping estuary defences			
Industrial category o	of business	High risk	Medium risk	Low risk	Total
Hair and beauty	Count	3	3	8	14
	%	21%	21%	58%	100%
Wholesale and retail	Count	10	28	69	107
	%	9%	26%	65%	100%
Construction	Count	4	13	40	57
	%	7%	23%	70%	100%
Manufacturing	Count	12	34	50	96
	%	13%	35%	52%	100%
Transport, storage	Count	4	11	20	35
and comm.	%	11%	32%	57%	100%
Agriculture	Count	7	6	8	21
	%	33%	29%	38%	100%
n = 331					

Table 5.14 - Risk perceptions of sea water overtopping estuary defences by category of business

The shading in Table 5.14 shows similar patterns to Table 5.13 in that 'low' risks dominate respondents' perceptions within each sector. This includes both hair and beauty and agriculture, although 33% of agriculture respondents perceived 'high' risks. Interestingly, the construction industry shows the greatest proportion of respondents perceiving 'low risk' at 70%, and the lowest for proportion of respondents perceiving 'high risk' at just 7%, a pattern mirrored by wholesale and retail.

In order to check whether the trends identified between the different industrial sectors are significant, I ran statistical tests on the data (Table 5.15).

Table 5.15 - Kruskal-Walis test for difference between flood risk perceptions and category of business

	Perceptions of flood risk from backflow within drainage systems	Perceptions of flood risk from sea water overtopping estuary defences	N		
Industrial category of business	0.212	0.029*	331		
* denotes significant difference at p value of 0.05					

Table 5.15 shows that the sectoral differences between flood risk perceptions for backflow within drainage systems are not statistically significant at the 95% certainty level, but differences for sea water overtopping were statistically significant at the 95% certainty level, contrasting strongly with the data shown in Table 5.11. Further analysis is required to determine which categories show significant differences. This was carried out using pairwise Mann-Whitney U tests (Table 5.16).

	Hair and beauty	Wholesale and retail	Construction	Manufacturing	Transport, storage and comm.	Agriculture
Hair and beauty						
Wholesale and retail	0.421					
Construction	0.251	0.472				
Manufacturing	0.992	0.074	0.029*			
Transport, storage and comm.	0.793	0.422	0.199	0.630		
Agriculture	0.325	0.007*	0.003*	0.081	0.075	
n = 312 * denotes significant difference at p value of 0.05						

Table 5.16 - Mann-Whitney U tests for difference between flood risk perceptions and category of business for sea water overtopping

Table 5.16 shows the only differences in risk perceptions to be statistically significant are those between the manufacturing and construction, agriculture and wholesale and agriculture and construction industries. The differences between the other industrial sectors within the table were not significant at the 95% certainty level and may well have occurred by chance.

Table 5.14 shows the proportion of respondents perceiving 'low risk' is greatest within the construction industry at 70%, whilst only 7% respondents within the same industry perceive sea water overtopping estuary defences as a 'high risk'. In contrast, the smallest proportion

of businesses perceiving this type of flooding as a 'low risk' is (except for agriculture) within the manufacturing industry at 52%, with a larger 13% of respondents perceiving it as a 'high risk. Interviews suggest that this may be down to the different nature of operations within the two businesses, in that manufacturing is more regulated in general. Tony (1501-2000m distance band, North Lincs) who runs a manufacturing business said: "We have a risk management plan. And that incorporates risks such as fire, flood. We've got a flood management plan, obviously as a manufacturing plant in excess of 70 tonnes a week, we've got to be accredited. So we abide by the CCL [Climate Change Levy] regulations and obviously we're licensed."

Alex (Manufacturing, 501-1000m distance band, North Lincs) also mentioned regulation in respect to his business operations. He said: "We've got three business areas: refrigerants and liquefied gaseous chemicals and scientific. We've got quite a lot of electrical equipment, electronic equipment, as well. You know if they go by the letter of that saying you [high hazard plant operators] can't put high hazard storage on a flood area, you're stuffed."

It can be seen that the manufacturing industry, at least in these two cases, is subject to intense regulation which requires assessment of flood risk within legislation governing such business operations. In conjunction with the large amount of capital invested within the sites in equipment and plant, this may suggest why flood risk perceptions are slightly higher than those within the construction industry.

Although the construction industry covers a wide range of businesses from painters and decorators to builders and plumbers, evidence from the interviews suggested that businesses within the industry are more footloose in their nature than manufacturing. Whilst still having premises as a company base, work is generally carried out on another site, or sometimes multiple sites involving other partners. When working at these other sites, flood risk may not always feature as Pat said: "The Industrial Park is owned by Yorkshire Forward and we are the development partner. We're taking precautions and we're hoping that they will maintain their banks properly". Sidney added: "So what I'm getting at [is] it's not our problem. It's the Council's problem or the Environment Agency's problem... It's no threat to me!"

The mobile nature of the construction sector and its collaborative nature may go some way to explaining why flood risk perceptions are lower in relation to those of the manufacturing industry whose capital is geographically fixed and immobile. However, it is important not to over-emphasise the very slight variations between risk perceptions, as both industries also reflect the general trend shown in all sectors (except agriculture) towards perceiving 'low risk' overall (Table 5.14).

Table 5.16 showed that the agriculture industry also exhibited statistically significant differences in risk perception levels from the construction and wholesale industries. Construction and wholesale showed the highest percentage of respondents perceiving 'low risk' from flooding caused by sea water overtopping estuary defences. Table 5.16 also shows construction to have the smallest percentage of respondents perceiving flood risk from sea water overtopping estuary defences as a 'high risk' at 7%, with wholesale closely behind at 9%. This contrasts markedly with agriculture, with 38% of agriculture respondents perceiving this type of flooding to be a 'low risk' and 33% to be a 'high risk'. These findings can be explained to an extent by contrasting business operations. Like manufacturing, agricultural businesses are rooted in a specific geographical location, and although crop rotations and diversification may take place, mobility is inherently low. Also, dealing with water forms a major component of the farming business, with all three farmers interviewed

for this project being members of their local drainage board. Drainage boards are elected bodies managed by a mixture of local farmers, local residents and local councillors. The primary purpose of the drainage board is to maintain and manage the local drainage channels that are tasked with delivering water from the drain network either directly into the Humber estuary, or to Environment Agency pumping stations on the various regional waterways that flow into the estuary. Robin (Agriculture, 0-500m distance band, North Lincs) explained his experience on the drainage board: "For sixty years I've been involved with the land drainage, partly because my first year farming I was bogged down and my field was in a mess. I thought if I'm going to continue farming, I'm going to make sure the drainage systems is right [sic]. So from there I've always been involved [with] drainage ever since".

Chris (Agriculture, 501-1000m distance band, North Lincs) also highlights the family and community aspect of the business, meaning that tacit knowledge such as that outlined above by Robin, is passed on to others in the farming community: "We've got generations of history. Not just the last 3 weeks. It goes back probably the best part of 70 or 80 years. You know. It's been handed down from one generation to the next... there's my father. He's a classic example. He's 86 years of age. He's been dealing with drainage all his life. Since during the war and he knows the history of all the pumps and everything like that... he has some very good knowledge, although his memory is going a bit. But he remembers the disasters. He remembers '53 and things like that".

These key experiences have been captured through long term involvement in drainage issues and land management on the estuary, and comprise the tacit knowledge from which farmers construct their flood risk perceptions. Once again the role of prior experience comes into play. Even though some of the farmers may not have witnessed previous

estuarial flooding themselves, the tacit knowledge from many years ago still appears to be shared and active within farmers' perceptions thanks to the existence of the drainage boards. Flood risk appears to be integrated within business operations, as farmers deal with the management of their land on a daily basis. Robin explains: "We've done a lot of drainage work. And we can cope with heavy rain. What we couldn't cope with is if the banks burst, overtopped. Where it actually flooded [in 1947] it took two or three years to recover [because] the banks were so bad."

Although farmers seem capable of dealing with flooding from pluvial sources, they are also aware of the extreme destruction from estuarine flooding based upon well communicated tacit knowledge. This was in marked contrast to both the construction and the wholesale industries which appeared to view flooding from sea water overtopping as a non-severe event. Pat (Construction, 0-500m distance band, Hull) described what he thought would happen: "I think one of the interesting things there is that these [sea defences overtopping] are not sort of flash flood events that, you know, just happen within a couple of hours. It'd be over a cycle of tides. And you would actually see the water creeping up the road you know so people would have plenty of time to take action. It's not, you know, flooding from rivers bursting their banks and stuff which you get further inland"

Pat has no prior experience of estuarine type flooding, and the way in which he imagines that events unfold are in sharp contrast with Robin (Agriculture, 0-500m distance band, North Lincs) who describes his experiences in relation to the 1947 events: "I remember two bits of overtopping coming over the banks. It was frightening actually. And it'd washed the top of the banks and the road away and it went around and it was going inland. And got near to Scunthorpe, but it's contained within a short distance of the Trent because of the higher ground. So if it had come this side [of the banks] it could have spread for 10 or 15 miles inland. They tried to block it [using] six barges. It just flung the barges inland. So what they did in the end, they got Dutch engineers to send some big excavators across from Holland. They built an embankment and brought it inland. Then that stopped the water flushing through. That took them nine months to do *that*"

There was no evidence of any prior knowledge of the effects of estuarine flooding within the wholesale industry either. Mandeep (Wholesale and retail, 0-500m distance band, North Lincs), near to the River Trent, admitted he did not know much about the risks from tidal surges. He said: "I think they [Environment Agency] should advise the businesses about the risks. You know. In a greater way than they do at the moment. Especially when they design new industrial estates, or any new developments so the businesses are aware. There is a risk, and how big is the eventual risk to the business? 'Cause obviously it will make a difference".

Whilst evidence gathered from the interviews suggested that the small differences in flood risk perception for sea water overtopping estuary defences may be down to different business practises alone, the more substantial differences exhibited between agriculture and construction and agriculture and wholesale appear to be a fusion of both business practice and experience. Agriculture was the only industry to have shown a significantly higher number of respondents perceiving 'high' flood risk in Table 5.14, at 39%. Whilst agricultural business practices vary from those within the construction and wholesale industry, they are also intertwined with tacit knowledge which is retained within the industrial sector. This is facilitated by the use of drainage boards as a conduit for exchanging flood related knowledge. It appears that this knowledge is the key to shaping the unusual risk perceptions observed within Table 5.13 and Table 5.14. There was no evidence of similar tacit knowledge use in either the construction or wholesale industries, nor a network

through which these could be effectively communicated to different businesses within the same industry. Even though business practices may be different, there is no evidence from the in-depth interviews to suggest how such practices may impact upon risk perceptions without a tacit knowledge grounding. The only observation in this area is that business practices for both construction and manufacturing are less dependent upon the local environment and shared tacit knowledge within the industrial category than is the case for agriculture.

This finding is supported by previous research where both Wynne (1989, 1992a) and Posthumus *et al.* (2009) highlight the importance of farmer experience and tradition in relation to 'working with' nature. By contrast, Linnenluecke (2011) observes that (non agricultural) businesses are typically imagined to be operating in an economy that is fundamentally disconnected to the natural environment. However, this is not to say that such businesses are incapable of making any connection with the natural world through their daily operations. Petts (1999) emphasises that although businesses can demonstrate concern about the environment, she found that they are not inclined to involve themselves in environmental issues unless it involved complying with specific regulation, many of which do not apply to SMEs which represent the largest category of private businesses in the UK.

The differences in flood risk perception between industrial categories of business again seem to come down to business experience. Although this is good news for the Environment Agency, as it suggests that businesses are likely to be no more difficult to involve in the flood risk governance process for the Humber estuary on the basis of their industrial sector alone, it does serve to re-emphasise the issue of counteracting a lack of tacit knowledge to ensure that businesses are aware and concerned enough to take part within the governance process. Probing deeper into the role of experience, I wanted to look at whether the

business 'life' impacts upon flood risk perceptions. With some of the business tacit knowledge circulating within the agricultural sector being around 80 years old, I wanted to see whether the number of years the business had been operational, and subsequently whether the number of years the respondent had worked within the business, affected flood risk perceptions and knowledge transfer. This is examined within the next section.

5.6 Do flood risk perceptions vary according to business 'life'?

As tacit knowledge is gleaned over time, I would expect older businesses to be more aware of flooding from both pluvial and estuarine sources than newer businesses. Research has shown that older businesses are likely to grow attached to their premises, with the propensity to relocate decreasing with age (Brouwer *et al.*, 2004; Brouwer, 2010). As such, older companies should build up a tacit knowledge of the local area, which includes previous flood events and their associated effects. With this in mind, I coded the dates provided within the surveys around the last major estuarine flooding event in 1953. Due to the low number of respondents with companies starting before 1953, their perceptions were all grouped together up to the year of the East Coast Floods. Tacit knowledge was examined by grouping perceptions in 10 year periods after 1953. Table 5.17 shows mean flood risk perception values in relation to the business startup date groups for both backflow within drainage systems and sea water overtopping estuary defences. The figures displayed are means based upon numerical values of 3 for 'high risk', 2 for 'medium risk' and 1 for 'low risk'.

Table 5.17 - Mean risk perception	levels attributed to different flood types in relation to
business startup year	

	Flood type		Backflow within
Business startup year	Backflow within drainage systems	Sea water overtopping estuary defences	drainage systems <i>Minus</i> Sea water overtopping estuary defences
1890 – 1953	1.80	1.73	0.07
1954 – 1963	2.06	1.75	0.31
1964 – 1973	2.25	1.70	0.55
1974 – 1983	1.88	1.50	0.38
1984 – 1993	1.80	1.52	0.28
1994 – 2003	1.91	1.44	0.47
2004 – 2009	1.87	1.43	0.44
Range between risk perceptions within flood type group	0.45	0.32	
n = 330			

Table 5.17 shows no clear pattern between the company startup date and mean flood risk perception values for flooding caused by backflow within drainage systems. Values rise from 1.80 to 2.25 for companies which started between 1890 and 1973, before falling to 1.80 for companies which started between 1974 and 1993. They then rise slightly to 1.91 for companies which started between 1994 and 2003, before falling once again to 1.87 for companies which started between 2004 and 2009. In the case of flooding caused by backflow within drainage systems, older companies do not appear to exhibit distinctly different flood risk perceptions to new companies.

On the other hand, a negative trend can be observed in mean perception values for flooding caused by sea water overtopping estuary defences. The mean flood risk perception value increases from 1.73 for the 1890-1953 company startup group, to 1.75 for the 1954-1963 company startup group but after that, flood risk perception values fall consistently for companies starting up between 1964 and 1983. For the 1984-1993 startup group, they rise slightly to 1.52 before falling again amongst companies starting up between 1994 and 2009

to an overall low of 1.43. The general trend appears to be that older companies exhibit higher flood risk perceptions in relation to flooding caused by sea water overtopping estuary defences than their younger counterparts.

The difference between backflow within drainage systems perception values and sea water overtopping estuary defences perception values shown in Table 5.17 does not exhibit a clear pattern. However, all values are positive, as within each grouping of company startup dates, risk perception levels are higher for floods caused by backflow within drainage systems than for those caused by sea water overtopping estuary defences. There is also a greater range in mean risk perception levels associated with backflow within drainage systems at 0.45 compared to sea water overtopping estuary defences at 0.32. In order to examine these patterns further, Table 5.18 shows a break down of flood risk perceptions associated with backflow within drainage systems.

		Flooding from backflow within drainage systems			
Company start	up date	High risk	Medium risk	Low risk	Total
1890 – 1953	Count	10	15	19	44
	%	23%	34%	43%	100%
1954 – 1963	Count	5	7	4	16
	%	31%	44%	25%	100%
1964 – 1973	Count	8	9	3	20
	%	40%	45%	15%	100%
1974 – 1983	Count	5	11	8	24
	%	21%	45%	33%	100%
1984 - 1993	Count	14	27	28	69
	%	20%	40%	41%	100%
1994 – 2003	Count	27	32	36	95
	%	28%	34%	38%	100%
2004 - 2009	Count	18	17	26	61
	%	29%	28%	43%	100%
n = 330					

Table 5.18 - Risk perceptions of backflow within drainage systems by company startup year

The modes within Table 5.18 show a mixed pattern. Companies which started up between 1890 -1953 are more likely to perceive backflow within drainage systems to be a 'low risk' at 43%. However, for companies starting up between 1954 and 1983, respondents are most likely to perceive backflow within drainage flooding as 'medium risk'. Perceptions revert back for companies which started up between 1984 and 2009, with respondents most likely to perceive a 'low risk'. This was unexpected, as if tacit knowledge is constructed upon experience, it does not seem logical that companies established between 1890 and 1953 would exhibit lower risk perceptions than those established between 1954 and 1973. By virtue of their age, these companies would have been operating at the same time. Table 5.18 also shows that their 'low risk' perceptions for backflow within drainage systems (e.g. in 2007) are not offset by a higher concern for sea water overtopping estuary defences (e.g. in 1953). Respondents are least likely to perceive 'high risk' in all company startup year groups apart from companies that started up between 1954-1963 and 1964-1973. Within these groups, 31% and 40% of respondents perceive 'high' risks respectively, although it is unclear why. I therefore turned to the sea water overtopping estuary defences flood type (Table 5.19).

		Flooding from sea water overtopping estuary			
			defer	ices	
Company startup date		High risk	Medium risk	Low risk	Total
1890 – 1953	Count	11	10	23	44
	%	25%	23%	52%	100%
1954 – 1963	Count	2	8	6	16
	%	12%	50%	37 %	100.0%
1964 – 1973	Count	2	10	8	20
	%	10%	50%	40%	100%
1974 – 1983	Count	1	10	13	24
	%	4%	42%	54%	100%
1984 – 1993	Count	9	18	42	69
	%	13%	26%	61%	100%
1994 – 2003	Count	9	24	62	95
	%	10%	25%	65%	100%
2004 – 2009	Count	6	14	41	61
	%	10%	23%	67%	100%
n = 330					

Table 5.19 - Risk perceptions of sea w	vater overtopping estuary defences by company
startup year	

Table 5.19 appears to show a more confused pattern than the original analysis within Table 5.17. However, it closely resembles Table 5.18 in terms of the 'low risk' being commonly perceived across all groups, shown by the shaded boxes. Again, it seems unlikely that older companies would not recognise the same risks that their younger counterparts have experienced. Strangely, 52% of respondents amongst the oldest group of business respondents in the 1890-1953 groups perceive a 'low risk' for sea water overtopping estuary defences, whereas 25% perceive it to be 'high risk'. The number of respondents within this

risk perception level is twice that of any of the others (for example, 13% of 1984-93 startups perceiving 'high risk') in Table 5.19. A clear trend is visible however between businesses established between 1984 and 2009, where the number of respondents perceiving flooding as a 'low risk' decreases with company age from 67% to 61%. This suggests that newer businesses perceive flooding from sea water overtopping estuary defences as a lower risk than their older counterparts, which would fit in with tacit knowledge based risk perceptions due to the lack of recent estuarine flooding in the area. To check these observations, I tested the differences between the perceptions related to the two flood types for significance (Table 5.20).

Table 5.20 - Kruskal-Walis test for difference between flood risk perceptions and company startup year

	Perception of flood risk from backflow within drainage systems	Perception of flood risk from sea water overtopping estuary defences	n		
Company startup date	0.355	0.143	330		
* denotes significant difference at p value of 0.05					

Table 5.20 shows that the differences between the company startup date and flood risk perceptions related to flooding caused by both backflow within drainage systems and sea water overtopping estuary defences are not statistically significant at the 95% certainty level. However, when looking at the business 'life', it is also important to consider the role of the respondent within the company. The questionnaire respondent may not have been at the company since it was established, and may not have gleaned tacit knowledge regarding flood risk within the region uniquely from their role within the business. To see whether this was the case, I was able to examine the role of the how long the respondent had worked at the business by using data collected from question 2 within the quantitative survey. Table 5.21 shows the average flood risk perception of business respondents by number of years the respondent has worked at the company, for both backflow within drainage systems and sea water overtopping estuary defences flood types. The respondent start year groupings were modified slightly from the company startup year groups to account for the lower range in respondent ages compared to company startup years. The figures displayed are means based upon numerical values of 3 for 'high risk', 2 for 'medium risk' and 1 for 'low risk'.

	Flood	Backflow within	
Year respondent started at company	Backflow within drainage systems	Sea water overtopping estuary defences	drainage systems <i>Minus</i> Sea water overtopping estuary defences
1949 – 1973	1.95	1.85	0.10
1974 – 1983	1.86	1.77	0.09
1984 – 1993	1.86	1.51	0.35
1994 – 2003	1.96	1.52	0.44
2004 – 2009	1.83	1.39	0.44
Range between risk perceptions within flood type group	0.13	0.46	
n = 330			

Table 5.21 - Mean risk perception levels attributed to different flood types in relation toyear respondent started at the company

Again there appears to be no distinct pattern, with only small differences shown. The highest mean risk values were exhibited by respondents who started at the company between 1994 and 2003 with a mean value of 1.96, whilst respondents starting at the business between 2004 and 2009 had the lowest mean risk perception values at 1.83. However, despite the lack of a trend between mean risk perceptions and the year the respondent started, the range between mean risk perceptions values concerning backflow within drainage systems is very limited at 0.13, compared to 0.45 in Table 5.17. The mean risk perception values concerning flooding from sea water overtopping estuary defences within Table 5.21 are similar to those in Table 5.17, whereby people who have worked at the business longer have higher mean flood risk perceptions. However, flood risk perceptions varied more by the year the respondent started at the business (range of 0.46) than by company startup date (range of 0.32). The mean risk perception values were broken down between the two flood types to allow a more detailed examination (Table 5.22).

		Flooding from backflow within drainage systems			systems
Year respondent started at company		High risk	Medium risk	Low risk	Total
1949 – 1973	Count	6	7	7	20
	%	30%	35%	35%	100%
1974 – 1983	Count	9	12	14	35
	%	26%	34%	40%	100%
1984 – 1993	Count	16	27	26	69
	%	23%	39%	38%	100%
1994 – 2003	Count	35	42	40	117
	%	30%	36%	34%	100%
2004 - 2009	Count	22	30	37	89
	%	25%	34%	41%	100%
n = 330					

 Table 5.22 - Risk perceptions of backflow within drainage systems by year respondent started at company

A similar pattern is found whereby 'low' flood risk from backflow within drainage systems is the most common answer for respondents starting between 1949 and 1983, whilst 'medium' flood risk is most common for respondents starting between 1984 and 2003. These were compared to the perceptions relating to flooding from sea water overtopping estuary defences (Table 5.23).

		Flooding from sea water overtopping estuary defences			
Year respondent started at company		High risk	Medium risk	Low risk	Total
1949 – 1973	Count	7	3	10	20
	%	35%	15%	50%	100%
1974 – 1983	Count	7	13	15	35
	%	20%	37%	43 %	100%
1984 – 1993	Count	6	23	40	69
	%	9%	33%	58%	100%
1994 – 2003	Count	13	35	69	117
	%	11%	30%	59%	100%
2004 – 2009	Count	7	21	61	89
	%	8%	24%	68%	100%
n = 330					

Table 5.23 - Risk perceptions of sea water overtopping estuary defences by year respondent started at company

Similarly, Table 5.23 shows that 'low risk' is the most common answer for each of the

respondent start year groups, although 35% of 1949-1973 group do perceive 'high risk',

perhaps retaining some of the tacit knowledge associated with the estuarine flooding in

1953. To test whether these observations are valid, a Kruskal-Walis test for difference was

used (Table 5.24).

Table 5.24 - Kruskal-Walis test for difference between flood risk perceptions and yea	ar
respondent started at company	

	Backflow within drainage systems	Sea water overtopping estuary defences	N		
Year respondent started at company	0.806	0.040*	330		
* denotes significant difference at p value of 0.05					

Table 5.24 shows that the difference between risk perception levels and the year the respondents started at the company is not statistically significant for flooding caused by backflow within drainage systems at the 95% certainty level. This is quite possibly due to

nearly all of the respondents having experienced the 2007 pluvial floods, meaning that no discrimination is possible here. However, it does show a statistically significant difference (at the 95% certainty level) in risk perceptions by year the respondents started at the company for flooding by sea water overtopping. Follow up Mann-Whitney U tests revealed more detail (Table 5.25).

	1949 – 1973	1974 – 1983	1984 – 1993	1994 – 2003	2004 – 2009
1949 – 1973					
1974 – 1983	0.851				
1984 – 1993	0.163.	0.087			
1994 – 2003	0.152	0.071	0.990		
2004 – 2009	0.034*	0.060	0.204	0.157	
n = 330 * denotes significant difference at p value of 0.05					

Table 5.25 - Mann-Whitney U tests for difference between flood risk perceptions and year respondent started at the company

Table 5.25 reveals that the only statistically significant differences in risk perceptions are between the youngest and the oldest two respondent groups. This suggests that respondents who started between 1949 and 1973 experienced the 1953 estuarine flood, and retained higher flood risk perceptions than respondents who started work since 2004. Respondent start date may also correlate with business category (Table 5.26).

Industrial Category	Mode year respondent started at the company	n			
Construction	2004 – 2009	57			
Hair and beauty	1994 – 2003	14			
Manufacturing	1994 – 2003	95			
Wholesale and retail	1994 – 2003	107			
Transport, storage and comm.	1984 – 1993	35			
Agriculture	1949 – 1973	21			
n = 329					
(NB this is due to the exclusion of the utilities sector)					

Table 5.26 - Mode Startup Date of Businesses by Industrial Category

Table 5.26 shows that construction is the only industry with a 2004-2009 mode, whilst agriculture is the only industry with a 1949-1973 mode. This lends further support to the idea that knowledge regarding flood risk is shaped by previous experience, with respondents starting work more recently exhibiting lower risk perceptions for sea water overtopping estuary defences than respondents who have been working for a longer time.

Concerning knowledge transfer, the contrasting findings between company startup date and respondent start date suggest that knowledge is often not retained and transferred amongst workers within a company (except in agriculture). This finding supports research by Jasimuddin *et al.* (2005) which suggested that operational knowledge is often kept in a tacit format through business employees due to the nature of competition with other rival firms. As such, when key workers leave a company their displacement "translates into a loss of tacit knowledge" as they take their experience with them (Boiral, 2002:296).

Thus, risk perceptions within businesses appear to revolve around personal experience, in a similar fashion to that outlined in existing literature on public risk perception (Jasonoff, 1998). Within the interviews involving business people outside the agricultural sector, it was

common to hear participants talking about their personal thoughts. Sidney's business (Construction, 501-1000m distance band, North East Lincs) was established in 1930, but he only started at the company in 1986. He said: "Yeah I think, I mean. I've lived in Cleethorpes all my life. And the last floods were in 1986. I'll have to check it. '86 I think. My auntie used to live down there. It flooded across there and it got as far as this road there. So it went that way. Now the Environment Agency are saying that it'll breach here. Well it's never breached there. But I can't prove that it won't. I mean apart from the local knowledge I've got".

Although Sidney's opinions are influenced by his local knowledge, it appears to be removed from the collective knowledge within the business. Things are related to his personal perceptions, his family and his local experience from living in the area, with no mention of anything that occurred at the business within the 50 year period before he joined it. Carson (Transport, storage and comm., 1001-1500m distance band, Hull) also exhibited a lack of knowledge related to his company's history. The business started in 1929, but he did not join the company until 1980. He said: "You're going back to 1929, of course I can't really answer for my predecessors". His knowledge on flooding was based solely upon recent events, as he added: "I can only go on the basis of what happened in 2007. In the case of our depots only one depot actually got any flood problem and that was out at Withernsea. Where the pits that we have, we have inspection pits, where they flooded."

Morgan (Transport, storage and comm., 0-500m distance band, Hull) worked at the oldest company I managed to incorporate into my interview schedules, which was established in 1890. He also appeared to have no knowledge which had been passed down through the company's long history. He said: "I've got an interest in it [flood risk management] to be honest for myself. So I find out things because of my interest. My MD and the business want to know. So it's through my own personal [interest], you know, I've had environmental

diplomas and things. So I've had to do work for my qualifications which obviously when you do assignments and that. You look at your own business so I've had to do that myself".

These insights into business flood risk knowledge transfer are very surprising. There seems to be very little reliance on internal knowledge or company history when it comes to evaluating the flood risks that the business faces. Although the questionnaire concerns flood risk to the business, and not to the individual, respondents frequently cite their own personal experiences as the primary source for their flood risk perceptions. Whilst findings within this section provide yet more evidence for the pivotal role of experience within flood risk perception, they also emphasise that this experience appears to be personally based, with the company seemingly failing to create systems to better transfer and exploit tacit knowledge over the years. Although previous research concerning knowledge transfer within businesses cites that much operational knowledge is kept in a tacit format due to concerns around company power, status and competitive advantage (Szulanski, 1996, Sarasvathy, 1998), flood risk mitigation can be seen as a universal 'boomerang' (Beck, 1992) problem that all businesses will face in the Humber estuary region. Although some businesses are likely to experience different levels of disruption related to their assets and resilience (Crichton, 2008), road networks, utilities, local customer bases and other infrastructure are all likely to be adversely affected which will impact upon all business operations in the given area. In this sense, not sharing tacit experience between employees or between companies would make little sense. The only exception to this locking in of tacit knowledge is in the agriculture industry, which draws upon a wealth of pooled tacit knowledge within its specific business community. However, this appears to be facilitated by the presence of drainage boards which encourage farmers to cooperate with other local stakeholders in resolving drainage issues which could negatively affect all those who live and do business in the local area.

The related findings of the impact of industrial sector and business 'life' upon flood risk perceptions could spell difficulty for the Environment Agency in overseeing the governance of flood risk mitigation on the Humber estuary. With a lack of evidence to suggest that industries other than agriculture retain tacit flood risk knowledge within the company and a general exhibition of 'low risk' perception levels associated with estuarine flooding, increasing business participation within flood risk governance is likely to be especially challenging. Not only will information need to be provided for those who lack tacit knowledge, but a way in which to encourage the sharing of this knowledge among different firms may well need to be addressed. Although Evans (2006:527) sees governance as having begun to engage with lay knowledges which are vital to "the inclusive political philosophy associated with the new localism" in the UK, with looser networks having the potential to coordinate policy at different levels, the suitability of this for managing flood risk mitigation may be open to question.

Whilst the data analysis so far has emphasised the role of personal experience within the business community, it is also prudent to examine whether company perceptions of flood risk may vary with business size, which may also be an important factor in achieving a good representation of the business community within the governance of flood risk mitigation on the Humber estuary.

5.7 Do flood risk perceptions vary according to business size?

Berry and Perren (2003: 791) observe that since the release of the Bolton Report in 1971, smaller firms have been portrayed as important components within a market driven economy. Yorkshire Forward (2006:49) were keen to increase the numbers of SMEs in the Humber region, as part of their Regional Economic Strategy (that is currently being carried forward by the replacement Humber LEP) to "improve entrepreneurship and selfemployment" in a bid to create a sustainable economy which is less dependent upon the manufacturing sector. Existing research has shown that awareness and communication of risk alters with business size (Gibb, 2000; Needle, 2004; Hessels, 2008). This is particularly relevant to the role of company managers, and procedures and plans which are laid down within company policy. Within smaller businesses, managers may deal with a wide range of issues in relation to multiple or even all aspects of the business, with Reijonen and Komppula (2007:692) describing the small business owner in terms of exhibiting an overall "omnipresence". However, within larger companies, the manager may be removed from many of the daily operations, with tasks being divided up amongst a large workforce. These differences attributable to business size may impact the flood risk perceptions of businesses within the study area, therefore having a knock-on effect on companies' ability to engage within multi-level governance structures. Considering the findings from previous sections within the chapter which emphasise the importance of personal experience in forming flood risk perceptions, I was particularly interested as to whether business size had any impact at all on such perceptions. Table 5.27 shows mean flood risk perception values in relation to business size (classified by number of employees) for both back-flow within drainage systems and sea water overtopping estuary defences flooding types, based upon 3 for 'high risk', 2 for 'medium risk' and 1 for 'low risk'. With only 3 of the 328 companies within the dataset being classed as 'large', this sector was merged with the 26 medium companies to create a dataset large enough to test with statistics.

	Flood	Backflow within	
Business size	Backflow within drainage systems	Sea water overtopping estuary defences	drainage systems <i>Minus</i> Sea water overtopping estuary defences
Micro	1.95	1.53	0.42
Small	1.83	1.51	0.32
Medium & Large	1.79	1.62	0.17
n = 331			

 Table 5.27 - Mean risk perception levels attributed to different flood types (classified by number of employees)

Table 5.27 shows that mean flood risk perception levels concerned with backflow within drainage systems are highest for micro size businesses at 1.95 and lowest for medium and large sized businesses at 1.79. There appears to be a negative trend associated with risk perception in relation to company size. However, this trend is not apparent for mean flood risk perceptions associated with flooding from sea water overtopping estuary defences. For this flood type, medium and large sized businesses have the have the highest mean risk perception value at 1.62, followed by micro businesses at 1.53 and small businesses having the lowest at 1.51. Despite the lack of pattern, the mean flood risk for all business sizes was perceived as higher for a flood caused by backflow within drainage systems than for sea water overtopping estuary defences. The mean values were broken down to allow a more detailed examination of trends for each flood type (Table 5.28).

		Flooding from backflow within drainage systems			
Business size		High risk	Medium risk	Low risk	Total
Micro	Count	58	58	68	184
	%	31.5%	31.5%	37%	100%
Small	Count	26	46	46	118
	%	22%	39%	39%	100%
Medium & Large	Count	5	11	10	26
	%	17%	44%	38%	100%
n = 331					

Table 5.28 - Risk perceptions of backflow within drainage systems by business size (classified by number of employees)

Table 5.28 shows an interesting pattern. The largest percentage of micro firm respondents perceived flooding from backflow within drainage systems as a 'low risk', at 37%, whilst the percentage of respondents perceiving it as a 'medium risk' or a 'high risk' was equal at 31.5% each. The other two business size groups were even less likely to perceive high risk, with only 22% of 'small' firms' and 17% of 'medium and large' firms, though the trends are not particularly strong. These were compared to perceptions related to sea water overtopping estuary defences (Table 5.29).

Table 5.29 - Risk perceptions of sea water overtopping estuary defences by business si	ize
(classified by number of employees)	

		Flooding from sea water overtopping estuary defences			
Business siz	e	High risk	Medium risk	Low risk	Total
Micro	Count	26	45	113	184
	%	14%	25%	61%	100%
Small	Count	10	40	68	118
	%	8%	34%	58%	100%
Medium & Large	Count	3	9	14	26
	%	14%	34%	52%	100%
n = 331					

Table 5.29 again shows similar patterns. They are skewed heavily towards low risk perceptions within all business sizes, although the percentage of respondents perceiving 'low risk' decreased with business size. I tested the differences between perceptions related to the two different flood types using a Kruskal-Walis test. However, the differences between risk perceptions by business size were not statistically significant at the 95% confidence level in either case.

I also ran tests using company turnover as an alternative indicator to number of employees for company size. This was only possible on 274 companies due to the widespread nonresponse to question 4 on the survey. However, the results of the Kruskal-Wallis test for difference on company size classified by turnover also showed no significant difference at the 95% certainty level. The finding that flood risk perceptions do not alter significantly according to company size further strengthens findings from earlier in the chapter that the personal experience of the business person is the driving factor in the formulation of flood risk perceptions as opposed to company characteristics. Although research by Clemo (2008) and Zhang (2009) found that small scale businesses are often ill-equipped to deal with flooding and are less resilient than larger firms, business people working in micro and small scale businesses do not appear to express this within their flood risk perceptions in the Humber estuary region. However, with findings from throughout this Chapter highlighting the dominance of low flood risk perceptions amongst all respondents for all flood events, it is perhaps not surprising that a lack of knowledge and awareness of flooding is failing to translate into an awareness of potential economic and personal losses related to vulnerability based on business size. Again, this suggests a failure in the association of environmental risk characteristics (Visschers *et al.*, 2007:710) that may well have an impact upon the business' economic risks.

The findings here may simultaneously pose an advantage as well as a disadvantage to the Environment Agency in their quest to involve businesses within flood risk governance. Whilst business flood risk perceptions for both backflow within drainage systems and sea water overtopping defences are not significantly different between different business sizes, there is unlikely to be an imbalance in involving firms of different sizes within the governance process. However, considering the dominance of low risk perceptions and the importance of tacit knowledge in constructing these perceptions, as found in prior sections of the Chapter, a great deal of work will be required on behalf of the Environment Agency to increase participation of businesses through raising their awareness across the board.

The next section of this chapter examines whether flood risk perceptions vary according to local authority area. With the aim for a pan-Humber flood risk mitigation strategy, it is important to see whether businesses in different areas of the estuary share the same perceptions of flood risk. This is particularly important considering the role of previous tacit knowledge in forming risk perceptions due to recent flooding events which had an uneven impact upon different localities around the Humber estuary (Coulthard and Frostick, 2010).

5.8 Do flood risk perceptions vary according to local authority area?

Although flood defence mitigation is planned on an estuary wide basis through the Environment Agency's Humber Flood Risk Management Strategy, the prevalence of hard and soft engineering solutions varies from area to area (see Section 4.2). Local authorities work with the Environment Agency on such schemes in order to deliver such works on a practical scale. However, more importantly, local authorities also have a vital role within economic development and social and environmental planning (Gibbs *et al.* 2002; Haughton and Counsell, 2006). As such, differing risk perception levels may well be observed between respondents in different local authority areas. Any differences observed between local authority areas will also have important implications for the newly established Humber LEP

where the local authorities have a far greater role in economic development than was the case under the auspice of the Yorkshire Forward RDA.

Table 5.30 shows the mean business risk perception values for flooding caused by backflow within drainage systems and sea water overtopping estuary defences by local authority areas, based upon 3 for respondents ticking 'high risk', 2 for 'medium risk' and 1 for 'low risk'. Due to the low number of respondents within Lincolnshire, this authority was excluded in order to avoid skewing results.

	Flood type				
Local authority	Backflow within drainage systems	Sea water overtopping estuary defences			
Hull	2.01	1.41			
East Riding	1.89	1.54			
North East Lincs	1.73	1.68			
North Lincs	1.72	1.69			
n = 330					

 Table 5.30 - Mean risk perception levels attributed to different flood types in relation to respondent local authority area

I expected respondents in Hull and the East Riding on the north bank to exhibit higher mean risk perception levels related to flooding from backflow within drainage systems, primarily due to the widespread disruption caused in and around Hull during the 2007 pluvial flooding event. Table 5.30 shows that mean risk perception levels for flooding from backflow within drainage systems are highest on the north bank of the Humber at 2.01 and 1.89 respectively in Hull and the East Riding, with lower risk perceived on the south bank. However, the opposite pattern is shown for mean risk perception levels associated with sea water overtopping estuary defences, with the highest perceptions on the south bank at 1.69 for respondents in North Lincolnshire and 1.68 for respondents in North East Lincolnshire. The lowest average perception came from respondents in Hull at 1.41. Overall, the mean risk perceptions for respondents in all local authority areas concerning flooding from water overtopping sea defences were lower than those for flooding from backflow within drainage systems, conforming to previous observations made earlier in this chapter. The mean risk perceptions were broken down so that I could analyse them further in relation to each of the two specific flood types.

		Flooding	Flooding from backflow within drainage system				
Local Authority		High risk	Medium risk	Low risk	Total		
Hull	Count	45	60	43	148		
	%	30%	41%	29%	100%		
East Riding	Count	22	19	30	71		
	%	31%	27%	42%	100%		
North East Lincs	Count	16	23	36	75		
	%	21%	31%	48%	100%		
North Lincs	Count	6	14	16	36		
	%	17%	39%	44%	100%		
n = 330							

 Table 5.31 - Risk perceptions of backflow within drainage systems by respondent

 local authority area

Table 5.31 indicates that 'low risk' perceptions of flooding from backflow dominate respondents within North East Lincolnshire (48%), North Lincolnshire (44%) and the East Riding (42%) local authority areas. However, the mode for Hull is 'medium risk' at 41%. Overall, 'high risk' perceptions are more frequent (30-31%) on the north bank of the Humber than on the south bank (17-21%). However, this contrasted markedly with risk perceptions associated with sea water overtopping estuary defences (Table 5.32).

		Flooding	Flooding from sea water overtopping estuary defences				
Local Authority		High risk	Medium risk	Low risk	Total		
Hull	Count	9	42	9	148		
	%	6%	28%	66%	100%		
East Riding	Count	9	20	42	71		
	%	13%	28%	59%	100%		
North East Lincs	Count	11	29	35	75		
	%	14%	39%	47%	100%		
North Lincs	Count	11	3	22	36		
	%	31%	8%	61%	100%		
n = 330							

Table 5.32 - Risk perceptions of sea water overtopping estuary defences by respondent local authority area

Table 5.32 shows that 'low risk' perceptions still dominate amongst respondents, but Hull has the highest percentage of respondents perceiving 'low risk' from water overtopping estuary defences at 66%. Considering the significance of previous experience unveiled so far throughout the chapter, and the apparent lack of knowledge transfer between different types of flooding, this was not unexpected due to the pluvial floods which occurred in 2007. However, North Lincolnshire differs somewhat from the other authorities in that whilst a large 61% of respondents perceive flooding from sea water overtopping defences as a low risk, 31% also perceive it to be a high risk. It also does not fit in with my observations from academic literature such as Visschers *et al.* (2007) and Lange and Garrelts (2007) that risk perceptions of flooding from sea water overtopping estuary defences may be offset by recent tacit knowledge gained from extensive pluvial flooding on the north bank of the Humber during 2007. I therefore checked the significance of these unusual observations with statistical tests (Table 5.33).
	Perceptions of flood risk from backflow within drainage systems	Perceptions of flood risk from sea water overtopping estuary defences	n
Local Authority	0.041*	0.038*	330
* denotes significant di	fference at p value of 0.05		

Table 5.33 - Kruskal-Walis test for difference between flood risk perceptions and respondent local authority area

Table 5.33 shows significant differences between the flood risk perceptions of respondents within the different local authority areas for both flooding caused by backflow and for flooding caused from sea water overtopping estuary defences. However, the Kruskal-Wallis test does not determine which specific local authorities the significant differences in flood risk perceptions lie between for each of the two different flood types. Pairwise Mann-Whitney U tests are required to find this out, the results of which showed that for flooding caused by backflow within drainage systems, only differences between Hull and North East Lincolnshire (>95%, p = 0.011) and Hull and North Lincolnshire (>95%, p = 0.043) were significant. As perceptions of flood risk from backflow within drainage systems are higher amongst businesses in Hull than they are in North East Lincolnshire and North Lincolnshire, the prior experience of the 2007 pluvial floods again appears to have raised awareness of flood risk relating to this specific flood type.

However, the transferability of this pluvial flooding experience to a different flood type again seems to have failed. For flooding from sea water overtopping estuary defences, only differences between respondents in Hull and North East Lincolnshire were significant (>95%, p=0.004). The unusual perceptions exhibited by respondents within North Lincolnshire (31% perceiving 'high risk') were found not to be statistically significant at the 95% confidence level, and therefore could not be trusted to show an accurate pattern. Despite the statistical differences between perceptions of respondents within Hull and North East Lincolnshire, the differences shown in Table 5.32 were not large. Respondents within both authorities exhibited the same general trend whereby the least perceptions were 'high risk', followed by 'medium risk', with 'low risk' perceptions dominating. However, the slight differences observed whereby risk perception levels were on average higher in North East Lincolnshire than Hull may well be down to the increased focus on the flooding risk of backflow within drainage systems by respondents within the Hull area. Instead of increasing awareness of other types of flooding, the 2007 pluvial floods seem to have blinkered respondents in their tacit knowledge, as demonstrated in Sections 5.2 and 5.3. Data from question 8 on the business survey supported this, showing that 35 out of 44 respondents who had suffered previous negative effects of flooding at their business premises were located either within Hull or the East Riding.

The differences are unlikely to be down to shoreline flood risk management between the two areas. Due to the internationally important ports at Immingham and the large number of chemical industries located along the shoreline in North East Lincolnshire, the Environment Agency has proposed the further construction and maintenance of 'hard' engineered flood barriers in the area (Environment Agency 2008b). The same approach is being used for Hull, which due to its proximity to the estuary is unsuitable for new 'soft' defences.

Healey (1999a:18) observes that "places are social constructs, given identity and infused with value through the experience of living, working and doing business in them". This has been demonstrated through the accumulation and the dominance of tacit knowledge in each of the sections of this chapter. However, although this social capital has been shown to vary between respondents in different local authority areas in relation to flooding from backflow within drainage systems, this is not true for flooding caused by sea water overtopping estuary defences. Although significant differences do exist between Hull and North East Lincolnshire for respondent perceptions related to this type of flooding, it is important not to overemphasise these as the variations between them are only small.

Pollard (2001:38) states that "industry and business converse in the language of risk, and look increasingly likely to integrate health, safety and environmental risks within a broader business risk framework". If this is the case, then there may well be some difficult challenges ahead for a successful system of governance for flood risk on an estuary-wide scale in the Humber region. The power of tacit knowledge in the form of previous experience, especially amongst businesses in Hull, may well prove to be a barrier in getting businesses involved in processes relating to estuarine flooding. However, on a more positive note, the differences between flood risk perceptions between the local authorities do not range wildly. Providing that a way can be found to circumvent the deficit in the tacit knowledge of businesses within the whole study region, whilst combating the challenges highlighted through a lack of knowledge transfer between different flood events, there appears to be little need for concern in pursuing the involvement of Humber firms within the governance process based purely upon their business characteristics alone.

5.9 Summary

The findings throughout this chapter have shown that pluvial flooding, causing issues such as backflow within drainage systems, is more likely to be seen as 'high risk' by businesses, whereas estuarine flooding is overwhelmingly likely to be seen as a 'low risk' in terms of negative impacts upon their company premises.

In line with existing literature regarding public risk perceptions, business flood risk perceptions have been seen to be highly dependent upon personal experience (Wynne, 1989; Irwin, 1995; Jasanoff and Wynne, 1998; Morris, 2006; Harvatt *et al.*, 2011). This observation may help to explain why there is a lack of literature specifically focusing on *business* perceptions of environmental risk. In this instance, it is still important to emphasise that both public and business perceptions of risk are not necessarily one of the same, but they do appear to share many characteristics in terms of the importance of underlying knowledge which is used to formulate such perceptions for both groups, as has been discussed throughout the chapter. However, although some interesting similarities have been drawn between public and business flood risk perceptions, this thesis has only collected data from the business community. With business studies literature suggesting that business people may well be more psychologically risk averse than the general public (Romilly 2007; Ashcroft *et al.*, 2009), comparing the magnitude by which previous experience effects risk perception levels for both the public and business people as separate entities would be one such avenue in this subject area that requires further investigation.

The experience provided in the form of recent exposure to heavy rainfall, which overwhelmed drainage systems during 2007, appears to have brought the risk perception of flooding caused by backflow within drainage systems to the attention of business, especially in the Hull area, whilst the lack of an estuarine flood event for over 50 years has resulted in a deterioration of awareness of other kinds of flooding. Sea defences appear to have been forgotten, whilst tacit knowledge related to estuarine sea defences appears to have been lost to the extent that businesses operating near to the estuary no longer seem to be aware of the risks of sea water overtopping estuary defences as they have been protected under a previous safety discourse (Lange and Garrelts, 2007).

Slight differences within flood risk perceptions are found between different industrial business categories however. Agriculture was the only industrial sector surveyed to demonstrate a higher awareness of flood risk from sea defence overtopping than backflow within drainage systems. This was seen to be due to the retention of tacit knowledge related to previous flooding within the historic networks of local drainage boards. The importance of individual experience for other business sectors outside the agriculture industry was highlighted in the analysis of 'business life'. The emphasis on personal opinions, however, suggested that tacit knowledge in older businesses (outside the agriculture industry) appears to have been lost, with respondents working at more established companies not demonstrating any knowledge outside their own personal experiences since starting work at the company. This is possibly down to many businesses operating in a manner which is typically separate to the natural environment around them (Linnenluecke, 2011) as well as a peculiarity within the business world where tacit knowledge is not generally shared between workers or companies for competitive reasons (Jasimuddin *et al.*, 2005).

My findings also show that flood risk perceptions do not appear to alter according to business size either for flooding caused by backflow within drainage systems, or for sea water overtopping estuary defences. Whilst this was unexpected in terms of existing literature (Van Praag, 2003; AXA, 2006; Crichton, 2008; Clemo, 2009), it highlights a further case in the breakdown of the transferability of knowledge between different events. Although low flood risk perceptions dominate both types of flooding across all business respondents, the environmental risks that flood events pose do not appear to translate into economic risks, which would typically differ depending upon a company's resources as indicated by size. However, the limited data provided solely from the quantitative data on this issue is not sufficient to provide a detailed explanation of why businesses of different

sizes do not appear to perceive different levels of flood risk related to vulnerability. This is an issue that will be investigated further with additional data within the next two Chapters.

It is not very surprising that the Environment Agency have not had limited success involving businesses with the governance process so far, especially as the Environment Agency use the generic term "flood risk" in their policy documents (see Environment Agency 2005a, 2008b, 2009b). Whilst this is used within policy documents relating specifically to the estuary, it is clear from the findings throughout this chapter that perceptions of flood risk are highly influenced by tacit knowledge. As such, the use of the term "flood risk" may evoke perceptions that are locked in to other types of flooding outside the context of the estuary which do not necessarily transfer the same nuances to the business person. This has been highlighted by the gulf in flood risk perceptions between the flooding types of backflow within drainage systems and sea water overtopping estuary defences. A lack of experience of estuarine flooding appears to have pushed the risk of sea water overtopping estuary defences further down business risk radars, which in turn may well have resulted in a lack of willingness to participate within the governance process as it is not seen as a threat or a concern to business operations.

Although the findings within this chapter offer a snapshot of current flood risk perceptions, answering my first research question of how businesses perceive and construct technical understandings of flood risk, they do not indicate whether they have changed over time. The next chapter will offer a more in-depth analysis of the data collected by looking at the temporal variations associated with businesses and flood risk mitigation, examining whether flood risk perceptions have altered over time and looking as how businesses perceive time in terms of their estimation of how long it will take to recover from a flood event.

Chapter Six Flood Risk as a Dynamic Issue

6.1 Introduction

The previous chapters showed that business perceptions of flood risk vary according to the tacit knowledge of business respondents within the Humber region, as reality testsappear to create substantial shifts in risk perceptions. However, their long-term influence on flood risk perception requires further examination, being of importance to the ongoing governance of flood risk management around the Humber and its impact upon the wider economic development of the region.

This chapter addresses my second research question that asks how business flood risk knowledge has changed over time with changes in scientific understanding. It also addresses part of my third research question concerning how businesses juxtapose environmental risks with their daily operations. The importance of managing flood risk within the context of daily business operations over time is explored in Section 6.2, whilst Section 6.3 looks specifically at the role business flood risk perceptions play in choosing company premises and whether this has altered over time. Section 6.4 investigates how businesses view time in a slightly different context, looking at how long businesses estimate it would take them to recover from a flood event. The chapter concludes with a brief summary of findings within Section 6.5.

6.2 Has the importance of flood risk management as part of day to day business operations changed over time?

Substantial changes have occurred in the way that environmental policy is implemented and managed within England over the last 50 years (see Chapter Two). This is particularly evident within the field of flood risk mitigation on the country's coastlines. Large national

scale flood defence projects, such as those implemented in the aftermath of the 1953 floods (Steers, 1953), have been replaced by strategic regional management, partly in order to accommodate a range of newer supra-national policies emanating from the European Union. On the Humber estuary, the Environment Agency has sought to manage flood risk with active participation from both the voluntary and private sector (see Environment Agency 2005a, 2008b, 2009b). In light of the results from Chapter Five, it would appear that this approach could be fraught with difficulty considering that businesses appear to construct flood risk perceptions upon prior personal experience of flooding, rather than more strategic management approaches. Adam (1996:96) observes that "change is conceptualised as being caused by the past in a sequential cumulative way". Therefore, this section will consider how past experiences of flood risk compare with and influence current and future risk perceptions and business management strategies.

Questions 17, 18 and 19 from the business survey asked respondents to rate the importance of the need to manage flood risk as part of the day to day business operations at their premises for three separate time periods: ten years ago, the current day (2009) and over the next five years. Responses were measured using a 5-point Likert scale, where 1 represented 'Not Important' and 5 represented 'Very Important' as shown in Figure 6.1.

Figure 6.1 – Questions 17, 18 and 19 from the business survey

17	On a scale of 1 to 5, I part of the day to da	now important v y operations of t	vas the need for the hese Humber prem	company to ma ises <u>10 years ago</u>	nage flood risk as ?? (Please Circle)
17	1 Not Important	2	3	4	5 Very Important
10	On a scale of 1 to 5, I of the <u>current</u> day to	now important i day operations	s the need for the co of these Humber pr	ompany to mana emises? (Please	ge flood risk as part Circle)
10	1 Not Important	2	3	4	5 Very Important
19	On a scale of 1 to 5, I part of the day to da (Please Circle)	now important v y operations of t	vill the need be for t hese Humber prem	the company to r ises over the <u>nex</u>	nanage flood risk as <u>κt 5 γears</u> ?
	1 Not Important	2	3	4	5 Very Important

Table 6.1 - Mean and mode values for importance of managing flood risk as part of theday to day operations at company premises

Time Period	Mean importance value of managing flood risk	Mode importance value of managing flood risk
Ten years ago	1.66	1
Current day	2.57	1
Over the next five years	2.77	1
n = 212		

Table 6.1 shows that on average, respondents feel that managing flood risk at their business premises has become more important over time. The mean importance value of managing flood risk as part of day to day operations ten years ago was 1.66, rising to 2.57 for the current point in time and to 2.77 over the next five years. However the mode for all three time periods remains 'Not Important'. This is right at the bottom of the Likert scale, reflecting the findings throughout Chapter Five of the low level of risk perceptions amongst businesses generally. Section 5.3 in the previous chapter concluded that businesses which had suffered previous negative effects from flooding were more likely to perceive flooding as a higher risk than those businesses which had not. However, the shock effects (Lange and Garrelts, 2007) resulting from exposure to flooding need to be examined further.

Table 6.2 - Mean importance values of managing flood risk as part of the day to day operations at company premises by businesses' experience of previous flooding

	Mean importance value of managing flood risk						
Business suffered negative effects from previous flooding at premises	Ten years ago	Current day (2009)	Over the next five years				
Yes	2.05	3.37	3.66				
No	1.55	2.39	2.57				
n = 211							

Table 6.2 shows that respondents who have experienced previous flooding do on average perceive higher importance for managing flood risk than those who have not through all three time periods. The difference between the two groups is noticeable for past importance (0.5), but is greater for current and future importance (0.98 and 1.09 respectively).

Table 6.3 - Importance of managing flood risk as part of day to day operations at company premises ten years ago by businesses' experience of previous flooding

		Impo	Importance of managing flood risk as part of day to day operations at company premises ten years ago						
Business suffered negative effects from previous1Not flooding at premisesNot		1 Not Important	2	3	4	5 Very Important	Total		
	Count	19	9	4	1	5	38		
Yes	%	50%	24%	10%	3%	13%	100%		
	Count	122	25	15	3	8	173		
No %		70%	14%	9%	2%	5%	100%		
n = 211									

Table 6.3 shows that 'Not important' remains the mode perception, although this is most pronounced for respondents who did not report previous negative effects from flooding (70% compared to 50%). More people who experienced previous negative effects from flooding perceived flood risk management in the past as 'Very Important' than those who did not (13% compared to 5%). Previous experience therefore appears to affect the importance attached to flood risk management ten years ago.

Table 6.4 - Importance of managing flood risk as part of day to day operations at company
premises at the current day (2009) by businesses' experience of previous
flooding

		Impo operat	Importance of managing flood risk as part of day to day operations at company premises at the current day (2009)							
Business s negative from pro floodin prem	suffered effects evious ng at ises	1 Not Important	2	3	4	5 Very Important	Total			
	Count	6	3	8	13	8	38			
Yes	%	16%	8%	21%	34%	21%	100%			
	Count	57	41	41	19	15	173			
No %		33%	24 %	24%	11%	8%	100%			
n = 211	n = 211									

Table 6.4 shows that flood risk management is perceived to be more important in the present than in the past. 55% of respondents who suffered negative effects from previous flooding at their premises gave a score of 4 or 5 to flood risk management in the present. In contrast to past management, just 16% of people who reported previous negative effects from flooding (and 33% of those who did not) perceived present flood risk management to be 'Not Important'.

However, a general negative pattern was evident for companies who had not suffered negative effects from previous flooding at their premises with a mode of 'Not Important', at 33%. Only 8% of respondents that had not experienced any prior flooding perceived the managing of flood risk as part of their current day to day operations as being 'Very Important', compared to 21% of respondents who had been flooded. Although managing flood risk is seen as more important in the present than in the past for both those respondents who have and those who have not experienced previous flooding over the past 10 years, the increase is more substantial for those who have experienced previous flooding at their company premises.

Table 6.5 - Importance of managing flood risk as part of day to day operations at company premises over the next five years by businesses' experience of previous flooding

		Impor operat	Importance of managing flood risk as part of day to day operations at company premises over the next five years							
Business s negative from pro floodin prem	Business suffered negative effects from previous flooding at premises		2	3	4	5 Very Important	Total			
	Count	4	5	3	14	12	38			
Yes	%	10%	13%	8%	37%	32%	100%			
	Count	47	42	42	22	20	173			
No %		27%	24%	24%	13%	12%	100%			
n = 211										

Table 6.5 moves on to look at perceptions of flood risk management in the future. It shows that most respondents who have suffered negative effects from previous flooding at their premises perceived flood risk management over the next five years as important, with 69% giving a score of 4 or 5 and only 10% perceiving it to be 'Not Important'. This is similar to the pattern displayed in Table 6.4, although the overall percentage of respondents perceiving the importance of future flood risk management is greater.

Again, there was a general negative trend in the importance of flood risk management over the next five years evident for companies who had not suffered negative effects from previous flooding at their premises. Table 6.5 shows that 27% of respondents perceived flood risk management to be 'Not Important' as part of day to day operations at their premises over the next five years, with 51% giving it a score of only 1 or 2 and only 12% perceiving it to be 'Very Important'. This is lower than for present flood risk management (Table 6.4), with the percentage of respondents perceiving flood risk management as 'Not Important' decreasing from 33% to 27%.

Overall, it appears that respondents feel that the importance of managing flood risk has increased over time, irrespective of whether they have experienced previous flooding. However, those respondents who have experienced prior flooding at their premises attach a much greater importance to flood risk management in past, present and future than those who have not. To see whether these observations were statistically significant, I tested for difference using a Mann-Whitney U test.

	Ten years ago	Current day (2009)	Over the next five years	n
Previous negative effects from flooding at business site	0.013*	0.000*	0.000*	211
* denotes significan	t difference at p va	lue of 0.05		

 Table 6.6 - Mann-Whitney U tests for difference between importance of managing flood

 risk and previous flooding at business premises

Table 6.6 shows that perceptions of the importance of managing flood risk as part of day to day business operations are significantly different between those businesses which have suffered negative effects from previous flooding at their premises and those businesses which have not. Although the significant difference applies throughout all three time periods, it is more pronounced for the present and the future (>99% probability), compared to the past at 0.013 (>95% probability).

This is particularly interesting, as the shock aspect related to experience of previous flooding appears to influence past memory as well as future perceptions. Although 50% of people who had experienced previous flooding perceived flood risk management as 'Not Important' 10 years ago, on average this group still perceives flood risk management in the past, present and future to be higher than those who have no prior experience of flooding. This is unusual considering that only 8 out of the 38 respondents who had suffered previous flooding at their company premises had done so before 1999, which was the cut off point for perceptions relating to 'the last ten years' time period. However, Loewenstein *et al*. (2001:274) explain that such "emotional reactions guide responses not only at their first occurrence, but also through conditioning and memory at other points in time". As such, this may give a false indication of the importance of flood risk in the past, causing a situation where the importance of managing flood risk is seen to have increased by a smaller extent than is the case.

Of more immediate concern to the governance of flood mitigation however, is the finding that those businesses which have not directly experienced previous flooding view flood risk management as a growing area of importance in the day to day operations of their business, although still at a lower level than those respondents who have experienced previous flooding. Due to the lack of tacit flood risk knowledge, it can therefore be concluded that some form of explicit codified knowledge on the subject of flood risk appears to be influencing businesses in some fashion, resulting in a heightened awareness of the growing need to consider flood risk management in the Humber region. This is a critical finding in relation to the fundamental principles of the governance system. Rhodes (1996:657) observes that all actors within a policy area require each other to contribute relative knowledge or resources as "no one has all the relevant knowledge or resources to make the policy work". Despite the higher risk perceptions amongst respondents who have experienced prior flooding at their premises, the general importance attached to managing flood risk as part of daily business operation has increased over time for *all* respondents. This is especially encouraging for a flood risk mitigation process relying on governance, as participants are only going to involve themselves if the issue in question is seen as relevant to them and as having a direct effect upon them (Martin and Foley, 2000).

Before examining data from the interviews to try and explore these patterns further, I checked for differences in the importance of flood risk management as part of daily operations for the three time periods related to: distance from the estuary shoreline, industrial category, company startup date and respondent start date (business life), business size and local authority area. The data showed little difference in the importance attached to managing flood risk when cross tabulated with most of these six variables, except for industrial category and respondent start date (Table 6.7).

		Importance of managing flood risk as part of day to day operations at company premises ten years ago					
Business suffe negative effects	ered 5 from	1	2	3	4	5	
previous floodi premises	ng at	Not Important				Very Important	Total
	Count	5	1	2	1	0	9
Hair and beauty	%	56%	11%	22 %	11 %	0%	100%
Wholesale and	Count	53	10	5	0	4	72
retail	%	77%	14%	7%	0%	5%	100%
	Count	20	4	2	0	1	27
Construction	%	74 %	15%	7%	0%	4%	100%
	Count	43	11	4	1	3	62
Manufacturing	%	69%	18%	7%	2%	5%	100%
Transport,	Count	15	3	3	1	1	23
storage and comm.	%	65%	13%	13%	4.5%	4.5%	100%
	Count	5	5	3	1	4	18
Agriculture	%	28%	28%	17%	5%	22%	100%
n = 211							

 Table 6.7 - Importance of managing flood risk as part of day to day operations at company premises ten years ago by industrial category

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The shading in Table 6.7 shows that the mode was overwhelmingly 'Not Important' for all

categories except agriculture, where only 28% of respondents perceived flood risk

management to be 'Not Important' and 22% considered it to be 'Very Important' (compared

to only 4-5% for manufacturing, wholesale, transport and construction). These differences

also persist for present flood risk management perceptions (Table 6.8).

		Importance of managing flood risk as part of day to day operations at company premises ten years ago					
Business suffered negative effects from previous flooding at premises		1 Not Important	2	3	4	5 Very Important	Total
	Count	1	3	4	1	0	9
Hair and beauty	%	11%	33%	45%	11%	0%	100%
Wholesale and	Count	20	15	15	10	12	72
retail	%	28%	21%	21%	14%	16%	100%
	Count	11	4	7	4	1	27
Construction	%	41%	15%	26 %	15%	3%	100%
	Count	21	12	16	10	3	62
Manufacturing	%	34%	19%	26%	16%	5%	100%
Transport,	Count	8	7	4	1	3	23
storage and comm.	%	35%	30%	18%	4%	13%	100%
	Count	2	3	4	5	4	18
Agriculture	%	11%	17%	22%	28%	22%	100%
n = 211							

Table 6.8 - Importance of managing flood risk as part of day to day operations at company premises at the current day (2009) by industrial category

The modes shaded in Table 6.8 are mostly 'Not Important', but are markedly less pronounced in comparison to perceptions of past flood risk management . Again, agriculture has the highest perceived importance levels, with 'Very Important' reported by 22% of respondents. 16% of respondents within the wholesale industry also see present flood risk management as part of daily business operations as 'Very Important' (5% for ten years ago) along with 13% of respondents within the transport, storage and communication industry (compared to only 4.5% for ten years ago). Very similar results were found to those displayed in Table 6.8 for the importance of managing flood risk over the next five years. However, there was no obvious trend which could be identified between the different industries or differences in perceptions of the importance of flood risk management based upon respondent start date at the business either. These findings were tested for significance along with six other variables (Table 6.9).

Test variable	Ten years ago	Current Day (2009)	Over the next five years	n	Statistical test for difference used
Distance from shoreline	0.738	0.410	0.461	212	Kruskal – Wallis
Industrial category	0.004*	0.088	0.097	211	Kruskal – Wallis
Company startup date	0.159	0.381	0.384	211	Kruskal – Wallis
Respondent start date	0.014*	0.697	0.415	211	Kruskal – Wallis
Company size (employees)	0.407	0.810	0.945	211	Kruskal – Wallis
Local authority	0.119	0.118	0.328	211	Kruskal – Wallis
* denotes significant dif	ference at p v	alue of 0.05			

Table 6.9 - Tests for difference between importance of managing flood risk as part of theday to day operations for the remaining six variables

Table 6.9 shows that only differences between industrial categories and start date were statistically significant at 95% certainty. Further testing was required to discern exactly where these differences lay within these two variables (Table 6.10 and Table 6.11)

	Hair and beauty	Wholesale and retail	Construction	Manufacturing	Transport, storage and comm.	Agriculture
Hair and beauty						
Wholesale and retail	0.215					
Construction	0.349	0.927				
Manufacturing	0.321	0.630	0.651			
Transport, storage and comm.	0.651	0.393	0.427	0.614		
Agriculture	0.212	0.000*	0.001*	0.001*	0.020*	
n = 312 * denotes significa	nt difference	e at p value o	of 0.05			

Table 6.10 - Mann-Whitney U tests for difference between past importance of flood risk management and industrial category of company

 Table 6.11 - Mann-Whitney U tests for difference between past importance of flood risk

 management and year respondent started at the company

	1949-1973	1974-1983	1984-1993	1994-2003		
1949-1973						
1974-1983	0.049*					
1984-1993	0.001*	0.284				
1994-2003	0.019*	0.907	0.204			
n = 211 * denotes significant difference at p value of 0.05						

Table 6.10 confirms the trends that I identified within Table 6.7 and Table 6.8, whereby the agricultural sector perceived the importance ten years ago of managing flood risk differently to other industries (apart from hair and beauty, perhaps due to the low number of respondents at just 9).

Table 6.11 also confirms that only differences between respondents which started at their business between 1949 and 1973 and other respondents are statistically significant at 95% confidence. This adds weight to the link identified earlier in this section between importance of flood risk management and previous experience of flooding. However, this only applies to hindsight. The differences in importance by industrial sector and respondent start date are only significant for perceptions of the past, not for present or future importance of flood risk management, highlighting that businesses have converged with regards to the perceived importance of managing flood risk over time. Within interviews, the consensus seemed to be that flooding has become more of a 'visible' problem over the last ten years, particularly within the agricultural sector. Chris (Agriculture, no prior flood experience, North Lincs) said: "Over hundreds of years the government... have given grant aid to various authorities, whether they're river authorities or coastal defence authorities, to maintain the flood defence barriers. There seems to be an attitude nowadays that they can't afford to do it. They're not able to forward plan their schemes because they've never. They haven't got any money to do it!".

However, businesses from other industrial sectors seemed to have more mixed views. Tony (Manufacturing, no prior flood experience) said: "To be honest with you, we we're 14001 [standard] approved, obviously with the Environment Agency as well. And flood risk only came up 12-13 months ago for us as part of the audit criteria." As a large business with extensive environmental policies, Tony's company is only just starting to develop policies which were not deemed necessary in preceding years. Even though the operations that Tony's business engaged in made this a unique case, the interviews suggest flood risk management has become far more visible on business risk radars only recently.

Mandeep (Wholesale, no prior flooding experience, North Lincs) said: "Businesses have to take into consideration that the environment is changing. The climate is changing, and there is a risk. So I'm sure in the future people will be looking a bit more into it. We are in an area which is relatively in the high flood risk because of the river and I'm sure that insurance companies are asking us about more and more about what sort of plans we have in case of flooding". This was already a reality for Jackie (Hair and beauty, no prior flood experience, West Hull) who said: "When you go for insurance, the minute you say your postcode 'HU3', they put you straight into a flood risk area. We never realised, and everybody in the area

who's tried to get new insurance with a new broker or, they just can't get any insurance... and I've got to say it's quite a new thing."

However, Sandy (Manufacturing, no prior flood experience, Hull River) did not experience the same problems at his business on the other side of the city to Jackie. He said: "The insurance people sort of put a blanket on it and say 'ah that's a flood risk area so everybody had been flooded so we'll charge them'. We've got a good broker I've known him 25 years. Before our insurance was due, he rang me up and said did you get flooded? 'Nah'. He said 'ah that's alright then leave it with me' and he, there was never a discussion but I've no doubt he had discussions over it. But it never entered here you know. It just went off as normal so it wasn't any effect to us at all". There may well be ways around these problems of insurance zoning, as Sandy illustrates. However, regardless of the outcome, the issue of flood risk itself remains and is now being brought to the attention of businesses through practises related to the daily operations on the business premises such as building insurance.

These qualitative snapshots into how flood risk management has altered over recent years offer an insight into the general increase in the importance attached to flood risk management by all businesses, regardless of whether they have prior experience of flooding at their business premises. Flood risk insurance in the United Kingdom is currently sold in a bundle format, where it is only available if it is included with general disaster cover for fires, storm, theft and earthquake (Crichton, 2008:118). Although this system is currently under review, at the present time businesses that are unable to find an alternative policy as in Sandy's case are left with little choice as to whether they purchase insurance or not considering the vast range of other incidents such a policy would cover. Flood insurance will cover the property regardless of what type of flooding, be it pluvial or estuarine, causes the

damage. In terms of properties bordering the Humber estuary, the only incident that would not covered by such insurance would be the erosion of land on the foreshore, due to the legal point of "moveable freehold" (McGlashan *et al.*, 2009:150). Although the insurance factor may well be raising general awareness of flood risk amongst Humber businesses, how this is interpreted and what events the policy holder may be expecting protection against are not known. This issue does however have ramifications for pursuing economic growth in the region. Whether existing businesses look to move to larger sites in the area, whether new businesses are look to set up in the area, or whether businesses that are currently set up are faced with the withdrawal of insurance due to changes in the cover offered by brokers, the ability to obtain insurance may well influence the choice of business site. As such, the importance of flood risk perceptions in relation to choosing business premises are investigated within the next section.

6.3 What is the importance of flood risk perceptions when choosing business premises? With companies attaching greater importance to the management of flood risk within their day to day operations in the future compared to the past, it is imperative to find out whether this impacts upon their choice of business site. Yorkshire Forward, and its successor LEP, view the Humber ports, especially Grimsby and Immingham, as a "major focus for work [jobs] in North and North East Lincolnshire" (Yorkshire Forward, 2006: 104). Large business parks in proximity to the port, such as the Europarc in Grimsby, are already under construction, despite the fact that they are within zones at high risk of estuarial flooding (Environment Agency 2008b). As noted in Section 6.2, increasing insurance costs may pose a problem in attracting businesses to land bordering the Humber estuary. However, this problem is not just limited to new businesses setting up or relocating to the Humber region. Question 12 on the business survey revealed that 26% of all business respondents were looking to expand within the Humber region in the next five years. Understanding whether flood risk perceptions impact upon the choice of business premises is imperative, not only to ensure that existing businesses wanting to expand are retained within the region, but also to ensure that flood risk does not detract companies situated further afield from setting up on the Humber. Question 9 from the business survey asked respondents to rate how important a factor flood risk was for the company when originally choosing their premises, whilst Question 10 asked how important a factor flood risk would be for the company if choosing Humber premises today. The perceptions were recorded as either 'Very Important', 'Quite Important' or 'Not Important' as shown in Figure 6.2.





Mean and mode values were calculated for the responses given for each of the two time periods, shown in Table 6.12. The figures displayed are means based upon numerical values of 3 for respondents ticking 'Very Important, 2 for 'Quite Important' and 1 for 'Not Important'.

Table 6.12 - Mean and mode values of importance of flood risk when choosing company premises

Time Period	Mean importance value of flood risk	Mode importance value of flood risk
Originally	1.33	1
If choosing today	2.21	3
n = 359		

Table 6.12 shows that the perceived importance of flood risk as a factor when choosing company premises has increased on average, from 1.33 originally to 2.21 for the current day. However, unlike other variables examined beforehand such as managing flood risk as part of daily operations, there was also a marked increase in the mode, which increased from 1 'Not Important' to 3 'Very Important'. Considering the dominance of tacit knowledge in the formation of flood risk perceptions so far within this investigation, I was keen to see whether this variable also appeared to influence perceptions related to the choice of company premises.

Table 6.13 - Mean importance values of flood risk when choosing company premises by previous experience of flooding

	Mean importance value of flood risk when choosing company premises		
Previous experience of flooding	Originally	If choosing today	
Yes	1.24	2.36	
No	1.34	2.19	
n = 357			

Table 6.13 shows that respondents on average perceived the importance of flood risk to have increased as a factor when choosing company premises over time, regardless of whether their business experienced previous negative effects from flooding or not. However, whereas findings in Section 6.2 showed that respondents who have experienced previous flooding perceive higher flood risk importance on average than those who have not across all time periods, this was not the case in this instance. Respondents who had experienced previous flooding perceived the mean flood risk importance value when

choosing premises originally to be lower (just 1.24) than those who lacked this experience

(1.34), but higher if choosing premises today (2.36 compared to 2.19).

		Importance of flo	ood risk when orig	inally choosing p	remises
Business suffered negative effects from previous flooding at premises		Not Important	Quite Important	Very Important	Total
	Count	38	3	4	45
Yes	%	84%	7%	9%	100%
	Count	235	49	28	312
No	%	75%	16%	9%	100%
n = 357		-			

Table 6.14 - Importance of flood risk when originally choosing company premises by previous experience of flooding

Table 6.14 shows that the majority of respondents who had previous experience of flooding (84%) perceived flood risk to be 'Not Important' as a factor when originally choosing their premises, compared to 75% of those who had no prior experience of flood risk. This observation was not what I expected, as within Section 6.2, it was shown that the shock effects of flooding had *increased* risk perceptions in the past. The data gathered from this section of the survey contradicts this, as it suggests that previous experience of flooding in fact rescales perceptions to fit later negative consequences. In this way the perception of the importance of flood risk when originally choosing company premises are *reduced* as respondents had seen it as *less* important than it turned out to be. This certainly seems to be the case with Drew (Wholesale, West Hull) who was one of the interviewees to have suffered previous flooding at his business site. He perceived the flood risk as 'Not Important' when originally choosing his site and said "I'm in the same position I was still in three years

ago where yes. If it does happen again we will flood". This was supported further by data in

Table 6.15.

		Importance of flood risk if choosing premises today			
Business suffered negative effects from previous flooding at premises		Not Important	Quite Important	Very Important	Total
Yes	Count	6	17	22	45
	%	13%	38%	49%	100%
	Count	68	116	128	312
No	%	22%	37%	41%	100%
n = 357					

Table 6.15 - Importance of flood risk if choosing company premises today by previous experience of flooding

Table 6.15 shows that just 13% of respondents who had previous experience of flooding perceived flood risk to be 'Not Important' as a factor if they were choosing business premises today, whereas 49% perceived it as 'Very Important'. Respondents who had not experienced previous flooding followed a similar positive trend, but with somewhat lower scores. Here, 22% of respondents perceived flood risk to be 'Not Important' whereas 41% perceived it to be 'Very Important'.

Although Lowenstein's (2001) theory that previous negative experience can alter perceptions across different points in time appeared to work with the opposite effect with this data, compared to the data within Section 6.2, the results did support other prior findings which suggested that previous experience of flooding increases the level of importance attached to flood risk management in the present and the future. To make sure that these patterns had not occurred by chance, I conducted a test for difference between the perceived importance of flood risk when choosing premises based upon whether or not businesses had suffered negative effects from previous flooding. A Mann-Whitney U test showed the differences were not statistically significant (at >95% significant level) for either 'original' or 'current' time periods.

This was surprising. On one hand, it meant that the unexpected patterns I observed (that contradicted earlier findings from Section 6.2) regarding the conditioning of memory in past time frames were not statistically significant. On the other hand, it also meant that there were no significant differences in the perceived importance of flood risk when choosing premises based upon whether or not businesses had suffered negative effects from previous flooding. Although this finding was not what I expected, as it does not fit in with the observations from Chapter Five and Section 6.2, it is potentially positive in its implications for governance as the importance of flood risk in choosing premises has increased over the years for *all* businesses.

However, this finding should still be treated with caution. Whilst Harvatt *et al*'s. (2011) research demonstrated that experience is particularly important in influencing risk perceptions, they also drew attention to the fundamental problems posed by trying to motivate people into action if they have little prior experience. Chapter Five suggested that business respondents may not be fully aware of the type of flood event which could pose disruption to their operations because respondents see backflow within drainage systems as more likely than sea water overtopping estuary defences. Although an overall awareness may well have increased, the nature of the wording of question 9 and 10 mean that it is unknown whether this awareness is limited to specific *types* of flooding or not. Whilst it may be good news for the Environment Agency that businesses are becoming more concerned over the importance of flood risk when choosing premises, it may still not help their governance approach to flood risk mitigation if businesses harbour higher perceptions of

the effects of pluvial flooding than estuarine flooding around the estuary shoreline which is directly affected by the current Humber Estuary Shoreline Management Plan.

In addition to previous direct experience of flooding, I checked for differences in the importance of flood risk as a factor when choosing company premises by distance from the estuary shoreline, industrial category, company startup date and respondent start date (business life), business size and local authority area, but the data again showed little difference. The only discernable differences were in respondent start date relating to the importance of flood risk when *originally* choosing premises, and the local authority the business is located within relating to the importance of flood risk if choosing premises *today*. Table 6.16 shows details of the variations observed by respondent start date.

		Importance of flood risk when originally choosing premises				
Respondent start date		Not Important	Quite Important	Very Important	Total	
	Count	19	0	4	23	
1949-1973	%	83%	0%	17%	100%	
	Count	29	1	2	32	
1974-1983	%	90%	3%	6%	100%	
	Count	64	8	4	76	
1984-1993	%	84%	11%	5%	100%	
	Count	97	22	13	132	
1994-2003	%	73%	17%	10%	100%	
2004-2009	Count	63	22	9	94	
	%	67%	23%	10%	100%	
n = 357	n = 357					

Table 6.16 - Importance of flood risk when originally choosing company premises by respondent start date

The shading in Table 6.16 shows that the majority of business people from all respondent start date groups classed flood risk as a factor when originally choosing their premises as 'Not Important'. The start date group 1949-1973 displays an odd pattern which is different to the other date groups. 83% of respondents perceive the importance of flood risk to be 'Not Important' when originally choosing premises, with 0% perceiving it to be 'Quite Important' and 17% perceiving it to be 'Very Important'. In contrast, the other respondent start date groups all share a similar pattern where the importance of flood risk as a factor appears to increase as the respondent start date group becomes newer. This is shown by the 90% of respondents who started between 1974 and 1983 perceiving flood risk as 'Not Important', which drops progressively with each respondent start date group to just 67% of respondents who perceive it to be 'Not Important' in the 2004-2009 respondent start date group. A complimentary positive trend is identified for respondents perceiving flood risk to be 'Quite Important', starting at 3% for those starting between 1974 and 1983, and rising steadily up to 23% of respondents in the 2004-2009 respondents start year group. A similar,

though less pronounced overall positive trend is also apparent for the percentage of respondents perceiving flood risk to be 'Very Important', rising from 6% in the 1974-1983 group, before dipping slightly to 5% for the 1984-1993 group, and then rising again to 10% for those who started between 1994 and 2009. However, despite the increases, perceptions of flood risk as 'Not Important' still remain dominant. On the other hand, a very different pattern is shown in relation to perceptions of the importance of flood risk as a factor if the business were choosing premises today (Table 6.17).

		Importance of flood risk if choosing premises today			
Respondent start date		Not Important	Quite Important	Very Important	Total
	Count	6	7	10	23
1949-1973	%	26.1%	30.4%	43.5%	100.0%
	Count	7	11	14	32
1974-1983	%	21.9%	34.4%	43.8%	100.0%
	Count	14	24	38	76
1984-1993	%	18.4%	31.6%	50.0%	100.0%
	Count	29	49	54	132
1994-2003	%	22.0%	37.1%	40.9%	100.0%
2004-2009	Count	18	43	33	94
	%	19.1%	45.7%	35.1%	100.0%
n = 357	n = 357				

Table 6.17 - Importance of flood risk if choosing company premises today by respondent start date

The mode in each of the start date groups in Table 6.17 is 'Very Important', apart from those starting between 2004 and 2009 where it is 'Quite Important'. The 'Not Important' perception has the smallest percentage across the board and shows little variation between respondent start year groups.

Table 6.18 -	Importance of flood risk when originally choosing company premises by local
	authority

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		Importance of f	flood risk when o	originally choo	sing premises
Local authority		Not Important	Quite Important	Very Important	Total
	Count	117	31	9	157
Hull	%	74%	20%	6%	100%
	Count	54	12	10	76
East Riding	%	71%	16%	13%	100%
	Count	28	4	7	39
North Lincs	%	72%	10 %	18%	100%
North East Lincs	Count	73	6	7	86
	%	85%	7%	8%	100%
n = 358					

Table 6.18 shows that the majority of respondents within all local authority areas classed the importance of flood risk as a factor when originally choosing their premises as 'Not Important', with only small variations. However, larger differences were found in relation to perceptions of the importance of flood risk as a factor if choosing company premises today.

Table 6.19 - Importance of flood risk if choosing company premises today by local authority

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		Importance	of flood risk if c	hoosing premi	ses today
Local authority		Not Important	Quite Important	Very Important	Total
	Count	30	51	76	157
Hull	%	19%	33%	48%	100%
	Count	16	27	33	76
East Riding	%	21%	36%	43%	100%
	Count	9	10	20	39
North Lincs	%	23%	26%	51%	100%
North East Lincs	Count	19	45	22	86
	%	22%	52%	26%	100%
n = 358	n = 358				

Table 6.19 shows that the mode is 'Very important' each of the local authority areas , apart from North East Lincolnshire where it is 'Quite Important'. This is interesting, as it does not reflect patterns identified in Section 5.8 where perceptions within *North Lincolnshire* were found to be statistically different from the other local authority areas.

Table 6.20 - Tests for difference between importance of flood risk as a factor in choosing
company premises for the remaining six variables

Test variable	Ten years ago	Current day (2009)	n	Statistical test for difference used		
Distance from shoreline	0.386	0.772	359	Kruskal – Wallis		
Industrial category	0.218	0.229	358	Kruskal – Wallis		
Company startup date	0.102	0.113	356	Kruskal – Wallis		
Respondent start date	0.034*	0.668	357	Kruskal – Wallis		
Company size (employees)	0.863	0.544	298	Kruskal – Wallis		
Local authority	0.161	0.043*	358	Kruskal – Wallis		
* denotes significant difference at p value of 0.05						

Table 6.20 confirms the lack of significance for variations in perceptions of the importance of flood risk as a factor in choosing company premises related to distance of the business premises from the estuary shoreline, industrial category, company startup date and company size. Statistically significant differences were only found between start date groups, and local authority areas.

Further Mann-Whitney U tests revealed that the trends identified within Table 6.16, whereby the importance of flood risk as a factor when originally choosing premises appeared to increase with each year groups after 1974, were confirmed at the 96% certainty level. This fits in logically with the increase in the overall importance of flood risk as a factor when choosing premises over time, as shown in Table 6.12. However, the lack of statistical differences between flood risk as a factor if choosing premises today and respondent start date shows that another factor may be at work which is influencing flood risk perceptions amongst respondents of all start date categories.

Table 6.21 shows where the significant differences lay in the importance of flood risk when choosing company premises today.

Table 6.21 – Mann-Whitney U tests for difference between importance of flood risk as a factor in choosing company premises today

	East Yorkshire	Hull	North Lincs	NE Lincs
East Yorkshire				
Hull	0.500			
North Lincs	0.633	0.977		
NE Lincs	0.083	0.006*	0.064	

The only statistically significance difference identified was between North East Lincolnshire and Hull (*p*=0.006, >99% confidence), confirming the observation above about NE Lincolnshire being different. This geographical difference may be related to information sent out by the Environment Agency on flood risk in the area. To see whether this was the case, I examined whether mean importance values of flood risk when choosing company premises altered depending on the respondent receiving flood risk information (Table 6.22).

Table 6.22 - Mean importance values of flood risk when choosing company premises by flood risk information received

	Mean importance value of flood risk when choosing company premises				
Flood Risk Information Received	Originally	If choosing today			
Yes	1.16	2.04			
No	1.40	2.27			
n = 354					

Table 6.22 shows that the importance of flood risk when originally choosing company premises for respondents is perceived to be higher if choosing company premises today, than when originally choosing them. However, those who have *not* received information from the Environment Agency appear to perceive flood risk as more important (in both time periods) when choosing company premises than those who have received information from the Environment Agency. More respondents (30) in North East Lincolnshire claimed to have received flood risk information at their businesses premises from the Environment Agency than elsewhere (24 in East Yorkshire, 23 in Hull and 15 in North Lincolnshire). This is investigated further below (Table 6.23 and Table 6.24)

Table 6.23 - Importance of flood risk when originally choosing company premises by receipt of flood risk information from Environment Agency

		Importance of flood risk when originally choosing premises				
Respondent received flood risk information from Environment Agency		Not Important	Quite Important	Very Important	Total	
Yes	Count	81	4	5	90	
	%	90%	4 %	6%	100%	
No	Count	187	49	28	264	
	%	71%	19%	10%	100%	
n = 354						
Perhaps surprisingly Table 6.23 shows that the vast majority of respondents who have received flood risk information (90%) perceived flood risk as 'Not Important' when originally choosing their premises, compared to 71% of respondents who had not received flood risk information.

		Importance of flood risk if choosing premises today				
Respondent received flood risk information from Environment Agency		Not Quite Important Important		Very Important	Total	
	Count	27	32	31	90	
Yes	%	30%	36%	34%	100%	
No	Count	47	98	119	264	
	%	18%	37 %	45%	100%	
n = 354						

Table 6.24 - Importance of flood risk if choosing company premises today by receipt of flood risk information from Environment Agency

Table 6.24 shows a greater spread of perceptions across the risk categories for choosing premises today than choosing premises in the past. Only 30% of respondents who had received flood risk information from the Environment Agency perceived flood risk as 'Not Important' if they were choosing premises today and 34% as 'Very Important' (compared to 90% and 6% for original choice of premises). However, this is counter intuitive, as people who are in possession of more information appear to see risk as less important in the past.

At both points in time, the importance of flood risk in choosing company premises is perceived as more important amongst those companies which have not received flood risk information at their premises from the Environment Agency than for those companies which have. I tested whether these observations were statistically significant using a MannWhitney U test. This showed a statistical difference in perceptions of importance for both those who had and those who had not received information in both time periods at >95% confidence. However, the difference is more pronounced for when companies were originally choosing business premises at 0.000 (>99.9% probability), compared to the value of 0.019 (>98% probability) for companies if considering choosing premises today. This suggests that, as well as tacit knowledge heavily influencing flood risk perceptions, codified knowledge also influences flood risk perceptions when it comes to choosing premises. Morris (2006:115) describes codified knowledge as "explicit, standardised and easily transferable". The Environment Agency has changed its stance since September 2000 from "defence" to "risk reduction" (Environment Agency, 2003a:15), with public awareness campaigns focussing on the need for greater awareness of flood risk. An example of a recent campaign contains the tag line "Flood: We can't prevent it. You can prepare for it" (*Ibid*). In order to see why these "risk reduction" messages have not raised business flood perception awareness further, I looked at the type of information which businesses had received.

90 respondents reported receiving 100 pieces of information from the Environment Agency. 86% of these reported receiving leaflets from the Environment Agency, with 15% receiving Tides News and 10% of respondents receiving an email. Irwin (1995:87) sees leaflets as a "model of informing rather than empowering" the public, where people are viewed as witnesses as opposed to participants. This may well have sat at odds with the tacit knowledge already possessed by respondents, leading to the possibility that it may have been viewed as irrelevant and therefore disregarded (Smith and McCloskey, 1998; Masuda and Garvin, 2006). Question 7 on the business survey also asked respondents whether they found the information helpful, and asked them to provide any comments on what they had received. 76% of respondents who had received a leaflet reported that the information the Environment Agency provided was helpful with just 26% saying that it was not.

Unfortunately I was unable to find out exactly which leaflets had been sent out in mail shots from the Environment Agency as the necessary records at their Humber offices were not complete. However, a possible explanation for why the information appears to be lowering rather than raising risk perceptions related to choosing company premises could be due to the way in which flood risk is interpreted. The findings from Chapter Five show that previous experience shapes how the business respondents interpret and relate to the word flood risk, but the codified knowledge being distributed by the Environment Agency may refer to a type of flood risk (estuarine) which is not well understood by business people. Whilst there are many examples of the mismatch between scientific and lay knowledges (Star & Griesember, 1989; Wynne, 1992a; Riley, 2008), in all these examples, there appeared to be a tacit history of knowledge already in place amongst the affected individuals. Without any prior experience of flooding from sea water overtopping estuary defences, the respondents who have received the codified information may have misinterpreted the knowledge resulting in lower flood risk perceptions. Although codified information is standardised in its nature, Hislop (2002) emphasises that the recipient needs to make inferences and judgements on the data they are given, supporting Polanyi's (1969) assertion that no knowledge is ever fully explicit.

Evidence of misinterpretation amongst the respondents was evident within the interviews. All the interviewees within the North Lincolnshire business cluster claimed to have received flood risk information from the Environment Agency at their business premises, but saw it as riddled with uncertainties, perhaps making action problematic. Leslie (Manufacturing, In receipt of information, North East Lincs) said: "One of the enormous difficulties is the uncertainty associated with it. You know, the ranges of probabilities and possibilities. You know as they say with all forecasting you can say where you're going to get to or you can define a date, but you'd be extremely foolish to put the two together". Sidney

(Construction, In receipt of flood risk information, North East Lincs) voiced similar concerns relating to information provided and timescales. He said "You know information comes in all the time. But we do find that there's no consistency with it all. You can't, these things don't happen overnight. If it was okay for five or ten years, that's fantastic. At least you'd know it'd be getting updated. But it doesn't work like that. Little bits come and as soon as they've got another piece of information it changes".

Alex (Manufacturing, In receipt of flood risk information, North East Lincs) said: "We have had communication around improved flood defence along here and I know they have been working along the kind of sea wall area. Which is another reason why, if that was one of the exposures I was thinking of, then they're actually being seen to put steps in to improve those. So we can be fairly comfortable". Alex was aware of the defence works which were going on as part of the Humber Flood Risk Management Strategy and claimed he was comfortable with the improvements being made, which could be an additional reason why the importance of flood risk management is lower for those in receipt of flood risk information in this area of the estuary, because they more readily assume that action is being taken by others (government agencies) to protect them, reducing their own need to act.

Only 3 of the respondents in the Hull clusters had received flood risk information from the Environment Agency. Sandy (Manufacturing, In receipt of flood risk information, Hull River) exhibited similar views to his counterparts in North East Lincolnshire in that he recognised that there were defences in place and trusted them to protect the business. He said: "We've got the tidal barrier at the end of the river, so there isn't a real threat of flooding here. They just bring the barrier down and the water doesn't go up any further, so they can control the water level. They know when to bring that barrier down and to stop it from rising. We

haven't had any problems with tidal flooding since we've been here and at the end of the day I doubt whether we will have, I mean they're improving it at the moment aren't they". Pat (Construction, In receipt of flood risk information, Hull River) echoed Sandy's opinions with regard to the timescales involved in such a flood event. He said "These aren't sort of flash flood events that, you know, just happen within a couple of hours. It'd be over a cycle of tides and you would actually see the water creeping up the road you know so people would have plenty of time to take action. It's not, you know, flooding from rivers bursting their banks and stuff which you get further inland. This is estuarial flooding".

Contrary to Sandy and Pat's complacency, estuarial flooding can happen very quickly indeed, and Environment Agency information contains warnings about how the frequency of storm surges is going to increase with time (Environment Agency 2008b, 2009a, 2009b), but these interviewees did not appear to take on board any information relating to the timescales of flooding.

The misunderstanding of timescales was also apparent amongst respondents who had not received any flood risk information at their premises, but were looking actively at Environment Agency resources. Morgan (Transport, storage and comm., Not in receipt of flood risk information, West Hull) had looked on the Environment Agency website and said: "the level of risk on the Environment Agency website is one in a hundred years... we've just had one in 2007 so I'm hoping by the time I go we don't have another one... I would say on your risk assessment, you know, one in every one hundred years is like a plane crashing. So how much do you put in?"

Dimitriadis and Simpson (2005:803) observe that "in order for information to become knowledge, it first needs to be interpreted so as to have a meaning". The understanding of

timescales related to flood risk appears to be a major stumbling block, which the Environment Agency is failing to adequately communicate to businesses both within its publications, and also on resources available to businesses which have not been sent flood risk information directly to their premises. Whilst businesses appear to be noticing the codified information relevant to the current flood risk mitigation plans, the evidence suggests that they are not understanding the timescales involved. Although previous sections show that overall perceptions of the importance of flood risk as a factor when considering business premises has increased over time, this major miscommunication in codified knowledge could well be viewed as being responsible for the lower importance attached to flood risk when choosing premises in both the past and the present. The uncertainty surrounding these issues can be seen to create what Jasanoff and Wynne (1998:15) terms as a "domain of interpretive flexibility" where businesses may appropriate information distributed by the Environment Agency consistent with their own interests, and subsequently allow this to influence their thoughts relating to flood risk perceptions in the past much in the same way as with tacit knowledge as observed in Section 6.2. Although both tacit and codified knowledge can be seen to exist as separate sources in terms of ways of communicating information used for flood risk perceptions, codified knowledge distributed by the Environment Agency inherently becomes entwined in a "continuum" (Tsoukas, 1996; Jasimuddin et al., 2005) when it is interpreted and combined with existing tacit knowledge.

The consequences of this misinterpretation of codified knowledge distributed by the Environment Agency could well be disastrous for flood risk governance in the Humber region. Poortinga and Pidgeon (2003:962) suggest that people "tend to trust people or organisations that are consistent". However, consistency is remarkably difficult to achieve in communicating about climate change due to its dynamic nature and the lack of scientific

certainty surrounding its causes (Environment Agency 2008b). Observations drawn from the interviews relating to the constantly fluctuating sea level predictions may well damage the credibility required by the Environment Agency as a partner within the governance process and risk isolating the very people that they are trying to inform with their codified knowledge as Wynne (1992a; 1992b) highlights the importance people attach to tacit knowledge and the difficulty posed in trying to use codified information from outside sources to alter their risk perceptions. The next section probes further into these interesting findings related to the understanding of timescales by examining how long businesses estimate it will take them to recover from a flood event.

6.4 How long do businesses estimate it would take them to recover from a flood event from a non-specific source?

The resilience of businesses in relation to environmental disasters is an area of research which lacks a substantial literature base. Linnenluecke *et al.* (2011:130-131) conclude that although "business researchers have undertaken significant work to understand firm adaptation to competitive environments as well as firm relocation in response to economic motivations... existing frameworks have been based on assumptions regarding the natural environment which often preclude the natural environment as a significant factor". Evidence from Section 6.3 suggests that businesses have difficulty relating to, and understanding, codified information regarding the uncertain timescales associated with flooding. Petts (1998:19) suggests that environmental problems are "defined broadly and often based in personal experience [therefore] individuals do not necessarily relate their work activities with environmental impacts." Once again the relevance of tacit knowledge would appear to factor into the decision making process, in conjunction with a communication failure in terms of knowledge in a codified format.

Linnenluecke *et al.* (2009:124) see firms as operating in "short-term financial reward cycles", which leads to a mismatch between changing climate patterns and firm goal setting behaviours. This may well lead to problems in judging timescales accurately when considering flood risk. However, Hoffman *et al.* (2009:260) see institutional change as a key factor in the ability of firms to adapt to disasters, which is determined "by an organisation's financial and human resources". The way in which these various factors interact may have profound implications for flood risk governance and economic development on the Humber. Varying levels of resilience throughout the regional economy could lead to uneven participation within governance, and at worst an uneven economic recovery from an environmental disaster.

Looking at how businesses conceptualise time in the form of recovery estimates for a flood event can therefore help to prevent such unbalanced governance and offer further insights into knowledge transfer of flood risk information. Question 15 from the business survey asked respondents to estimate how long they think it would take for the company to fully recover if a flood adversely affected their Humber premises (Figure 6.3) with aggregate respondent estimates of this detailed in Table 6.25.



Figure 6.3 – Questions 15 from the business survey

Table 6.25 - Aggregate e	estimates of flood recover	y time for all businesses
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Time Period	n	%
Less Than a Week	36	10%
1 - 4 weeks	95	26%
4 - 8 weeks	55	15%
2 - 6 months	84	23%
Over 6 months	75	20%
Unlikely to recover at all	21	6%
n = 366		

Table 6.25 shows that the most common estimate of recovery time was '1-4 weeks' at 26% although estimates are well spread across the different time periods. Existing literature on the topic of resilience is dominated by what Adger (2000:351) terms "the differing conceptions of human-environment interactions within different knowledge systems". This typically focuses upon adaptation strategies, local knowledge and experience (Bankoff, 2000; Allen, 2006) which are predominantly tacit intensive. Although tacit knowledge of flooding is not widespread amongst the survey respondents, and literature dealing with business responses to climate change postulates that resilience may be linked to company resources (Crichton, 2008; Clemo, 2009), it was still important to check to see whether estimates of business flood recovery time varied by previous experience of flooding.

Based upon the values of: 6 for respondents ticking 'Unlikely to recover at all', 5 for 'Over 6 months', 4 for '2 to 6 months', 3 for '4-8 weeks', 2 for '1-4 weeks' and 1 for 'Less than a week', the mean estimated recovery time value was 3.56 for respondents with previous experience of flooding and just 3.31 for respondents without. On average those who have prior experience of flooding estimate higher recovery times than those who lack such experience.

		Est	timates o	f business exper	flood reco ience of flo	very time oding	by previou	S
Respondent suffered negative effects from previous flooding		Less than a week	1 - 4 weeks	4 - 8 weeks	2 - 6 months	Over 6 months	Unlikely to recover at all	Total
	Count	6	9	4	14	11	4	48
Yes	%	13%	19%	8%	29%	23%	8%	100
No	Count	30	86	51	69	63	16	315
	%	10%	27%	16%	22%	20%	5%	100
n = 363								

Table 6.26 - Estimates of business flood recovery time by previous experience of flooding

Table 6.26 shows a wide variation of estimates when the mean values were broken down and examined in their raw format for both those with and those without previous experience of flooding. Although the differences in percentages are relatively small, respondents who have no prior experience of flooding are likely to estimate their recovery time as being slightly faster. The lack of distinct pattern, however, suggests that previous flood experience does not have a great influence on the estimates businesses give to flood recovery times. In order to test this observation, I conducted a Mann-Whitney U test which indicated that the difference is not statistically significant at the 95% level. Although this appears to be good news for flood risk governance, in that strong and deep rooted tacit knowledge does not have to be overcome in order to try and involve private sector businesses as actors within a governance framework, the term 'flood' may be seen to be ambiguous. Different types of flooding may be imagined by the respondents, leading to different interpretations of future flood severity and recovery.

Needle (2004:106) suggests that business people "tend to be reactive rather than proactive" when dealing with risks, so institutional capacity may have an important role in the firm's

ability to adapt and survive if it were to experience a flood event. Mean estimates of business flood recovery time by industrial category are shown in Table 6.27.

Industrial category	Mean estimate of business flood recovery time value	
Agriculture	4.42	Longest Recovery Time
Hair and beauty	4.38	
Wholesale and retail	3.51	
Manufacturing	3.20	
Construction	2.94	
Transport, storage and comm.	2.92	Shortest Recovery Time
n = 366		

 Table 6.27 - Mean estimates of business flood recovery time by industrial category

Table 6.27 shows that agriculture has the longest mean estimated recovery time at 4.42, closely followed by hair and beauty at 4.38. Construction and transport show the second shortest estimates at 2.94 and 2.92. A Kruskal-Wallis test was carried out and showed that the differences by industrial category were significant at over 99% confidence (p=0.000). Further Mann-Whitney U tests showed that these significant differences existed between nearly all of the different industrial sectors.

I was eager to find out what had caused these different estimates of flood recovery time and turned to the qualitative interview dataset for additional evidence. I found some particularly interesting findings which emphasised the risks perceived by micro firms and self-employed entrepreneurs. Jackie (Hair and beauty, West Hull, Over 6 months recovery estimate) said: "If there was the warning of it what could you do? Even filling up your air brick doesn't work. It [the water] comes from under the ground, you'll find it up the walls, water's a very powerful source". Jackie's premises are also not exclusively just for her salon, as she explains, "This place just came up for sale and I thought it's a good opportunity just to move over because it was a house and I had the opportunity to make it into flats, you know, to get some income in."Avery (Hair and beauty, Over 6 months recovery estimate, West Hull) said: "But you know, I have to travel over from York. We're reluctant traders here I'd have you know. I own the property and I've owned it for a lot of years now. But the previous occupiers with the hairdressing business got into difficulties and to protect the employment of the three staff, I'm now the owner of everything and we took over the management of the business". Avery had also diversified by renting out a beauty salon and flats. Both respondents have a great deal of personal investment in their single business premises. If a flood were to effect either premises, both Jackie and Avery would most likely have to sort out the recovery process themselves in relation to the multiple businesses going on within the building, using their somewhat limited personal resources. This may explain why their estimated business recovery times were both over 6 months.

A similar trend was identified within the agricultural sector. Robin (Agriculture, Over 6 months recovery estimate, North Lincs) said: "Where it [the field] actually flooded, it took two or three years to recover due to the salt". Chris (Agriculture, Over 6 months recovery estimate, North Lincs) added: "Everything starts to silt up and there's millions and millions of pounds of work that's been done to bring that land into production. If suddenly we want food again we can't bring it back online". Although these observations are based on tacit knowledge gleaned from their shared farming knowledge, both farmers find themselves in a similar situation to Jackie and Avery in estimating large recovery times due to the weight of responsibility. In a similar fashion to Jackie and Avery, Robin and Chris cannot simply move their livelihood to a new location pending any recovery to damaged assets, as they have an attachment to their business as it is their livelihood.

This was in marked contrast to the views exhibited by Sam (Transport, storage and communication, 4-8 weeks recovery estimate, North East Lincolnshire) who said: "Our activity would be easier to recover for example than a manufacturer because we don't have static machines or things like this. So all we actually need is a plot of land and a covered area where you can work. So I suppose in that way we're probably easier to relocate. But if there was an issue that any of the greater area around here flooded, there would be a lot of similar industries to us trying to relocate somewhere. There could be issues". Sam's business is a satellite site of a much larger company and compared to Jackie's, Avery's, Robin's and Chris's, is considerably more footloose. Alex (Manufacturing, 1-4 weeks recovery estimate, North East Lincolnshire) was even more optimistic regarding his recovery time: "I suppose it [a flood] would disrupt us being able to operate the filling facilities for a while. But in terms of our stuff, then all of our materials are transported by heavy goods vehicles anyway. And they take a fair bit of stopping, you know the kind of flooding that would stop a car or a van, these things will go through without noticing. So, it's never a particular fear for us".

Both Sam and Alex run medium sized businesses. Leslie (Manufacturing, 2-6 months recovery estimate, North East Lincolnshire) runs a micro manufacturing business and had very different views regarding his how easily he could recover. He said: "People being unable to get to work would be a big handicap, and we're in a business where speed of response is absolutely critical to the service that we provide and any interruption to postal services and courier services would be. Well it would stop us getting raw materials in and stop us getting deliveries out. We're *very* dependent upon that". Having few staff, Leslie was most concerned about the disruption a flood event could cause with people coming into work. He was also less footloose than Sam's larger Transport, storage and communication and Manufacturing businesses. Leslie said "Just look how old I am. You know one of one of my concerns I guess is that I own the building, as well as the business. And even if I'm no

longer operating the business I'm dependent at my old age for rental income from the building". Having to repair the building and deal with staffing issues and disruption to the business seems to have increased Leslie's estimate of flood recovery compared to larger businesses.

Mean values for estimated recovery business size are shown in Table 6.28, based upon 6 for 'Unlikely to recover at all', 5 for 'Over 6 months', 4 for '2 to 6 months', 3 for '4-8 weeks', 2 for '1-4 weeks' and 1 for 'Less than a week'. Due to the small number of respondents within the individual large and small business size categories, these were merged for statistical tests.

Table 6.28 - Mean estimates of business flood recovery time by business size (classified by turnover)

Business size (classified by turnover)	Mean estimate of business flood recovery time value
Micro	3.46
Small	3.06
Medium & Large	3.03
n = 305	

Table 6.28 shows that respondents in micro businesses estimate the longest flood recovery time out of all the businesses, with a mean value of 3.46, with both Small and Medium and Large businesses having much shorter flood recovery estimates (3.06 and 3.03 respectively).

A Kruskal-Wallis test showed that different estimates of flood risk recovery time were statistically significant between the business sizes at a 95% certainty level (p=0.047). Mann-Whitney U tests showed that the only statistically significant difference in estimated flood recovery times was between micro and small businesses (p=0.038, >95% confidence). This was surprising considering that there was also a large difference between the Medium and Large group and the Micro group in Table 6.28. However, the lack of statistical difference in this case may well be down to the low sample number of medium and large businesses at just 39, compared to the 70 small businesses and 196 micro businesses. Overall, it does indeed appear that business resilience relies upon the company's institutional capacity to affect change, which is influenced by business resources linked to both the industrial sector and specific business activities the respondent is engaged with, and size as classified by turnover, supporting existing (although limited) research within this area (AXA, 2006; Crichton, 2008; Clemo, 2009; Zhang *et al.*, 2009).

All other variables within the quantitative dataset were examined for effect on flood recovery times, but there were no clear patterns in the data and there were no differences that were statistically significant at the 95% level. It was interesting to note that business people appeared able to demonstrate detailed judgements on how flooding may affect them regardless of any prior experience of being flooded. The evaluation of the businesses' "capacity to absorb disturbance" (Walker *et al.*, 2002:4) by the respondent did not seem to be affected by a lack of coping practices in dealing with flooding. Although French (2004) highlights that flooding is an unusual experience which is not part of everyday life in countries such as the UK, the data shows that businesses in the Humber region still demonstrated estimates of business recovery times following a major flood in line with (limited) existing literature (Crichton, 2008). This was even more surprising when considered alongside the findings from Section 6.2 which drew attention to the misinterpretation of information provided by the Environment Agency, especially with regards to the perception of timescales related to flood events, a common problem which has also been highlighted in previous research by Cullman *et al.*, 2009).

What I find so interesting about these results is that business people were able to imagine the various effects of flooding on their businesses and construct (what would appear to be) rational judgements of how this would affect them, whilst simultaneously demonstrating a lack of flood risk knowledge and low perceptions of flood risk at their premises as shown throughout the data analysis so far. Whilst flood risk perceptions have been shown to be locked in to their causal events, the results here raise the possibility that businesses may have greater success in 'transferring' environmental issues into business risks in terms of the economic impact of their operations. As Messner and Meyer (2006:152) suggest, risk judgements may be seen to vary between different groups as a result of "positions of interest". In such instances, the low perceptions of flood risk may need examining in the wider context of business operations to see whether low overall perceptions of flood risk are being offset by other risks which businesses have to deal with.

However, even though the estimates of business recovery times may reflect the pattern expected from prior research on the subject, there is no guarantee that they are in any way wholly accurate. Previous academic research highlighted major variations in recovery time for victims of the 2007 Hull pluvial floods, coupled with a lack of consistency in the recovery process. Whittle *et al.* (2010) found that members of the public who were more socially vulnerable were seen to encounter additional problems due to their lack of resources, their reliance upon others and an inability to take control of the recovery process. Whilst similar issues may occur for businesses that are affected by flooding due to related issues such as the amount of resources available (in the context of industrial sector or business size), a greater problem may well rear its head in terms of disruption to the labour supply. Even though the limited academic research (AXA, 2006; Crichton, 2008; Clemo, 2009) describes in detail how businesses may be affected by flooding in terms of their operations and their adaptive capacity rooted within capital assets, the issue of labour disruption is glaringly

absent in all but Zhang et al.'s (2009) work. Flooding within the Humber region that affects business premises is also highly likely to affect employees living in the same area, causing considerable problems for businesses if staff are unavailable due to disruption to their personal life caused by flooding. Even if a business does succeed in recovering and resuming normal operations relatively quickly, flooding does not represent what Convery and Bailey (2008) coin as a big bang incident, as issues for homeowners who have been flooded can carry on for months after the initial event. The respondents within the survey did not appear to have been affected by this problem during previous flooding events that affected businesses, with only one survey respondent having raised the issue of the impact of flooding on staff levels, stating that "staffing was affected, not production". However, the issue of staffing did arise in the interviews with two of the large companies located within the Hull City Council local authority. Max (Manufacturing, 1-4 weeks recovery estimate, Hull River) who had experienced negative effects from flooding in 2007, said: "it didn't really have a physical effect, some staff were late to work or couldn't get to work because the roads were flooded". However, the disruption caused to Max was minimal and although he mentioned the subject within the interview, he had not declared this on his flood risk questionnaire survey.

Carson (Transport, storage and comm., over 6 months recovery estimate, West Hull) also reflected similar views to Max, although he stated on his questionnaire that his company had not been affected by any previous flooding. He said "The other factor which I haven't mentioned, as I should do of course, is the effect on staff because many of our staff were flooded at home and therefore had their own difficulties. Fortunately, they're all pretty good and even though they were trying to sort their own selves, they came to work so we didn't find ourselves short of staff. But of course if it was more serious in the future, then that could affect, you know, the staff coming to work which will affect us". Whilst the questionnaire did not ask whether respondents had personally suffered any negative effects from flooding at their homes, out of the twenty interviewees I asked, all reported that they had not done so. Overall, the businesses that were sampled for the research appeared to have escaped issues related to the effects of flooding on staff levels at the business from previous flood events. However, there is evidence to suggest that the immediate effects of estuarine flooding are likely to be more severe than those associated with pluvial flooding, involving greater damage and higher fatalities due to the volume and velocity of flood water associated with a storm surge flood event (Jonkman and Vrijling, 2008; De Bruijn and Klijn, 2009).

Determining potential labour disruption within an estimation of the time required for the business flood recovery process is fraught with difficulty owing to the huge number of variables that would need to be factored in to such a calculation. However, the business recovery time estimates should be handled with care owing to the potential for further unknown factors that may materialise within the flood recovery process (Convery and Bailey, 2008; Whittle *et al.*, 2009) in this instance, especially considering that the issue had so far largely escaped respondents within this project.

In terms of implications for governance, the findings emphasise that different industrial sectors and different business sizes have different levels of preparedness and resilience to potential flooding. Coupled with the insignificant differences associated with the codified information received by the Environment Agency, this suggests that information should be tailored to transfer knowledge more effectively between the Environment Agency and the businesses concerned to better integrate them within flood risk governance. However, the way in which this should be done remains unclear. Although Tewdwr-Jones and Allmendinger (1998:1979) note that much has been done to try and include the concepts of

Habermas into planning policy based on the lifeworld, "the stakeholders present within the arena of discourse will possess different values", as has been discussed throughout this section. Tewdwr-Jones and Allmendinger (1998) criticise "communicative rationality" that assumes that all sections of a community can be included within the collaborative planning discourse on account of its lack of explanation as to how this will achieved. This emphasises the role of power, which Healey (1999b) sees as "an ability to make a difference" and to challenge the assumptions and values embedded in everyday practice. However, she also acknowledges that such sets of values are complicated institutional projects which "unfold over time unevenly" (Healey, 2004:61). In order to address these issues on the Humber estuary, a closer look needs to be taken at the way in which businesses interact and the existing networks that allow communication between businesses and other stakeholders around the estuary.

6.5 Summary

Findings within this chapter have shown that the importance of managing flood risk is reported to be greater in the present and the future than in the past. Whilst the results suggest that this is a result of receiving flood risk information which has helped to fill the void in knowledge caused by a lack of personal experience, the importance of managing flood risk within day to day operations of the business is still higher for those respondents who have experienced previous negative effects of flooding at their premises than those who have not. It was also apparent that personal experience of flooding could also influence perceptions of risk in the past, as well as the present and the future, as "emotional reactions guide responses ... through conditioning memory at other points in time" (Loewenstein *et al.*, 2001:274). Whilst raising past perceptions of flood risk may not be particularly useful in terms of involving businesses within flood risk governance in the present day and in the future, it does count towards providing information on how tacit knowledge on

environmental hazards is transferred, a body of research which Terpstra *et al.* (2009) view as having received very little academic attention.

Significant differences in the perceptions of managing flood risk as part of business operations by industrial sector were limited only to agricultural businesses and business people who had started work between 1949 and 1973 for the time period '10 years ago'. This suggests that over time, businesses appear to have converged in their perceived importance of managing flood risk over time as it has become a more visible problem for the current day and also in the future. A common factor relating to this was revealed within the interviews, whereby some business people complained of facing increased insurance premiums at their premises in recent years, lending support to Petts *et al.*'s (2009) reasoning that businesses are more likely to be aware of environmental problems when they have a direct effect on their operations in a form of regulation.

Although the general increase in flood risk perceptions amongst all respondents is especially encouraging for the Environment Agency, as it means that flood risk is rising up onto business radars, the results need to be treated with caution. Questions 17, 18 and 19 which the responses were based upon did not ask respondents about a particular type of flood event, as the wording only referred to general flood risk. Considering the findings from Chapter Five, where variations in respondents' perceptions occurred between different types of flooding, the increased importance of managing flood risk may not necessarily refer to *estuarine* flood risk which the Environment Agency are attempting to manage through governance due to a lack of knowledge transfer based upon mismatched characteristics (Visschers *et al.*, 2007).

Section 6.3 also showed that the importance of flood risk in choosing company premises has increased over time. However, in contrast to all findings so far, there was no statistically significant difference between the perceptions of respondents who had experienced negative effects of flooding and those who had not. This suggested that respondents were receiving other information to raise flood risk perceptions in the absence of tacit knowledge, as demonstrated in prior research (Myatt *et al.*, 2003a; Myatt *et al.*, 2003b; Morris, 2006). When examining the perceptions according to whether respondents had received codified flood risk information from the Environment Agency at their premises, it transpired that perceptions at both points in time were lower for those in receipt of Environment Agency information than those who had not received any. Further investigation revealed that this was likely to be due to trouble which businesses had in interpreting the information which the Environment Agency had given them in terms of timescales, leading some businesses to substantially underestimate flood risk.

As both findings from Section 6.2 and 6.3 show, miscommunication can occur due to the way in which business people are interpreting the meaning of information (Dimitriadis and Simpson, 2005, Jasimuddin *et al.*, 2005). Within the Humber estuary region, information which is being distributed by the Environment Agency may have the opposite effect to that intended, by decreasing flood risk awareness and harming the governance approach to flood risk mitigation in the process (Martin and Foley, 2000).

Whilst businesses appeared to have particular difficulty in interpreting environmental timescales from information provided by the Environment Agency, within section 6.4 they were shown to be able to estimate flood recovery times in a more accurate manner, as determined by business studies literature, in relation to their resources and assets based upon their industry and company size (Clemo, 2008; Crichton, 2008; Zhang *et al.*, 2009).

These estimates were not affected by the respondent's experience of negative effects of flooding at their premises, which suggested that businesses were able to perceive environmental hazards more accurately when they were framed within an economic context that was directly related to business operations (Messner and Meyer, 2006; Visschers *et al.*, 2007). This finding holds particular importance for the Environment Agency as it showed that flood risk information requires tailoring to meet the different needs of businesses within the region, echoing observations from Chapter Three that people, or in this case businesses, cannot just be given information in the manner of "empty vessels" that require filling (Brown and Damery, 2002:422).

However, although businesses appear to hold reasonably accurate perceptions of their vulnerability and resilience in an *economic* sense, recovering from a flood is not a straightforward process. Convery and Bailey (2008) and Whittle *et al.* (2009) highlight the vast number of unknown factors that people have to deal with during the flood recovery process. Although many of these may apply directly to businesses themselves, such as having to wait for decisions from insurance companies that are effectively out of the victims' direct control, there is also the issue of disruption to the business through staff being unable to attend work. The participants involved within this particular research project seemed to have escaped this issue during previous flood events in the region. As such, this may explain why flood recovery estimation did not alter with previous experience of flooding considering that this issue is largely missing within the limited literature related to business vulnerability and resilience to environmental hazards (Zhang *et al.*, 2009).

Overall, flood risk perceptions have been shown to have increased over time, although they still remain at a low level as shown throughout Chapter Five, which has provided an answer for my second research question asking how business flood risk knowledge has changed over time with changes in scientific understanding. However, the way in which businesses interpret information has been shown to alter depending upon the context within which it is set. Considering that respondents appear to show a better understanding of flood risk when it is presented in an economic context, further investigation of the risks which businesses deal with on a daily basis may help to explain why the analysis of the data collected has shown overall business flood risk perceptions to be low. The next chapter will address the juxtaposition of environmental and economic risks more fully, providing more comprehensive evidence with which to answer my third research question, whilst investigating how these issues may be addressed through a process of governance on the Humber estuary.

<u>Chapter Seven</u> Balancing Flood Risk Mitigation and Economic Development through <u>Governance</u>

7.1 Introduction

So far the quantitative aspect of my research has shown that businesses' risk perception reflects personal experience as demonstrated within Chapter Five. Whilst it was found that many businesses lack the tacit knowledge relating to estuarine flooding due to an absence of such flood events in the Humber area over the last half century, it has been shown within Chapter Six that businesses perceive the importance of managing flood risk as part of business operations to have increased over the last ten years, with the task seen as becoming even more important in the future. Chapter Six also touched on some of the vulnerabilities of businesses in terms of their ability to recover from a flood event. However, the statistical significance of the trends observed from this data was shown to be limited solely to variations in perception related to industrial sector and company size. Although the quantitative data has succeeded in uncovering a good overall picture with which to understand basic business flood risk perceptions on the Humber estuary, it lacks the depth required to probe further into how such understandings can manifest themselves in both local and regional governance. As such, this Chapter focuses solely on the qualitative data gleaned from the twenty interviews conducted within the four business clusters of the Humber estuary study area. This will provide a fuller answer to my third research question concerning the juxtaposition of environmental and economic risks, whilst also answering my fourth research question that asks whether concern over flood risk mitigation and economic development has encouraged stakeholders to plan and execute their activities through estuary-wide governance processes.

Section 7.2 builds upon the notions of vulnerability and resilience touched upon within Chapter Six, looking more in depth at the range of issues businesses deal with on a day to day basis and where flood risk mitigation sits amongst the other operational processes the businesses must deal with. Section 7.3 looks at where businesses get their flood risk information from, and precisely where this information sits relative to their own tacit knowledge. The concepts of trust and consistency are also explored terms of the provision of this information, and the impact that this has on business flood risk perceptions. Section 7.4 explores the shared responsibilities involved in flood risk mitigation between businesses and statutory bodies together with the networks that exist between the different businesses that were interviewed. Drawing upon these findings, the potential for a successful flood risk mitigation governance model is analysed. Section 7.5 concludes with a summary of the Chapter's findings.

7.2 What other business concerns does flood risk management have to contend with?

Perhaps the most astonishing answer I got from a business when questioning a respondent on the risks which their businesses dealt with on a daily basis was the statement that "We don't really have any" (Sandy, Small - Manufacturing, Hull River). Sandy was not alone in this opinion, with Jackie (Micro - Hair and beauty, West Hull) stating "I wouldn't say that there is anything that worries me" and Ashley (Micro - Wholesale and Retail, Hull River) also concluding "No not really, nothing particularly that becomes a problem".

The question seemed to stump some of the respondents, with the word 'risk' appearing to be the root of the confusion. As such, the term 'risk' required clarification, either from reemphasis and probing on my behalf, or by further questions posed by the respondent. An example of this was Leslie (Micro - Manufacturing, North East Lincs) who said "Well I don't really understand what the context is". After some thought and further clarification, the respondents came up with some issues which they thought might be seen as risks within the daily business operations. Jackie (Micro - Hair and beauty, West Hull) demonstrated the unfamiliarity of the use of the term 'risk' in this context by saying "It's just... As you go through your daily routine, you do have things that come into your mind that you have to think about. Security is one of them. You know, things like that. You do get some unsavoury people [who] do pass by!"

Ashley (Micro – Wholesale and Retail, Hull River) on the other hand, after some thought on the matter concluded that risks to his business were "General business risks... the normal health and safety risks I suppose". Sandy (Small - Manufacturing, Hull River) echoed Ashley, stating: "Other than sort of normal risks of fire and electric failure and all of them [sic] sort of things, not much of a risk to us at all really". This apparent perception of normalised risks may be useful in understanding how knowledge has so far appeared to be locked in to specific events as discovered throughout Chapter Five. With the interviewees indicating that business people may not conceptualise everyday functions of their operation as risks, it is possible that when presented with the concept of flood risk, this may well be seen as something that is outside the normal day to day running of the company and therefore not particularly significant.

Interestingly, some of the other business respondents that were interviewed picked up on the concept of risk much faster than those outlined above. When asked about what risks his company dealt with, Mandeep (Small - Wholesale and retail, North Lincs) stated "The main risk as a company we'll have is always fire risk. Fire risk is number one and it's obviously in the nature of our business. The flood risk is there, it's not necessarily one of the highest risks. It is probably one of the lowest risks so far". Morgan (Medium – Transport, storage

and comm., West Hull) also reacted quickly to give risks that were also specific to the nature of his business. In terms of his risks he said "Ammonia. We deal with toxic chemicals, so fire, 'cause of the infrastructure [on site]". In terms of these two businesses, the respondents dealt with risks inherent to the business operations that were controlled under health and safety legislation. This fits in with both Tilley's (1999) and Petts *et al.*'s (2009) observation that environmental awareness is often framed by businesses in terms of compliance with regulations, building on the evidence already gathered in Chapter Six.

Furthermore, *all* businesses must still comply with statutory regulations governing certain forms of risk regardless of the nature of their operations. An example that applies to all of the interviewees in this project is the 'Use Classes' regulations of the company premises as specified under the Town and Country Planning Act 1987. These regulations are enforced by the relevant local authority through their planning department, and cover orders such as 'The Regulatory Reform (Fire Safety) Order 2005' (CLG, 2006a). After some thought on the matter of what risks his business faced, Sandy concluded that fire was a normal health and safety risk, suggesting that it was not particularly important, whilst both Jackie and Ashley failed to mention fire specifically amongst risks they dealt with, even though all the interviewees are subject to this legislation.

In terms of satisfying the 'The Regulatory Reform (Fire Safety) Order 2005' (CLG, 2006a), businesses must display appropriate signage around their premises for fire fighting equipment and fire exits, whilst also formulating a fire action plan. The premises are inspected at the time when the 'Use Class' designation is awarded by the planning department, but the business site may only be subject only to future spot inspections thereafter. As Sandy, Jackie and Ashley's daily business operations do not come under the auspice of special risk regulation, research by Zhang *et al.* (2009:81) suggests that "non-

essential planning tasks" are likely to be ignored as SMEs focus on the short term issues involved with the day to day running of the business. Relatively simple actions are required to satisfy an officially regulated risk such as fire for a small business with non-hazardous operations, many of which will be one off tasks. For example, fire exit signage and fire plans are fitted when the business moves into a property and are unlikely to be replaced thereafter unless the appropriate legislation is altered to require such changes. Within a business that does not have an elevated risk of fire caused by its specific operations, it is possible that such a risk would be regarded as a normalised or a background risk, as it is overshadowed by activities that require greater amount of attention on a more frequent basis and therefore becomes embedded and unseen (Lange and Garrelts, 2007).

If businesses do not see themselves as subject to risky events, the perception of risk associated with flooding may be influenced accordingly. Although results from Chapter Six suggest that business people are increasingly worried about managing (general) flood risk in the region as part of their business operations, findings from Chapter Five suggest that the overall perception of flood risk amongst businesses is still low, offering support to this theory.

Those respondents who explicitly mentioned flood risk as part of regulations governing their operations at their sites highlighted the fact that flooding had only recently been included their risk assessments. Tony (Medium - Manufacturing, North Lincs) said "Flood risk only came up 12-13 months ago for us. So that gives you an idea how slow it's creeped [sic] in". Tony's comments are particularly interesting, as it appears that businesses have been dealing with other forms of risk as part of their operations for far longer periods of time, and as such have seen improvements in the factors associated with these over the years. Jamie (Micro - Manufacturing, River Hull) demonstrates this with regard to fire risk, as he said:

"We have a health and safety consultant who visits us a few times a year and does an assessment. In the modern [censored] industry that we are part of, the chances of fire are much reduced. Obviously, clearly we use paper. Essentially, trying to set fire to a pallet of paper is very like trying to set fire to a tree, it's not that easy. The kind of chemicals and solvents we use are nothing like as volatile or flammable as they used to be. And it's now a non-smoking environment. Basically the risk factors are controlled".

Having had the persistent risk of fire within business operations for a number of years, developments have been made in countering and reducing these threats where possible. Although flood risk differs in its characteristics to fire in that it is likely to affect a larger area rather than one business site (and possibly some neighbouring buildings in the case of a severe fire), fire risk does serve as an example as to how risks can be minimised when the problem is addressed through regulation and the relevant developments that are made over time. However, whereas measures to counteract the risk of fire are included within regulations for businesses, and are enforced by assessors as demonstrated by Jamie's example above, measures for counteracting flood risk at business sites are not applied in the same universal fashion. Even with the passing of time, as flood risk appears to be a new issue for businesses, Zhang (2009:52) highlights that *non-essential* investment in hazard mitigation is likely to be avoided to prevent decreasing the "short term profitability" of the business.

The only legislation that currently applies to a business' physical premises regarding flood risk is found within PPS25 (CLG, 2006) which controls the planning associated with any new developments within floodplains. However, research by Bosher *et al.* (2009) has shown PPS25 to be less than watertight in its objectives, as it may still allow certain low risk development within flood risk areas if there is nowhere safer to build nearby. SMEs with low

risk business operations that would class under such development include those run by Sandy, Jackie and Ashley, all three of whom already have a low awareness of flood risk.

Ashley (Micro - Wholesale and Retail, River Hull) was particularly vocal in his opinions about flood risk at his current site, saying "Whatever risks are there [at the location of the business] we have to take them. You know there is nothing we can do in-house to circumvent the possibility of a flood". He went on to describe the difficulties that his business has had at its current location over the last few years: "Unfortunately, St. Stephens has opened. The station and bus station has been revamped. A lot of people now don't come to this end of the city. They just purely stick around that end of the city, we've lost an awful lot of footfall you know. If I tell you that my turnover last year in 2009/10 was what it was in 1999/2000... you know turnover's gone down."

Using the evidence gathered from the interviews, there is a possibility that business people who are unaware of flood risk, or have low perceptions of it affecting their business, may not actively be worried about locating themselves in a flood risk zone. Ashley's overriding concern, although interestingly he did not class it as a risk when asked initially, is being able to sustain his daily business operations in terms of income. He continued "I'll keep my doors open as long as I possibly can. Once customers find an alternative, they'll probably stick with it... so it erodes at your business".

Drew (Micro - Wholesale and retail, West Hull) also had low perceptions of risk, despite being flooded, as previously discussed in Chapter Five. However, in terms of his business operations, he is also dependent on a strong customer base in his local area. He said "I'm a West Hull person and I have a strong business here in West Hull". Jackie (Micro - Hair and beauty, West Hull) also demonstrated ties with people living in the vicinity of her business, saying "I used to have a salon across the road in the block of shops... this place came up for sale and I thought it's a good opportunity just to move over with the clientele that I had there".

Looking at these three examples, there is evidence to support Crichton's (2008) findings that SMEs are at risk of increasing their vulnerability to flooding by following their customers into locations where they are likely to be exposed to flood risk. None of the businesses quoted above stated any intentions of moving, either within the interviews or on the questionnaires. However, from the information they have given on how much they rely on their local customer bases, such businesses are unlikely to move from an area which they rely on for their business to function because of flood risk considering their low flood risk perceptions. With Convery and Bailey (2008:101) emphasising that people's needs are embedded within the terms of their "employment status, financial resources, legal entitlements and the housing situation", businesses can be seen as a crucial element in establishing "social cohesion" (Crichton, 2008:125) in both urban and rural areas. Without a more comprehensive legal framework, or regulations making specific flood risk measures mandatory in a similar fashion to those governing fire, it would seem from the data collected that there is little hope of flood risk featuring higher on the radar of SMEs, as the risk of the business failing due to customer loss is more likely and also of more immediate concern than the possibility of being flooded. However, even with regulation, it has been demonstrated that in contrast to indications from Chapter Six that there is a possibility that some businesses may continue to think of flooding as a normalised or background risk if it does not compete with more pressing issues within the daily business operations such as in the case of fire risk legislation.

Most of the businesses which I spoke to were particularly worried about the present state of the economy, and business concerns appeared to be far higher for the economic wellbeing and the future growth of the Humber as opposed to tackling flood risk on site at the business. Sandy (Small - Manufacturing, Hull River) said "You know, a guy I was talking to last week who's a pallet maker. He's lost sales for an awful lot of pallets with companies which have either relocated out of Hull or they've gone bust in Hull. And he says the sad thing is it's not getting replaced with anything". Ashley (Micro - Wholesale and Retail, Hull River) reflected similar concerns: "We need as many businesses as we can get [in the city]. I mean, you'll remember we were a fishing port. The fishing industry died, we turned into a caravan building type city. We need a variation. Yes we've got Reckitt's, yes we've got Smith and Nephew's. But we need a lot of other businesses here as well. You know the bigger you are the harder you fall, if we were to lose one of them two we'd be really stewed here". Avery (Micro - Hair and beauty, West Hull) also commented upon the need for more businesses stating "I think a current priority is in, in attracting businesses to increase employment in the area and the city as a whole". All three respondents expressed concern for the current economic state of Hull, with Ashley highlighting that "I think Hull is one of the hardest hit through the recession. There's so many people out of work, you know without money in their pockets unfortunately, and it's hurting everyone... people only buy [the product he sells] when they've got loose change in their pockets. And there's a lot less people out there with loose change in their pockets".

The views of the Hull businesses were also reflected by respondents further afield within the other local authority areas around the Humber. Tony (Medium - Manufacturing, North Lincs) said "I think that attracting new businesses to the area is key for the area. Erm bearing in mind I think we've got is it the second or third largest port in the country?" Sidney (Micro - Construction, North East Lincolnshire) also commented on what he perceived to be the

priority of the local council "The planners, they want to regenerate the town. They're very concerned with economic development in the area... and the regeneration so [that] business stays in the town".

Business concerns regarding economic development also extended to cover the infrastructure within the region. Tony (Medium - Manufacturing, North Lincs) said "It's imperative that we keep the network, the road network, the rail network, open and flexible and that we improve it". He saw the road and rail infrastructure as being particularly important to businesses, especially considering that his raw materials were hauled in by road, and shipped out again by road to national distribution hubs. Mandeep (Small - Wholesale and retail, North Lincs) also reflected this in his concerns over aspects of the location of the business which make operations difficult, saying: "I think really it's to do with the state of the infrastructure. Mainly roads 'cause they're in a very poor state".

In some cases, the concern over infrastructure surpassed concern over the need for further economic development of the region. Although respondents such as Ashley (Micro -Wholesale and retail, Hull River) highlighted that they were dependent upon the wider success of the economy in order for his business to remain healthy, other businesses appeared more insular with regards to their immediate vicinity. Jamie (Micro -Manufacturing, River Hull) was one such example, stating "It [economic development] probably wouldn't have that great effect bearing in mind the client base that we've got... Most of our paper comes in on wagons, like daily deliveries from Leeds so... Clearly though from the point of view of the future prosperity of the city, if there are future barriers to large companies relocating or expanding in the city then that's not so good."

Sandy (Small - Manufacturing, River Hull) provided some particularly interesting views on the positioning of Hull and its infrastructure in terms of economic advantage. Like Jamie, his business was based in Hull but he had dealings with suppliers and customers much further afield. He said "The whole area is incredibly cut off. My company has skills that are nationally recognised in our particular area. And one phrase irritates me, and I get it on probably a monthly basis. Companies from outside of this area who say to me "You know if you wasn't [sic] in Hull, by God you'd be cracking! I don't feel like going and setting up in Birmingham or Leeds or whatever, but I can see where they're coming from. We had people here from Scotland the other day, and the guy said 'what a bloody place Hull is to get to'... and there's a crew in Swindon that need training at the moment and they just can't be bothered to get up to Hull. Because when you look at that map [gesturing at map on wall], there's nothing at this side. There's a perception that, how the hell do you get at it? You go [from] London, across the country, you turn, you go up through Birmingham towards Manchester, you nip in Leeds area, Newcastle area and that's England! That's the economy of England. There's nobody coming into the city, I always think Hull is a bit of a back-water".

Although some businesses were seen to be more insular than others, the concerns they stated over both economic development and local and regional infrastructure are closely intertwined. Despite the academic debate over the advantages of Foreign Direct Investment (Tickell and Dicken, 1993; Crone and Watts, 2000; Girma *et al.*, 2001; Phelps, 2003), there is still an emphasis on promoting the Humber estuary region as a site suitable for such projects. This is demonstrated by the Green Port Hull proposal (www.greenporthull.co.uk) currently being driven by Hull City Council and ABP to attract the Siemens company's Renewable Energy division to choose a site on Hull Docks as its new manufacturing base for wind turbines (Green Port Hull, date unknown). Whilst there are widespread expectations for thousands of new local jobs and a major boost to the region's industry (Hull Daily Mail,

20.01.2011; Hull Daily Mail, 17.03.2011), such a project is also likely to bring substantial upgrades in infrastructure, both directly and also indirectly as a catalyst for related economic development (Hull Daily Mail, 03.07.2012). As such, the economic and infrastructure related risks that businesses have outlined within the interviews are likely to be addressed when the contracts are expected to be formally signed by Siemens in December 2012 (Daily Mail, 16.07.2012).

However, the enthusiasm for the development of the green port was not universal amongst regional stakeholders, despite its touted economic advantages. Both the Environment Agency and Natural England expressed concerns that the Green Port development could adversely affect the flood defence strategy for the Humber and infringe upon the EU Wildlife legislation that covers the estuary's intertidal areas. The Environment Agency were particularly concerned that if they were unsuccessful in delivering suitable managed realignment sites in the appropriate parts of the estuary, to compensate for the coastal squeeze caused by the development (see Chapter Four), they "will be unable to fulfil [their] flood risk management role by continuing to build new and improve and maintain existing flood defences in the estuary... ultimately result[ing] in places like Hull, Grimsby and Immingham being placed at an increased risk of flooding" (Hull City Council, 2012). As a result, the decision on the planning application was referred to the Secretary of State, Ed Davey. However, in May 2012, just one month after lodging objections, the Environment Agency and English Nature both fully withdrew them (Hull Daily Mail, 03.05.2012). Subsequently, the Secretary of State passed the plans to the Environment Secretary, Caroline Spelman, in order to sign off the Habitat Regulations which will approve "the reclamation of land from the Humber Estuary to create a riverside guay where wind turbine components will be shipped from" (Hull Daily Mail, 16.07.2012). An Environment Agency spokesperson simply stated that "Following discussions with ABP, we are now satisfied

there is sufficient habitat compensation provided for the scheme" (Hull Daily Mail, 03.05.2012).

Whilst this could be a sign of the national government level usurping the regional/ local governance process, within which the Environment Agency has considerable power in terms of granting planning consent (Jessop, 2000; Williams, 2010a), there is no doubt that the issue will have done little to raise the profile of flood risk amongst businesses in the area considering the speed at which the flood risk issues were withdrawn and the lack of publicised discussion on the matter of flood risk. Despite the data that was collected from the questionnaire suggesting that the importance of managing flood risk as part of business operations has increased over time, risk perceptions were still generally found to be low amongst business respondents for all types of flood events. Looking at some of the issues which have been uncovered in this chapter section, it is perhaps not surprising that flood risk perceptions remain low considering the number of other more immediate economic issues that businesses are preoccupied with in dealing with their daily operations.

Although Romilly (2007) observes that risk is a pervasive feature in business decisionmaking, the nature of dealing with such risks appears to have been normalised by business respondents. This is supported by the confusion shown by some respondents when first asked about what risks they deal with as part of their everyday operations. Business people in companies whose operations and premises were regulated under various forms of legislation appeared to pick up on the risks label more quickly, as they were used to dealing with activities that were officially designated as risks. Whilst business owners were worried about the current economic climate, and the infrastructure upon which economic activities and indeed future economic development appeared to rely upon, these appeared to surface as concerns as conversations progressed, as opposed to being immediately associated or
labelled as risks during questioning. This supports Foster's (1993:123) findings that businesses, and particularly SMEs are "reluctant planners" whereby managers are often too busy with concerns related to the immediate work involved in running the business to bother with long term planning which is required for effective flood risk planning.

Typical examples of responses given when respondents were asked about where flood risk sits within business operations included Sam (Medium - Transport, storage and comm., North East Lincs) who said "It's become more of a consideration, but it's not hugely high on our list of priorities, we've had no effects [from flooding] whatsoever". He went on to say "I think there's always something else that's more of a priority at the moment. Rightly or wrongly that is, but that's how it works". Max (Large - Manufacturing, Hull River) reflected this, stating "Hmmm [flood risks are] fairly low in terms of daily business. We've far more worries with other issues than flood risk in terms of operations", whilst Avery (Micro - Hair and beauty, West Hull) also emphasised "Flood risk is very low on the agenda. I'm far more concerned about getting people in, getting them in 'cause [customer] numbers are down". These outlooks are understandable in the light of research by Watson *et al.* (1998), Van Praag, (2003) and Van Gelderen et al., (2006) who emphasise that the primary reason for business failure is, quite logically, poor trading conditions. Whilst larger companies may have multiple managers overseeing different areas of responsibilities, this issue is exacerbated in SMEs where managers are omnipresent in their business operations (Hill and McGowan, 1999), meaning that issues that are not of immediate concern are likely to be left on the back burner whilst more important issues are addressed.

Findings from Chapter Six also suggested that businesses appear to have difficulty reconciling environmental and economic timescales. This has the potential to exclude flood risk from being considered within business operations due to their incompatibility with

shorter-term business cycles and business attitudes which are viewed by Needle (2004:106) as being predominantly "reactive as opposed to proactive". However, this observation does not apply to all types of businesses universally.

It has already been seen that agricultural businesses operate with much longer timescales than other business categories within Chapter Six through the management of farmland in terms of generations of families. As Chris (Micro - Agriculture, North Lincs) explained "I do business planning, and do short term as five years. Forty years is long term". The timescales used for planning with agriculture can be seen to be considerably longer than those within other industrial sectors (Needle, 2004; Husted, 2008; Riley, 2008), highlighting the gulf between long term environmental processes and short term everyday business operations that non-agricultural businesses had to deal with. However, some interesting findings on the interconnection of economic and environmental objectives were revealed by two respondents within the Construction industry.

Whilst the Construction industry (as specified by the SIC code selected for my research in Chapter Four) includes businesses as wide and diverse as painters and decorators to builders to plumbers, the two interviewees who represented the industry within the qualitative research phase were from companies that dealt with property development. Their business operations were therefore tied up in issues related to flooding in respect of developing properties under PPS25 within the floodplain of the Humber estuary. Pat (Micro - Construction, River Hull) demonstrated this by saying "The problem is we're having to adapt to flood risk... we've found most of the sites round here are affected in some way by it and you've just got to adapt the design of your buildings to minimise the risk". Although Pat is having to integrate flood risk into his business operations, again this is an example of integration due to regulation enforcement. Pat appeared to display mixed feelings about having to abide by such regulation however, stating "Basically I would say what they [Environment Agency and local authorities] are doing is not wrong, it's right and in the interests of society general, but if we're not careful we're just not going to be in a competitive world".

Sidney, (Micro - Construction, North East Lincs) his counterpart from the South Bank of the estuary, reflected similar concerns, stating "People live in floodplains, people want to live near the sea. They want us to regenerate the town... when you go inland from here you have the Lincolnshire Wolds which is an Area of Outstanding Natural Beauty, so they're not going to get any building on the Wolds!". Interestingly, both Pat and Sidney were highlighted in Chapter Five as being examples of business people within the Construction industry who had low perceptions of flood risk due to the footloose nature of their industrial sector, as opposed to respondents in the manufacturing sector who had slightly higher flood risk perceptions. Even though they perceive the risk of their business being flooded as 'low', ironically flood risk is still impacting upon their business operations through regulations in the form of PPS25. In this sense, flood risk is transferred into a major issue for their businesses, even though it does not register as a high risk in terms of its physical manifestation with either respondent.

As part of their operations, they have had to deal with issues relating to the balancing of both economic timescales of business operations and also from environmental timescales relating to PPS25 planning regulation. Pat (Micro - Construction, River Hull) demonstrated this with an example of a business park site that they are involved with in North East Lincolnshire "We got planning consent in 1996 and of course then it [flood risk] wasn't so much of a consideration, so Yorkshire Forward invested a lot of money in the infrastructure if the site. You know, probably circa £10 million. Of course, the outline consent lapses after

five years. You renew your planning application, but when you do it of course it is the legislation that's appropriate at the time. So PPS25 has now come in, so you're going back to the Environment Agency saying 'well I know in the past we built at two metres above ordnance datum, now we are required to build at three metres... Importing fill over an acre would be about £150,000, so that comes off the value of the land. It actually gives the land a negative value in effect, so we had to look at ways of getting round that". Sidney also had a similar story to tell: "This site at [censored] we've been working on for seven or eight years. Now the initial flood risk assessment that we did. All of a sudden that's superseded... they seem to move the goalposts all the time. So all of a sudden, we've got to do another one, or update the old flood risk which we know is better than the original one... so you can see how frustrating it is to get something, to progress the site. Two years down the line or even 18 months down the line it's out of date again and you have to revisit the whole thing". Building work on large sites can take several years as sections of the site are developed at a time, and as such the builders interviewed have clearly had a difficult job in keeping pace with the planning regulation requirements which are in turn influenced by scientific findings related to climate change science on sea level rise.

This is a particularly interesting finding which would not have been uncovered had the project relied solely upon quantitative data collection. However, it is important to emphasise that the findings related to the two interviewees representing the construction industry in this instance are not applicable to the wider industry as the qualitative data is not representative. This finding nevertheless brings up an important issue that has been touched on in both Chapter Five and Chapter Six, namely that of where businesses get their flood risk information from and whether they agree with the information and trust the source. Although the Environment Agency have distributed information to business people within the project study area, it still needs to be ascertained whether businesses would

consult any other sources if they are being pro-active and looking for information on the issue of flood risk themselves. This will be explored in the following section.

7.3 Where do businesses turn for flood risk information and do they trust the source(s)? The interview transcripts revealed the monolithic source that businesses would turn to for flood risk information as being the Environment Agency. This did not appear to be affected by whether the respondent had received information from the Environment Agency on flood risk beforehand (50% of those interviewed did not think they had received any information from the Environment Agency within the last year), with sixteen of the twenty businesses naming the Environment Agency as a primary source for flood risk knowledge. However, the point in time at which some of the interviewees appeared to think about looking for information from the Environment Agency on flooding was particularly concerning. Amongst those interviewees who had conducted their own research on flood risk was Morgan (Medium – Transport, storage and comm., West Hull). He said: "It's just what we access and what we do by ourselves on their [Environment Agency] website and things like that". Jamie had also actively searched for information on flood risk and said: "Well I've looked on the Environment Agency website which obviously you can sort of put your postcode [into] and go through it and sort of see it all". However, this pro-active behaviour whereby business people had searched for information in advance of a flood event was not demonstrated by all of those that were interviewed.

The point in time at which some of the respondents would think to search for information on flood risk appeared to coincide with the arrival of a flood event. Leslie (Micro -Manufacturing, North East Lincs) said "Well I guess I'd Google flood risk. Grimsby. Hmmm. We're making a lot of assumptions aren't we. I mean, is internet access still possible at the time when you hope you want to know and so forth [laughs] I think if it got to that point, I

mean that's clearly an emergency situation and you're looking to protect your life at that point and your car". Interestingly, it was amongst the respondents who exhibited a more reactive attitude to obtaining flood risk information that alternative organisations to the Environment Agency emerged as a source for knowledge. Jackie (Micro - Hair and beauty, West Hull) exhibited a similar attitude to that of Leslie in terms of looking to access information at the point at which a flood was actually in progress. She said: "We'd go on sky TV, or one of the local channels. You find you pick it up just there... and the local radio for the flood area, Humberside. Even the local KC radio, they do it". The Met office and water authorities were also mentioned as a source for flood risk information, as well as the emergency services. Carson (Large - Transport, storage and comm. – West Hull) said "I'd like to think [I'd know who to ask], but whether it's right or anything I don't know. I mean the Environment Agency, Local Authorities and the Met Office I suppose are the key ones... It's more to do with the communication with you know, Gold Command and whatever it is in the police and the local authorities to make sure we can keep the services going and divert them... And Yorkshire Water, we have a fair number of dealings with them anyway over things like sewer replacements and what have you, so I mean we know the people to talk to."

Although these more reactive last-minute responses from the businesses above were surprising, the respondents still have an idea of how they would get information, with Carson in particular demonstrating a good knowledge of specific contacts and people he has had dealings with before. Reasons behind why some of the businesses appeared to be reactive as opposed to proactive in finding out information on flood risk may be explained by some of the perceptions of what issues a flood event would bring to them and how it would affect their business. Some of these reasons also tied into the concept of vulnerability as explored in Section 6.4 of the previous Chapter.

Leslie (Micro - Manufacturing, North East Lincs) explained "I think [in the event of a flood] we would feel helpless in those circumstances, I think most of the significant decisions would be taken by others. About all we could do, and it would depend you know if we were talking about an inch or two, then things like sandbags might be helpful in stopping water getting into the premises... but other than that I really don't think there's much we could do". Jackie (Micro - hair and beauty, West Hull) also painted a similar picture, saying "I would say that the only thing possibly that you could do as a property owner is to make sure that your damp courses are all secure... Sandbags don't work... even filling up your air bricks doesn't work... water's a very powerful source". As both Leslie and Jackie felt that there was very little which they could do to avert the damage caused by a flood event, they appeared to rely upon obtaining knowledge from the relevant sources at the time when the flood was in progress.

Interestingly, Carson (Large - Transport, storage and comm., West Hull) exhibited a very different view to both Leslie and Jackie. He said "Given the severity of those floods [2007 pluvial flooding]... I presume that all other things being equal that's not likely to happen again... The depot [itself] didn't flood, our problem was much more getting around on the roads". A possible explanation for Carson's reactive stance on finding out flood risk information could lie within the nature of everyday operations taking priority in the management of the business as highlighted in Section 7.1. Some of the respondents who had been proactive in their search for flood risk information had been so for specific reasons. For example, Morgan (Medium – Transport, storage and comm., West Hull) said "I've got an interest for myself to be honest. I found out things because of my interest rather than you know, my MD and the business wanting to know that". However, whilst the proactive and reactive nature of searching for information on flood risk may be an item which the Environment Agency may care to address as part of their information distribution,

the important observation is that the majority of the business representatives who were interviewed were aware of the Environment Agency's role in flood risk mitigation, and would actively search for information from them (in addition to information from other sources in some cases).

The interviews did reveal some exceptions to this observation however. Perhaps unsurprisingly, each of the representatives from the agriculture sector did not see the Environment Agency as an authoritative source for gaining flood risk information. In line with observations from both Chapter Five and Chapter Six, the farmers that were interviewed got information on flood risk knowledge through their local drainage boards.

The flood risk knowledge that the Environment Agency provides is based upon scientific research on climate change. This knowledge underpins the Humber Estuary Shoreline Management Plan which contains predicted flood recurrence levels and a strategic plan for the Humber estuary flood defence network over the next 25 years (Environment Agency 2008b). In contrast to the scientifically based climate change knowledge that the Environment Agency uses, the farmers' relied upon tacit knowledge gleaned from generations of farming that was shared through the drainage board network. Whilst the farmers were particularly vociferous in their disagreement with the processes and the methods that the Environment Agency were using in their areas to tackle flood risk, this was not simply because it reflected a different style in addressing flood risk mitigation compared to what had previously existed under the safety discourse (Lange and Garrelts, 2007), but more because they saw the underlying knowledge which the Environment Agency was using as being untrue. The biggest frustration that the farmers communicated to me was in relation to the way in which managed realignment was being carried out on the estuary.

Robin (Micro - Agriculture, North Lincs) explained: "Members of the Environment Agency with their representatives saying what they do say, I could weigh up in stupid! That works at Alkborough Flats... they're flooding it all the time. I thought they were flooding it at just these exceptional high tides, or when there's a surge coming down the Trent. Or spring tides, let it flood over certain parts of it into the area they've reserved for flooding. But what have they done? They flood it every bloody tide! What they do realise, but they don't particularly know, is [that] the amount of sediment in the Trent is enormous. So the sediments, they're suddenly finding themselves more. And you can see if you dig a new dyke, these little layers of tide sediments. There's miles of sediments coming down the Trent. So going over to Alkborough Flats every tide, in 20 years time it'll have lifted up the land level probably 3 or 4 or 5 foot, so there won't be any room for any flood waters. We've said time after time they shouldn't be flooding it every tide. Only flood it at exceptionally high tides, so you only get this silt deposit about 4 times of 5 times a year, but no, they don't listen." Both Chris (Micro - Agriculture, North Lincs) and Kelly (Micro - Agriculture, North Lincs) echoed Robin's concerns about the non-viability of the Environment Agency's managed realignment plans on the estuary due to silting. Kelly said: "The amount of water that they can get *in* at Alkborough is a lot reduced from what it was. And that's only going to get worse. So the benefit they may have had, it's disappearing very quickly". The farmers consistently emphasised the validity of the drainage board's knowledge over that of the Environment Agency. Chris said "They [drainage boards] understand the drainage. They know how it works, and they can make long term decisions... because they've got generations of history, not just the last 3 weeks, it goes back probably the best part of 70 or 80 years. Which you know, it's been handed down from one generation to the next". These observations are particularly interesting, as they reflect the same issues investigated by Wynne (1989; 1992a) in terms of knowledge conflicts between farmers and scientific experts when trying to manage the effects of radioactive fallout in sheep farming. As in

Wynne's (1989) sheep farming example, the Environment Agency's *scientific* knowledge can be seen to be culturally and practically incompatible with the values used in farming that incorporate managing flood risk as standard agricultural practice. Although the Alkborough Flats managed realignment site is geographically close to all three farmers who were interviewed, they were even more concerned about issues currently affecting the land which they farmed that were also attributed to the Environment Agency's lack of knowledge of sedimentation. Chris (Micro - Agriculture, North Lincs) said "The Environment Agency has now stopped doing the maintenance to their drainage systems, their drains, to the extent that they have to leave an area for environmental strengths or various wildlife. A drain is there to remove the water, to remove it from the property and the land and it's not doing the job it was designed to do". Chris's opinions were also reflected by Robin (Micro -Agriculture, North Lincs) who said "You make certain your own dykes are cleaned out regularly, so you get the water off your land. It's part of the farmer system that you maintain your dykes... They [Environment Agency] don't do it. This is what causes some of the floods."

The knowledge which farmers have gleaned through their experience related to the way in which they interact with the land on the Humber is seen allows them in this instance to "see problems, issues and solutions that experts miss" (Fiorino, 1990:227). As such the information provided by the Environment Agency is rejected by the farmers in favour of their tacit knowledge on flood risk mitigation held collectively by the drainage boards. What was most striking about the interviews conducted with the farmers was that although they did not trust the scientific knowledge that the Environment Agency had based their flood risk mitigation strategy upon, they did not disagree entirely with some of the methods the Environment Agency wanted to use, despite their unorthodoxy compared to traditional practices in the local area. Robin highlighted this by saying "Recently, the attitude has

changed. At one time they [farmers] wouldn't have accepted it [Managed Realignment] at all, would *not* have accepted it. By now, on the majority, they will to a certain extent if it's explained, and if you show it is necessary... I think it's more acceptable than what it would have been ten or twenty years ago".

The farmers gave the impression that the plans that the Environment Agency had, such as managed realignment, could well work if they took into consideration the tacit knowledge of the farmer-led drainage boards. Although scientific and lay knowledge, and the influence that such knowledges had on processes used to mitigate flooding, differed between the farmers and the Environment Agency it was less extreme than that demonstrated in Wynne's (1989) research. To quote an example from Wynne's research, when a government expert advised a hill farmer to de-contaminate his sheep by feeding them straw, the farmer reacted "I've never even heard of a sheep that would look at straw as fodder. When you hear things like that it makes your hair stand on end. You just wonder, what the hell are these blokes talking about?" (Wynne, 1989:34). In contrast the farmers who I interviewed appeared to see the Environment Agency as'misguided in their knowledge, but not totally incompetent and alien in their thinking, despite some of the frustration that the interviewees expressed. Whether the farmers' stance may change in the future remains to be seen however. Chris highlighted that despite the issues which they have with the Environment Agency's knowledge, the defences on the estuary were currently in an adequate condition. He said: "We know there's not going to be a problem in the short term, five years. They have to keep [looking] at the long term to avoid it as the sea levels rise. They have to start to deal with that matter". If the current defences are not maintained to the standards which the farmers expect, the relationship between the drainage boards and the Environment Agency could become more hostile, as opposed to the irritation which the Environment Agency currently appears to be regarded as by the drainage boards.

Out of all the interviewees, the farmers stood out as being the one group that would not turn to the Environment Agency for information on flood risk mitigation, instead relying on their own established tacit knowledge which was at odds with the Environment Agency. Although the farmers' substantial tacit knowledge can be seen to be the root of the lack of trust they place within the Environment Agency flood risk information, the rest of the interviewees displayed mixed levels of trust for a variety of reasons.

Most of the businesses confirmed that on the whole, the information provided by the Environment Agency did not stand at odds with their own local knowledge. However, even though it has been established that the Environment Agency was the primary source for flood risk information for all but four of the respondents interviewed, a complicated picture emerged with regards to the trust that was placed within this information.

Some of the businesses outside the agriculture sector appeared to hold a high level of trust in the knowledge of the Environment Agency and the information which they made available on the subject of flood risk, holding them in an expert capacity. For example, Ashley (Micro - Wholesale and retail, Hull River) stated: "You know, some of the times in fact, very rarely, just the odd little snippet I think 'nah' they might have got that wrong, but apart from that no, 99% of the time I follow their thinking 'cause they're the experts so they know what they're talking about".

The Environment Agency's professional status was also remarked upon by Morgan (Medium - Transport, storage and comm., West Hull) who said: "They're a government body, they get paid a lot of money... They're the same as the HSE (Health and Safety Executive), they've got a job to do... I can ring the Environment Agency and I can ask for information you know, confidentially, and get what I need, I believe". Sam (Medium - Transport, storage and

comm., North East Lincs) also reflected this, saying "I don't have a major issue I don't think. Whether we like or dislike their policies and views, I don't think they lie to us with information... I've never had nothing [sic] that I've received from them in the way of advice that I've looked at and thought that's rubbish". These responses echoed those from the general public that were uncovered in Harvatt *et al.*'s (2011) research, where the Environment Agency were seen as having a defined policy arena which was managed through their core functions.

The three respondents quoted above had not experienced negative effects of previous flooding at their business premises and did not have any previous tacit knowledge that was in conflict with the Environment Agency's information. Therefore the codified information provided by the Environment Agency appeared to be accepted by the business people in terms of its authority. However, I was surprised to find other businesses, that also had no previous tacit knowledge of flooding, that were less trusting of the information offered by the Environment Agency.

Carson (Large - Transport, storage and communication, West Hull) said "I suppose [we trust them] reasonably so, but I don't know that we perhaps look for enough information to really confirm that to be of trust or not. So you like to think your trusting... we don't have much dealing with the Environment Agency particularly". Although Carson was one of the interviewees who had a more reactive approach to finding out information on flood risk, he still appeared hesitant to fully trust a body which he hadn't had extensive dealings with. This was unexpected as previous research has indicated that trust within agencies charged with delivering information is primarily seen to be built upon shared values (Yearley, 1999; Poortinga and Pidgeon, 2003; Masuda and Garvin, 2006). This may be a point which the Environment Agency needs to address in the information which they provide, for example,

by explicitly outlining the values and primary aims of the agency. Recent publications by the Environment Agency typically have a full page spread at the front outlining the agency's values and their key aims (Environment Agency, 2008b, 2010). Although this feature was not present in similar information distributed before 2008, these objectives are typically more publicly than industrially focused. Addressing this issue may help to overcome the initial lack of trust that a business may attribute to an organisation which it has not dealt with beforehand.

Another unexpected finding from the interviews was that some businesses did not trust the data due to the frequency with which it changed, as touched upon in the previous section. Sidney (Micro - Construction, North East Lincs) said "We *do* find that there's no consistency with it all. You know. Little bits come and as soon as they've got another piece of information, it changes overnight...There's a lot of conflicting information. It's not an exact science". Sidney stated that he relied upon the Environment Agency for information in order to carry out his business operations, due to the influence which they have over planning permission. However, he remarked "it's beyond the realms of us, and sort of your average man to understand flood assessments anymore.... you know information comes in all the time". From his comments, Sidney feels overwhelmed by the frequency at which the Environment Agency updates its flood risk information.

Mandeep (Small - Wholesale and retail, North Lincs) also expressed a similar opinion, even though his business does not deal with any aspects of planning or regulations related to flood risk in its daily operations. He said "That kind of information changes every day because of the circumstances. You know the environment is changing and the climate is changing. So they are useful to some degree. But they're probably only good today. You don't know how good they are tomorrow". However, when asked whether he felt like his

local knowledge of the area differs to that of the Environment Agency, Mandeep replied "I'm sure, because obviously it will be. Their knowledge would be more extensive than mine".

These findings were particularly unusual as they didn't appear to fit in with the existing academic literature that I reviewed on the subject of risk. Neither Mandeep nor Sidney appear to have a wholesale mistrust in the Environment Agency from a conflict of the agency's knowledge with their own (Wynne, 1989; Yearley, 1999; Burgess et al., 2000), nor do they mistrust the Environment Agency in terms of their values or via social amplification of risk caused by the previous mismanagement of other environmental issues (Kasperson, 1992; Freudenberg, 2003; Poortinga and Pidgeon, 2003). In both cases, Sidney and Mandeep acknowledge the uncertainty of the scientific information upon which the Environment Agency constructs its knowledge. Although the Environment Agency cannot alter the data that it receives on the science of climate change, it may have to look at filtering information more selectively to avoid confusing businesses which rely on the agency as a source for flood risk information. As Poortinga and Pidgeon (2003:962) suggest, people "tend to trust people or organisations that are consistent". Even though the evidence from the interviews shows that in circumstances such as this, the Environment Agency is not *directly* mistrusted, the sheer flux in information needs to be addressed to prevent businesses from becoming overcome and confused by the data. In such circumstances where businesses are overwhelmed, or cannot make sense of the data they are being provided with, participation in the governance process is likely to be affected through a knowledge communication breakdown whereby the constantly changing nature of information generates a perception that there is no benefit to collaborating (Martin and Foley, 2000).

Another issue related to consistency also arose in terms of the staff that businesses dealt with within the Environment Agency. Tony (Large - Manufacturing, North Lincs) said "Because we're low risk if you compare us to say Corus, we seem to get a new environmental officer every year. And it's more about teaching that individual about the business and how the Environment Agency runs and how we have to abide by criteria. That's how it comes across". Although Tony still stated that he trusts the information that the Environment Agency are giving, the organisation is not remaining consistent within its dealings with his company. As such, there is a possibility that the trust Tony attaches to the Environment Agency may be eroded if such inconsistency continues (Poortinga and Pidgeon, 2003). However, an unintended side effect of the constant changes in the environmental officers assigned to Tony's company have led him to conclude that he is a lower risk than other companies in the vicinity. Whilst this is not an issue directly related to trust, the way in which the Environment Agency has engaged with the company in this instance is doing little to support their mantra that that flood risk is of growing importance!

Although Tony appeared to trust all the environmental officers who liaised with his company, other business people only appeared to trust information when it came from specific members of the Environment Agency. Pat (Micro - Construction, Hull River) said "What we tend to find is that the older people there, there's a guy at the Environment Agency who's based in Willerby who's always dealt with this [flood risk]. And he's a guy who's been around for years, and you can talk to him about it, and you can reason with him. I think there's a lot of younger people, no disrespect to you, I think a lot of the people come into the Environment Agency who just work by the book and don't want to reason".

This is a particularly salient point for the Environment Agency. Although it is still seen as a monolithic source for flood risk knowledge, these examples have shown there to be

potential issues with the way in which the Environment Agency transfers information to the businesses it has been involved with. Due to the current lack of legislation, only companies with specific high hazard operations or those trying to negotiate PPS25 issues had experienced direct communication with specific members of the Agency as above. However, should a greater number of businesses be required to interface directly with an Environment Agency representative, a lack of consistency in information provision could well undermine the position of the Environment Agency as a trusted and competent body charged with flood risk mitigation, subsequently causing significant problems in maintaining an effective flood mitigation scheme through a governance framework (Simmons and Walker, 1999; Yearley, 1999, Freudenberg, 2003).

There was little to differentiate any feelings of trust based on the location of the interview clusters alone, apart from that of the Hull River cluster. Within the Hull River cluster there were two businesses which due to the geographical location of their premises which bordered the river bank, had been privy to involvement in previous flood risk mitigation plans. The River Hull currently has its own strategic management plan entitled 'The River Hull Flood Risk Management Strategy'. However, this plan only addresses fluvial flooding, and does not cover the mitigation of risk for tidal flooding along the river, which comes under the related Humber Estuary Shoreline Management Plan (Environment Agency, 2010). Both Ceri (Micro - Manufacturing, Hull River) and Sandy (Small - Manufacturing, Hull River) were particularly distrustful of the Environment Agency and the local council due to the way in which they perceived the two organisations to have treated property owners unequally along the River Hull.

Since the 1990s, there has been a substantial change in the land use around the River Hull corridor. Many of the older businesses that traditionally had ties to the River have now left.

During the interview, Ceri looked at his map and pointed out "So on the whole length of the river, actually now there is [counting] 1,2,3,4,5,6,7, *seven* people on the entire length of the river, both banks, who actually use the river". Sandy made similar comments saying "When we first moved here, there was [sic] quite a lot of coasters [that] used to come up the river going to Rix's, IBL, them kind of people. We hardly ever see one now... it could be maybe three, four weeks ago I heard one go by. Otherwise next to nothing".

Both Ceri and Sandy blame the change in land use on the river banks as having an impact upon the flood management of the area, as newer property owners no longer have a direct connection with the river. As stipulated in the current version of the River Hull Flood Risk Management Strategy, notice may be served by Hull City Council on the owners of land adjoining the river Hull "requiring them to carry out works to prevent the overflow of the River Hull" (Environment Agency, 2010:18).

Both Ceri and Sandy have had to carry out maintenance on the river wharf walls on their premises over the years. However, they have seen the wharf wall on neighbouring vacant premises fall into a state of disrepair. Sandy said "When we first moved onto the site the track of the river was pretty much down the centre of the river... [but] whoever owns the building on the other side of the river, their wharf wall's collapsed. So the main deep track of the river has moved right to our side of the river... we've got tidal water running along our wharf wall and eventually it will erode that wharf wall... We've had Hull City Council down, we've had the Environment [Agency] down, we've had the harbour master down. We've given up on it, 'cause nobody seems to have any interest whatsoever in making the people on the other side of the river put that wharf right... I remember one meeting we had our insurance guy here, the guy from the Environment Agency was here and a guy from the Council. And there was almost, well, there was certainly a heated argument about it. And so I said 'Well which one of you is going to make him [the owner opposite] put it right then?' 'Ah well, you know, all we can advise you is you must look after your own wall'... It's all somebody else's issue. At one time it was 'We don't know who the building owner is', and I said 'Well, at the end of the day that's a load of rubbish 'cause you just go to the land registry and you find out who owns the building'. We understand it [the property opposite Sandy's] is owned by one of the big property companies that just lets it out to whoever's occupying it, so it's nothing to do with the occupants. I guess the impression that's given is that it might be hard work to actually get them to put it right".

Sandy felt incredibly frustrated through his previous dealings with the Environment Agency and Hull City Council, particularly as he could not get either party to tell him who was responsible for an issue that directly affected the wharf wall which acts as a flood defence to his premises. Ceri reflected similar concerns, saying "The River Hull is prevented from flooding by local land owners. There is an onus on us to keep them to a particular height, but the Environment Agency come round every, oh, three or four months just to check... they walk the banks. But that it's my responsibility is crazy. You know there's [sic] all sorts of places up and down the river where the banks have collapsed, and the Environment Agency and Hull [City Council] have the right to go and repair your land if you don't do anything about it and charge you for it. I might be wrong, but I can't recall either the Environment Agency or the City Council going to somebody and saying 'you will do that'. I just don't think they've done it anywhere... My biggest beef with the Environment Agency is that there is nobody to make a decision. It's always someone else's department... It goes in one ear and straight out the other!"

Whilst previous mistrust of the Environment Agency examined within this Section dealt with issues directly related to the knowledge that the Environment Agency provided, Sandy and

Ceri's situation highlighted a slightly different situation. Interestingly, although both interviewees still identified the Environment Agency as a source for flood risk information, they exhibited a lack of confidence in the Environment Agency, and Hull City Council, to carry out their duties as a result of continuous negative experiences (Williams *et al.*, 2009) relating to river wharf wall maintenance over the last decade. Even though the interviewees may not have reason to mistrust the Environment Agency specifically through the flood risk knowledge which they are providing to businesses, neither Sandy nor Ceri are likely to involve themselves within a flood risk governance process due to the lack of trust they have in the Environment Agency, and Hull City Council, to carry out their responsibilities (Martin and Foley, 2000).

In such cases, Richardson (2003) highlights that trust can be incredibly difficult to reestablish, as strong negative perceptions of organisations are particularly difficult to overcome. However, there was no evidence to suggest that the negative experiences with the Environment Agency, and indeed Hull City Council, had spread via a process of "risk amplification" (Freudenberg, 2001; Masuda and Garvin, 2006) to the other business people in the Hull River interview cluster who had very different views to those of Sandy and Ceri regarding the effectiveness of the Environment Agency. This may be because the other business representatives did not have premises which directly bordered the River Hull and as such they were not involved within previous consultation on management strategies for the River Hull. However, without additional data collection within this specific area, any possible reasons can only be viewed as speculative.

What is apparent however is that whilst the majority of businesses turn to the Environment Agency for information on flood risk mitigation, the trust and the relevance of the knowledge upon which this information is constructed, and in the way in which the

Environment Agency relays it, appears to vary considerably between businesses. As such, the dominance of low flood risk perceptions amongst businesses related to all types of flooding throughout the Humber study region combined with issues of trust regarding both flood risk knowledge, and also organisational competence, may have serious consequences for the flood risk governance process. This is explored further in the next section of this chapter.

7.4 Businesses and the concept of governance

In order for an individual or organisation to involve itself within any form of governance, there has to be a relevant level of concern over an issue which acts as a trigger to encourage participation (Painter, 1997, Reed, 2008). The analysis of the data collected so far has shown varying levels of concern attached to both business perceptions and understandings of flood risk and also to the importance of economic development in terms of business operations. The way in which these balance out within a governance framework looking to achieve flood risk mitigation on the Humber through the doctrine of sustainable development therefore needs to be examined more closely.

Even though an understanding of business perceptions of flood risk and the context within which they are formulated has been gained throughout the data analysis so far, a fundamental question has not yet been addressed which will determine the way in which the various actors within governance are viewed by business people. This question is who do businesses see as being responsible for flood risk?

Despite the overall low flood risk perceptions exhibited by businesses around the estuary, a general consensus emerged from the interviews that businesses are partly responsible for protecting their own sites in terms of general housekeeping, but that there is also a

responsibility for ensuring that appropriate action is undertaken by both the Environment Agency and the Local Authorities in terms of maintaining defences and drainage systems.

Ashley (Micro - Wholesale and retail, Hull River) stated "We have to be responsible for a lot of things in life. You know, we've got the litigation world. Well to hell with it, if I trip over a kerb it's my fault for not picking me [sic] bloody feet up... Here [at the site] we make sure that the drains are kept clean all the time [in the yard]". Morgan (Medium - Transport, storage and comm., West Hull) reflected a similar opinion, stating "I believe businesses have got their own responsibility as much as what the government agencies have got responsibility as well... you've got to have your measures, you've got to ensure your drains are clean, you've got to insure the site. The way [our] sites are maintained are good". Despite the problems he had previously experienced with the Environment Agency, Sandy (Micro - Manufacturing, River Hull) also acknowledged the role which he had to play in mitigating flood risk at a site level. He said: "The top of our wharf wall had a small gap in it. We had finished up getting a letter [from the Environment Agency] telling us that if we didn't make it right within 14 days then they would take action against us. We made it right. We needed to for our own self interest!"

Mandeep (Small - Wholesale and retail, North Lincs) also illustrated the responsibility that his business took in terms of their warehouse procedure. He said "Most of the stuff is on pallets. So that protects it anyway. It's raised off the floor which is what the insurance company wants to see. Though if a big flood happened it would all be wrecked anyway... if the banks burst next to the Trent it'd be like, Jesus, the whole town would flood!"

Although businesses showed a willingness to take personal responsibility for issues related to their site which were within their control, they also expected responsibility for the

coordination of defences protecting wider areas to be carried out by the local authorities and the Environment Agency. As Tony (Large - Manufacturing, North East Lincs) highlighted "Like anything, we've got some responsibility for mitigating the risk of flood to our business. However, if there's activities [sic] taking place within the area that's going to change the way of the land and the landscape and potentially increase flood risk, then that's not a responsibility of ours. You know we as a business, we pay significant rates and taxes with the understanding that we'll be protected as much as we can by our local authority". Sam (Medium - Transport, storage and comm., North East Lincs) also voiced a similar attitude to Tony in terms of the service which they expect in terms of flood protection. He said: "We have to pay a fortune in business rates... so we have to trust that they're doing the best for the area in total".

Despite raising the issue of the amount of money that was paid in business rates, there was also evidence to suggest that businesses had an understanding of the limited resources government agencies had available to deal with the local and regional priorities, including that of economic development. Morgan (Medium, Transport, storage and comm., West Hull) said: "I think they've got a difficult job. You know, it's so diverse and wide ranging. You're throwing money at a bottomless pit. So, and I know, I won't say all of the enforcement policies in the council spend their money wisely, but I I'm sure everything that they spend it on is closely looked at due to the current economic climate". Sidney (Micro -Construction, North East Lincs) voiced a similar opinion saying "if they could sort out the defences then you know, we wouldn't have this problem, but there's not an endless supply of money anywhere is there". Leslie (Micro - manufacturing, North East Lincs) also acknowledged the political implications that are involved, as well as financial resources, when trying to resolve such issues. He said: "You know, the whole business of development or defending the land around here is a bigger issue... It is one of the big dilemmas of

democracy that big and potentially catastrophic issues cannot be dealt with by elected officials because to propose solutions which may be realistic or appropriate would not be consistent with them retaining their political positions".

The farmers stood out amongst the other businesses again though, and were particularly critical of the lack of money that was spent on flood defence under the current Environment Agency shoreline management plan. However, there was also an understanding of the reasoning behind why this change had occurred. Chris explained "Over hundreds of years, the government and the councils have given grant aid to various authorities, whether they're rivers authorities or coastal defence authorities, to maintain the flood defence barriers. There seems to be an attitude that they can't afford to do it now".

Robin (Micro - Agriculture, North Lincs) added: "The Environment Agency person said 'what you've got to understand is that maintaining the environment is under legislation and land drainage is not'... they could if they wanted to, go into an area and say 'right we're going to do this that and the other to create some habitat' but, they wouldn't do that I don't think.

Although some of the opinions that businesses have on flood risk, especially those from the agriculture sector, are at odds with current Environment Agency practice, there is an acknowledgement that there are not endless resources with which to address issues such as flood risk mitigation. There is also a realisation that the Environment Agency and their local authority partners may face limitations in the action which they can take due to supranational legislation in the form of EU directives. In this sense, some of the businesses appeared to demonstrate a particularly pragmatic understanding of the wider issues involved in flood risk mitigation and the responsibilities that were involved from multiple parties.

However, a smaller number of business respondents did appear to have more rigid expectations of the organisations charged with the responsibility of mitigating flood risk in the region. Drew (Micro - Wholesale and retail, West Hull) stated: "In my opinion they've not done a lot to solve the problem. You see an odd drain cleaner out now which you didn't see before, so that's going to help. But it's an old [drainage] system and it needs money spending on it. They could certainly do a lot more to make the problem better, 'cause it's going to happen again...it's alright having policies, but it's having action as well isn't it... so the policies aren't working for me personally". Ceri (Micro – Manufacturing, River Hull) also thought that the responsibility should rely more heavily upon official authorities as he said: "Hull is prevented by flooding by local landowners. Nothing at all to do with the Environment Agency. The owners of the properties along the [River Hull] riverbank, they're the people who are supposed to keep them [wharf walls] up... and the onus is on us to keep 'em to a particular height. The bottom of the dry dock there if I had the gates open, it's three foot higher than the road out here. Now if that failed, it won't because it's all solid concrete, but if that failed the water would be fantastic all around it. But it's my responsibility and that it's crazy!"

Although the respondents' opinions showed mixed feelings on responsibilities, most of the attitudes held by the businesses are particularly encouraging with regards to using governance as a process with which to manage flood risk mitigation around the Humber. The majority of businesses acknowledge that they are responsible for some aspects of flood risk mitigation, although they also acknowledge that the Environment Agency and the local authorities have responsibilities in terms of managing flood risk in the wider area outside their specific premises. The most important factor is that most businesses appeared able to identify the different areas of responsibility within flood risk mitigation, meaning that communication between businesses and either the local authority or the Environment

Agency are required, setting the scene for a potential collaboration (Raco, 2000; Larsen and Gunnarsson-Ostling, 2009).

An encouraging finding related to the potential collaboration process was that businesses in the region did not all appear to have unrealistic expectations of what the Environment Agency, and its partner local authorities, could achieve. Although interviewees such as Drew and Ceri expressed high and rigid expectations of what action the Environment Agency and the local authority should be taking to tackle flood risk in their respective areas, other businesses understood the limitations facing statutory organisations in terms of balancing multiple objectives with limited resources. Whilst there was no evidence to suggest that these interviewees were necessarily happy with this particular reality, business people did appear to accept the state of play. Such realistic attitudes are seen by Brown and Damery (2002) as being advantageous in terms of establishing a functional relationship between the Environment Agency and businesses, as disappointments are less likely to occur in terms of what the Environment Agency can actually achieve helping it to remain credible as a coordinator of governance.

Previous research conducted within the field of public risk perception found that trust is attributed to the responsible institution on the basis of its perceived competence in carrying out its duty of care to society (Freudenberg, 1993; Johnson, 1999; Bickerstaff *et al.*, 2008). Under reflexive modernity, where flood protection can no longer be guaranteed, the Environment Agency's performance may generate "disappointments when floods continue to occur" due to the public's unrealistically high expectations of what the Environment Agency can achieve in protection against flooding (Brown and Damery, 2002:423). This is not to say that businesses will not mind if they are flooded, or that they will not attribute any blame to the Environment Agency if a large flood event should occur. However,

evidence from the interviews suggests that some of the businesses do recognise the limited public funding and the wide ranging portfolio of responsibilities which must all be balanced by the Environment Agency and the local authorities in the flood risk mitigation process. In this sense, the disillusionment with what can be achieved through working with government agencies and other actors within a flood risk mitigation effort is less likely to handicap overall business participation in the governance model (Reed, 2008; Foxon *et al.*, 2009). However, the Environment Agency should not be complacent in their position as a result of this finding. Flood mitigation schemes require careful management to avoid the distrust that can occur as demonstrated in Section 6.3 by the example of the Environment Agency and Hull City Council's mismanagement of the earlier River Hull schemes.

On the whole, responses from businesses indicate that shared responsibility for flood risk mitigation between businesses and local statutory government bodies would be conducive in facilitating flood risk mitigation through a process of governance. However, the Environment Agency CASE partner (Andrew Barron) reported that the Environment Agency had particular difficulty in getting businesses involved in their consultations. By contrast, he reported that there had been a very strong involvement within flood risk mitigation consultations from local voluntary sector groups involved in wildlife conservation.

Interestingly, the strength of the voluntary sector's conservation lobby was remarked upon by interviewees from the agricultural sector. Chris (Micro - Agriculture, North Lincs) said "The environmentalists have a very strong lobby. And because we [farmers] are subsidised through taxes, the taxpayer has a chance to explain what they want. And the environmentalists and the RSPB are fairly high up on that list. And they do lobby very well. I have no difficulty with that. And it's tax payers' money, so fine, that's what they have to do... but the writing's on the wall. Carry on with the same RSPB and the environmental

people... they'll do it, the food price is going up and up way above inflation because there's less land to produce the food from... the more the tree huggers of this world get involved in doing all the things like that, the worse the situation is going to get". Kelly (Micro -Agriculture, North Lincs) also commented upon the strength of the environmental lobby saying "It's been the case for quite a while now. I can't really tell you how long, but yeah, the environmental people seem to have, you know, a huge say in what's going on".

The farmers saw the environmental lobby as being stronger in their influence than the local drainage boards which represent the farmers' views in consultations with the Environment Agency on drainage and flood risk schemes in North LincoInshire, particularly due to the legislation governing what the Environment Agency were able to do in terms of balancing flood defence construction with conservation under the EU Habitats Directive (1992). In their frustration at the power of the environmental lobby within the governance process, both Chris and Robin had contacted a government minister through the drainage board. Chris explains: "Well, I'm not sat here twiddling my thumbs. I've invited the shadow minister of agriculture to come and look at the situation. And he's now minister of agriculture, a junior minister. His name is James Paice and he has been into this area and looked at it with other interested bodies. He's taken it back to the Conservative Party and they are looking at all the issues".

Although the farmers appeared to feel like the governance process was stacked against them because of the strength of the environmental lobby and the conservation legislation which the Environment Agency had to abide by, that did not stop the farmers (represented as a group through the drainage board) from pursuing further action to try and fight for changes which they thought were important in terms of ensuring their own economic security through flood risk mitigation policy. The findings from Chapter Five demonstrated

that risk perceptions from respondents within the agriculture sector were higher than those in other industrial sectors, primarily because of the geographically embedded knowledge that was intertwined within their business operations. They also differed from other businesses in terms of the role that drainage boards played, acting as a hub for storing and distributing tacit knowledge amongst local farmers that had been gained throughout the history of farming the land within the area. However, structures similar to drainage boards, which united businesses and represented knowledge relating to flood risk mitigation, had not been identified amongst the other industries included within my research outside the agriculture sector.

Nevertheless, this is not to suggest that non-agricultural businesses act alone in the absence of networks through which knowledge is shared. The interviews revealed a wide variety of different networks and contacts which companies used in their daily business operations, some formal and others more informal. Membership to the more formal business partnerships and forums, such as the regional Hull and Humber Chamber of Commerce, appeared to be limited to larger companies, although Pat and Mandeep represented two smaller companies that had such membership.

Interestingly, the subject of flood risk did not appear to have featured particularly highly within meetings and the information that respondents received from the various business partnerships and forums. Mandeep (Small - Wholesale and retail, North Lincs) recalled an occasion when flood risk had been discussed, saying: "I think a few years ago, yes. There was some sort of seminar organised by the local Chamber of Commerce. In fact, I think I only once attended [sic] but that's a few years ago now." Likewise, Tony (Large - Manufacturing, North Lincs) recalled flood risk coming up in a meeting, but amongst a raft of other issues, as he said: "I'm one of the founding members of the Greater Economic

Success Group and it was basically a cohort of local businesses who got together to discuss issues such as employment, recruitment, environmental etcetera etcetera. That had now been superseded by the Economic Development Board, and we discussed things like the Humber Bank and the amount that's going on there".

Whilst there was some evidence of flood risk issues having been raised at business partnerships and forums, the organisations appeared to deal predominantly with economic issues. Pat explained: "I'm a director of a thing called HEP which is the Humber Economic Partnership. The idea [of it] is to bring all the local authorities and the private sector together in an organisation to promote economic development and other things. I mean we look at housing, and transport and training. As that's where it really starts, saying, you know, we start with the economic well-being of the sub-region and then work backwards from there... It's a recognition that it's economic development that is a primary driver and these things are secondary". Alex (Medium - Manufacturing, North East Lincolnshire) also told a similar story: "I'm the chairman for Humber Chemical Focus and it's [flood risk] not really [come up] compared to the other topics running for investment in the region. Things like, round the corner, there is the Centre for Apprentice Training and Competency Assessment and the continued expansion of that is our hot topic of conversation at the moment. Impact on flood risk, no not really, each individual operator seems to do its own thing on that". The industries that Alex is talking about here are large chemical industries located on the bank of the Humber which are regulated under COMAH legislation (HSE, 1999). However, Alex is particularly aware of the economic impact that PPS25 (CLG, 2006) may have on the industries within his business partnership, although he has not encountered any problems amongst his members as of yet. He said "Planning Policy Statement 25 could make the difference for some companies staying in business and not or

going and relocating their facilities or potentially closing down completely. Many of the established industries here are not hugely profitable".

This is not because the petrochemical companies Alex is talking about are small and lack adequate resources to recover from a flood event, but because it simply may be uneconomic for the companies to adapt existing facilities to comply with new legislation aimed at flood prevention, prompting them to move elsewhere. However, when asked if he thought the relevant authorities would listen to companies if they had any specific issues with plans being put in place to deal with flood risk mitigation, such as PPS25, he said: "Probably not in isolation. If we actually got the full weight of Humber Chemical Focus, that's a partnership of 108 companies, if it was found to be an issue of common concern, then that'd be how I'd choose to make our voice known".

As demonstrated in the interview quotations above, the interviewees revealed an array of different business forums, some of which represented specific business sectors or specific local areas, within the Humber estuary study area. Although flood risk had been discussed amongst members within some of these groups, economic issues related to development within the region appeared to overshadow these, supporting the analysis within Section 7.1. Unlike the drainage boards representing the agriculture sector, the interviewees gave no indication that the business forums representing other industrial sectors had run into any issues (so far) where economic objectives were being affected by the current flood risk mitigation plans overseen by the Environment Agency.

Interestingly, despite the low profile of flood risk amongst the other issues that were discussed within the business forums, Sam (Medium - Transport, storage and comm., North East Lincs) did comment upon the sharing of such flood risk knowledge within the

association he belonged to. Whilst previous academic research has suggested that businesses are unlikely to share tacit knowledge between each other due to the nature of competition between firms (Szulanski, 1996; Dhanaraj *et al.*, 2004; Jasimuddin *et al.*, 2005), Sam made an important distinction between types of knowledge that would be acceptable to share between businesses. He said: "I mean, we're a member of the chamber of commerce. The same circle of people move about, it's a relatively small community that we're trading in, working in. So everybody knows everybody. So I think, on these kind of issues if people have got information they do tend to share it. Especially if it's of a noncommercial nature, there's no problem with that".

This suggests that there is the *potential* to share flood risk knowledge amongst different businesses in the same way as the drainage boards have done. However, for the business forums representing those companies outside the agricultural sector, the combination of low levels of tacit flood knowledge (as discussed in Chapter Five), the dominance of economic concerns over flood risk concerns and the seeming lack of any conflict thus far between economic and environmental policy in the Humber region (for example, the Green Port development) mean that sharing of flood risk knowledge is not currently a notable feature of business forums and organisations. Again, the work of Lange and Garrelts (2007) can be applied to this situation. Whereas the farmers have experienced a reality testin the form of a breakdown in the status quo between economic and environmental objectives related to farming their lands, other industry sectors appear still to be awaiting such a reality test, as the only environmental legislation relevant to flooding (PPS25) has so far been demonstrated to have been relatively impotent in terms of restricting developments around the Humber Estuary. Most notably the economically critical Green Port Hull development, which could have broken the status quo of economic development overriding environmental concerns, bypassed PPS25 and EU Habitat Directive legislation via the

Secretary of State, providing a missed opportunity to catapult the issue of flood risk onto business forum agendas. However, should such a reality testarrive in the future, there is evidence to show that business forums have the capacity to act in a similar way to the agricultural drainage boards, in lobbying for the balancing of business interests with environmental policy and also as a conduit for sharing flood risk knowledge.

Although some of the businesses that were interviewed belonged to formal associations such as those outlined above, others demonstrated their involvement within less formal networks that also appeared open to sharing flood risk knowledge. Morgan (Medium - Transport, storage and comm., West Hull) was one such example. When questioned on whether he thought policy makers would listen to him and value his opinion as a business he said: "We're part of the [Censored] International Group, which is a massive worldwide group. So we have a little, I'll just say we have a little bit more sway than most. Plus we know the Smales family, and you know, we know local businesses that have a lot of sway with the council. So because it [flood risk] would impact on us all, I imagine we would do it as a joint venture rather than, you know, one person banging their drum". Again, Morgan demonstrates the dormant networks (informal in this case) that businesses have access to which *could* be used to foster greater involvement of the private sector within flood risk governance. However, whilst some businesses appeared to have good contact networks irrespective of whether they belonged to an official business forum, others appeared more insular.

Smaller businesses in particular stood out as having a more limited network of contacts. Ashley (Micro - Wholesale and retail, Hull River) described what he would do if he had concerns over flood risk policy affecting his business: "What I'd probably do more than anything else is I would contact the local councillor, if necessary my local MP, and I would

ask them who to contact. I'm not frightened of asking who to ask you know so I would find out eventually the right people to get in touch with". Jackie (Micro, Hair and beauty, West Hull) demonstrated a similar approach: "I'd go to the local councillor and get him involved, or her involved and coax them from there. I've had dealings with them before and I've got them involved about the parking. They do listen, and they were very good".

Both Ashley and Jackie run what Needle (2004:232) describes as lifestyle firms. In such instances, the person running the company does so as an alternative to working for someone else, with the primary objective of the business being to maintain an adequate level of income with little consideration for planning or future diversification of the business through dynamic growth. In such cases, the first point of contact for lifestyle business people appeared to be visible sources of local government, as opposed to other businesses in the area. This may well reflect the personal emphasis on how such lifestyle firms are run, with a greater reliance upon standard access points to governance that are used by the general public as opposed to those organisations and forums representing issues specific to businesses.

Despite the data suggesting that such lifestyle rely upon communicating their concerns through local government representatives, there was also evidence to suggest that some owners would be willing to collaborate with other local businesses, albeit with an input from a recognised authority. Leslie illustrated this by saying: "I don't think that any incident is going to apply specifically to this building cause you know at the very least we've got two immediate neighbours that are connected to us. People across the road and so forth. So I don't think it's going to be any situation that would obviously require me just to look after our own particular interests. That wouldn't mean that I wouldn't be interested in

contributing to something that is of a broader application, but I think I would need advice and guidance on what it is that we could do that would be useful and sensible".

This call for advice and guidance was also echoed by other businesses. Ashley (Micro -Wholesale and retail, River Hull) said he would appreciate such guidance in the form of "Better information, mail shots, letters to people telling us who they are what they're doing. If we're in a serious flood area, suggestions. Keep sandbags and we can supply the bags at 'X' amount of money you know bits and pieces like that". Mandeep (Small, Wholesale and retail, North Lincs) also emphasised receiving information over other forms of more personal or interactive communication. He said "I think the best [type of information] would be some sort of publication every so often rather than meetings. Because meetings are good, but publications are probably more likely to be read when you know and by more people than just one". However, considering the way in which some of the information that the Environment Agency had distributed to businesses had previously been interpreted, as discussed in Chapter Six, such a process may do more harm to fostering governance amongst lifestyle firms than enhancing it. Irwin (1995:87) also sees the distribution of information in this manner as fostering a "model of informing rather than empowering". This is likely to further damage efforts to establish a governance process, the objectives of which Healey (1999a:113) states are to incite a "dynamic of a 'public conversation' whereby all affected parties have a voice and are listened to".

However, for the Environment Agency to contribute effectively in such a public conversation, some of the issues highlighted in the previous section need to be addressed such as the consistency of information. Thus, the limited dialogue which the Environment Agency has so far had with businesses may well prove advantageous in the long term, helping to avoid the pitfalls of mistrust which could hamper the Environment Agency as an

effective coordinator of the flood risk governance process (Healey, 1999a; Yearley, 1999). However, the wider issue still remains of how to motivate businesses to get involved in participating in flood risk governance when the issue does not feature amongst their dominant concerns and reality tests (Lange and Garrelts, 2007) have so far not arisen.

Overall, the businesses within the Humber estuary study area appear to be well networked (both formally and informally) and there is evidence to suggest that business people would consider sharing knowledge on flood risk amongst such networks should the need arise. Whilst the possibility of collaboration between businesses and statutory agencies appears likely, with businesses demonstrating an understanding of shared responsibilities on flood risk issues, there has been no shock event whereby flood risk issues have challenged the primary concern of continued economic activity and the wider economic development within the area. As such, these networks currently appear to remain dormant in terms of a conduit for flood risk mitigation, and will likely remain so until the current status quo is broken and flood risk issues challenge the everyday practices and economic concerns of the businesses in the region. If activated, the range of forums and more informal networks that have been uncovered in the interviews would likely be able to lever considerable political pressure that may indeed surpass that of the strong environmental lobby as described by the farmers, especially considering the increased involvement that the Humber local authorities now have in the Humber LEP which replaced the Yorkshire Forward RDA (Jones et al., 2002; Raco, 2000; Bailey et al., 2010). With an emphasis on the Humber region catching up with the other areas of the UK in terms of economic development (Yorkshire Forward, 2006), acute political pressure is likely to be put on the Environment Agency in its role as a governance coordinator from businesses lobbying to ensure that continued economic development is not scuppered by flood risk plans.
The Humber LEP is also likely to be able to better accommodate lifestyle businesses (Needle, 2004) within the governance process than its Yorkshire Forward predecessor. As such businesses were found to rely upon universally visible access to local government to communicate their concerns, the greater integration of local authorities within the LEP is likely to help in terms of representing such businesses which do not have the same involvement in local business networks as their non-lifestyle counterparts. However, for all the potential that has been uncovered in terms of businesses being able to work effectively within a framework of flood risk mitigation through governance, the fundamental issue remains that flood risk has is not prominent enough on business radars to trigger such action.

7.5 Summary

Findings within this Chapter have offered an explanation as to why, despite increases in flood risk perception over time, businesses still harbour low risk perceptions of flood events. Businesses which engaged in operations that were governed by specific legislation were found to have a better understanding of risk due to compliance procedures which they had to undertake, supporting previous research by Petts *et al.* (2009). However, this observation did not extend to all risks covered by regulations. Even though all business premises must comply with fire regulations (CLG, 2006a), if such risks did not feature as part of the daily business operations, they were seen to fade into the background as business people became preoccupied with addressing short term concerns (Zhang *et al.*, 2009). Even though fire regulations have evolved to create safer workplaces over the years, the introduction of similar legislation to boost the status of flood risk amongst businesses is unlikely to help raise risk perceptions, as findings suggest that businesses that are not dealing with flood risk as part of their daily operations are likely to satisfy the mandatory criteria and then think of the risk as being normalised (Freudenberg, 2007; Lange and Garrelts, 2007).

Economic issues dominated the concerns of the businesses that were interviewed, with the health of the local and regional economy and the state of the infrastructure linking the Humber to other regions of the UK being highlighted as particularly critical. This supported previous research suggesting that that businesses, particularly SMEs, are inclined to focus on the short term economic objectives of their businesses and are unlikely to be receptive to long term planning issues as required by flood risk mitigation (Foster, 1993; Zhang *et al.*, 2009). There is currently only one piece of legislation in place in the form of PPS25 that could effectively force businesses to consider flood risk if they were to relocate to an alternative site. However, PPS25 has been shown to be impotent in its objectives, as it still allows low risk developments in flood plains (Bosher *et al.*, 2009), allowing businesses to place themselves at risk of being flooded through the pursuit economic goals associated with clientele living within such areas (Crichton, 2008).

Despite the disadvantages outlined above, the preoccupation with the economic state of the Humber region could actually be instrumental in catapulting flood risk onto the business agenda. Major economic developments such as the Green Port Hull scheme are seen by Humber stakeholders are being critical to the future economic health of the region (Hull Daily Mail, 17.03.2011). However, objections from English Nature and the Environment Agency to the project were withdrawn, scuppering the potential for a debate in terms of reconciling economic development with flood risk mitigation which may have kick started the governance process. As such, flood risk is likely to remain low on the business agenda due to a lack of a form of reality test(Lange and Garrelts, 2007).

In terms of the potential for establishing a governance framework for reconciling flood risk mitigation and economic development, the findings gathered from the interviews were

particularly positive. The Environment Agency was broadly recognised as a monolithic authority in terms of providing flood risk information that could be used by businesses, reflecting findings from the public domain as highlighted by Harvatt *et al.* (2011). However, room for improvement in the information provided by the Environment Agency was identified. This was most prominent in regards to the consistency of both information and the personnel communicating such information, which could undermine the role of the Environment Agency as a coordinator of the governance process (Brown and Damery, 2002; Poortinga and Pidgeon, 2003).

A more concerning observation was the trust instilled in the Environment Agency, which was shown to have varied considerably between participants. Whilst some interviewees remarked upon the professionalism of the Environment Agency in its official capacity, others were less complimentary. Participants from the agriculture sector were particularly vociferous in their distrust of the official government (in this case Environment Agency's) knowledge, although it was encouraging to note that the level of hostility displayed in this case was far less than that identified in Wynne's (1992) research. The mismanagement of previous schemes on the River Hull had also generated mistrust of the Environment Agency, although again, the effects of this appeared not to have been "socially amplified" (Kasperson, 1992; Masuda and Garvin, 2006) to other respondents within the same geographic cluster whose properties did not border the river, which was also encouraging.

Despite some limited concerns, the Environment Agency appears to be in a healthy position to effectively coordinate the flood risk mitigation process using its power as an ability to involve actors within the private business sector (Healey, 1999a). Current indications are that businesses do not have unrealistic expectations of what the Environment Agency can achieve in terms of flood risk mitigation, having acknowledged the scale of the task and the limited resources which are available to tackle it. Combined with the acknowledgement that businesses are also responsible for flood risk mitigation on their premises, there is a good base for collaboration to take place, with common understanding and a need for mutual assistance between the Environment Agency and the private sector (Docherty *et al.*, 2001; Brown and Damery, 2002; Phelps *et al.*, 2003).

Whilst the environmental lobby has been seen to be vociferous in the flood risk mitigation process so far, businesses have been remarked by the Environment Agency to be largely absent. Critically, this was not found to be down to a lack of *capacity* to lobby and participate within governance, as a plethora of formal associations and less formal networks within which business concerns were discussed were uncovered within discussions with the interviewees. However, a catalyst to activate the networks in terms of fulfilling their potential to communicate and lobby for business interests within flood risk mitigation plans was found wanting. So far a reality test (Lange and Garrelts, 2007) has not been experienced and the issue of flood risk remains off the business radar, overshadowed by more immediate economic concerns (Van Praag, 2003; Zhang *et al.*, 2009).

Whilst the Hull Green Port scheme failed as a catalyst to launch flood risk onto Humber business agendas and PPS25 not appearing to have adversely affected the business respondents within this project, there may well be a further opportunity of kick starting the governance process in terms of the role of insurance. As Chapter Six highlighted, insurance costs form part of the daily business operations. With some business respondents having already noticed increases in their insurance premiums following the pluvial flooding of 2007, warnings from the UK insurance industry that they are seeking to withdraw policy coverage from high flood risk areas (AXA, 2006) would very likely raise the issue of flood risk up

business agendas and potentially activate the private sector's business networks for a greater involvement in flood risk governance.

However, without such a large scale event, raising the awareness of flood risk amongst businesses is unlikely to increase involvement within governance, as the low possession of tacit knowledge (Chapter Five) and the limited effects of the Environment Agency's codified information distribution has shown (Chapter Six). These findings, together with those in Chapter Six provide a completed answer to my third research question concerning the juxtaposition of the environmental and economic risks within Humber businesses. Interestingly, the answer to the fourth research question is more complicated. Concern over flood risk mitigation and economic development has not encouraged (business) stakeholders to plan and execute their activities through an estuary-wide governance process as yet. However, the essential framework does appear to be in place should a situation arise which triggers the necessary reaction within the business community. Despite the replacement of the Yorkshire Forward RDA with the Humber LEP, Bentley et al. (2010) note the strong history of cooperation between the local authorities in the Humber estuary region based upon the pursuit of common economic goals. The businesses interviewed within my research have in turn demonstrated their potential power to pressure local authorities on economic grounds, using various formal and informal networks. With the appropriate trigger, governance networks can therefore be activated which will allow the issue to be discussed between stakeholders on an estuary-wide basis.

Whilst governance may be seen as a post-Fordist panacea for addressing policy issues that straddle local, regional, national and supranational scales (Rhodes, 1996; Jones, Jones and Wood, 2004; Barnett, 2010), its success in depends heavily upon economic, social, political and cultural aspects that influence the actors within its three constituent sectors. Whilst there appears to be nothing wrong with the actual governance framework in the case of flood risk mitigation and economic development in the Humber estuary region, a closer look at the understandings of private sector environmental and economic risk has provided important and novel insights as to why the Environment Agency is experiencing difficulty in *engaging* stakeholders in its role as a governance coordinator (Lindley *et al.*, 2007:53).

Chapter Eight Conclusions

8.1 How do businesses construct and interpret their technical knowledge of flood risk? Business flood risk perceptions have been seen to be highly dependent upon personal experience, reflecting existing literature concerning the construction and interpretation of risk by the public (Wynne, 1989; Irwin, 1995; Jasanoff and Wynne, 1998; Morris, 2006; Harvatt *et al.*, 2011). Tacit knowledge plays a critical role in formulating risk perceptions for business people, with networks (or a lack thereof) being instrumental in terms of the ability to share this tacit knowledge. The emphasis on personal opinions of business people in the construction of their technical flood risk knowledge suggested that tacit knowledge in older businesses (outside the agriculture industry) appears to have been lost, with respondents that were working at more established companies not demonstrating any knowledge outside their own personal experiences since starting work at that company.

Despite both direct and indirect exposure of businesses to pluvial flooding that occurred in the Humber region during 2007, the knowledge gained from this experience did not appear to be transferable in terms of influencing risk perceptions related to estuarine flood events. Although previous research by Loewenstein *et al.* (1999) and Terpstra *et al.* (2009) has highlighted the substantial variations that can occur in the accuracy of risk perception through heuristic association, evidence appeared to suggest that Lange and Garrelt's (2007) concept of reality tests played a key role in locking flood events into specific sets of characteristics related to the embedded security still associated with sea defences around the Humber estuary. Whilst this is a major obstacle to be overcome by the Environment Agency in terms of getting estuarine flood risk higher up on business radars to increase concern, and therefore foster a greater participation in the governance flood risk mitigation

process, the lack of variation in flood risk perceptions related to other business characteristics such as size and industrial category (excluding those which were shown to be a consequence of previous experience) means that the Environment Agency's resources can be focused in on trying to resolve the gap in flood risk knowledge caused by a lack of tacit experience. This would be particularly fortuitous in terms of tackling the use of the generic term of "flood risk" which is used in the Environment Agency's policy documents (see Environment Agency 2005a, 2008b, 2009b) relating specifically to the estuary. Such action would help in preventing the evocation of perceptions that are locked in to other types of flooding outside the context of the estuary, which do not necessarily transfer the same nuances to the business person. Armed with an understanding of how businesses construct their technical knowledge of flood risk, the Environment Agency is in a better position to tailor their flood risk mitigation governance process to incorporate businesses on common principles which they have so far failed to achieve (Rhodes, 1996; Bache, 2000).

8.2 Has business flood risk knowledge changed over time with changes in scientific understanding?

My research revealed that the importance of managing flood risk within businesses on the Humber estuary is perceived as greater in the present and the future than has been the case in the past. Although the data suggests that this is a result of businesses having received flood risk information which has helped to fill the void in knowledge caused by a lack of personal experience (Eden, 1998; Morris, 2006), the importance of managing flood risk within day to day operations of the business is still higher for those respondents who have experienced previous negative effects of flooding at their premises than those who have not.

However, a general pattern was uncovered whereby businesses appear to have converged in their perceived importance of managing flood risk over time as it has become a more visible problem for the current day and also in the future. A common factor relating to this was revealed within the interviews, whereby some business people complained of facing increased premiums at their premises in recent years, lending support to Petts *et al.*'s (2009) reasoning that businesses are more likely to be aware of environmental problems when they have a direct effect on their operations in a form of regulation or cost.

Although the general increase in flood risk perceptions amongst all respondents is encouraging for the Environment Agency's flood risk governance strategy in terms of fostering greater concern over the issue, these results need to be treated with caution. Questions 17, 18 and 19, which were used to gauge the perceived importance of flood risk management within different time periods, did not ask respondents about a particular type of flood event, as the wording only referred to general flood risk. Considering the findings related to the construction and interpretation of flood risk knowledge by businesses, where variations in respondents' perceptions occurred between different types of flooding, the increased importance of managing flood risk may not necessarily refer to *estuarine* flood risk which the Environment Agency are attempting to manage through governance due to a lack of knowledge transfer based upon mismatched characteristics (Loewenstein *et al.*, 1999; Visschers *et al.*, 2007; Terpstra *et al.*, 2009).

The importance of flood risk in selecting company premises was also shown to have increased over time. However, in contrast to the data used to ascertain how businesses constructed and interpreted perceptions of flood risk, this was not influenced by whether the business person had experienced negative effects of flooding. This suggested that respondents were receiving other information to raise flood risk perceptions in the absence of tacit knowledge, as demonstrated in prior research (Myatt *et al.*, 2003a; Myatt *et al.*, 2003b; Morris, 2006). When examining the perceptions according to whether respondents had received codified flood risk information from the Environment Agency at their premises, it transpired that perceptions at both points in time were lower for those in receipt of Environment Agency information than those who had not received any. Further investigation revealed that this was likely to be due to trouble which businesses had in interpreting the information which the Environment Agency had given them in terms of timescales, leading some businesses to substantially underestimate flood risk, supporting previous research on *public* flood risk perceptions by Cullman *et al.* (2009) and Harvatt *et al.* (2011).

Whilst business flood risk knowledge does appear to have altered over time in line with changing scientific knowledge, this is not necessarily good news for the Environment Agency. Due to the non-transferability of flood risk knowledge between different flood events, it does not necessarily imply that the increased awareness of generic flood risk will translate into a greater involvement of businesses within the flood risk governance process specific to the Humber estuary. This is particularly interesting, as although a general pattern of increased awareness of flood risk in line with changing scientific knowledge is demonstrated, it also serves to support Tsoukas' (1996) and Hislop's (2002) assertion that tacit and explicitly knowledge are deeply intertwined. In such circumstances, codified data based upon scientific evidence may be accepted by businesses, although some of the messages become confused due to interpretation through the businesses' tacit lens.

8.3 How do businesses juxtapose environmental and economic issues as part of their daily business operations?

Whilst businesses appeared to have particular difficulty in interpreting environmental timescales from information provided by the Environment Agency, they were shown to be able to estimate flood recovery times in a more accurate manner, as determined by business studies literature, in relation to their resources and assets based upon their industry and company size (Clemo, 2008; Crichton, 2008; Zhang *et al.*, 2009). These estimates were not affected by the respondent's experience of negative effects of flooding at their premises, which suggested that businesses were able to perceive environmental hazards more accurately when they were framed within an economic context that was directly related to business operations (Messner and Meyer, 2006; Visschers *et al.*, 2007).

Perhaps unsurprisingly, economic issues dominated the concerns of the businesses that were interviewed, with the health of the local and regional economy and the state of the infrastructure linking the Humber to other regions of the UK being highlighted as particularly critical. This supported previous research suggesting that that businesses, particularly SMEs, are inclined to focus on the short term economic objectives of their businesses and are unlikely to be receptive to long term planning issues as required by flood risk mitigation (Foster, 1993; Zhang *et al.*, 2009). In a business context, it would appear that there are imbalances between economic issues and environmental issues in terms of the timescales that are involved. However, the data collected showed that this was not a universal trait, with the agricultural industry demonstrating a greater harmony between business and environmental timescales in terms of their everyday business operations. Nevertheless, in terms of fostering SMEs which are a key component of the Humber estuary region's blueprint for economic development (Yorkshire Forward, 2006), substantial evidence from industries outside those in the agricultural sector lent support to Linnenluecke's (2011:124)

assertion that firms overwhelmingly appear to operate within an economy "disconnected from the natural environment".

Interestingly, businesses that engaged in operations that were governed by specific legislation were found to have a better understanding of risk due to compliance procedures which they had to undertake, supporting previous research by Tilley (1999) and Petts *et al.* (2009). However, this observation did not extend to all risks covered by regulations. Even though all business premises must comply with fire regulations (CLG, 2006a), if such risks did not feature as part of the daily business operations, they were seen to fade into the background as business people became preoccupied with addressing short term concerns (Zhang *et al.*, 2009). Even though fire regulations have evolved to create safer workplaces over the years, the introduction of similar legislation to boost the status of flood risk amongst businesses is unlikely to help raise risk perceptions, as contrary to Pett's *et al.*'s (2009) theory, findings suggest that businesses that are not dealing with flood risk as part of their daily operations are likely to satisfy the mandatory criteria and then think of the risk as being normalised (Freudenberg, 2007; Lange and Garrelts, 2007).

There is currently only one piece of legislation in place in the form of PPS25 that could effectively force businesses to consider flood risk if they were to relocate to an alternative site. However, despite its intention to empower the Environment Agency to pursue an agenda of sustainable development, PPS25 has so far been shown to be impotent in its objectives, as it still allows low risk developments in flood plains (Bosher *et al.*, 2009), allowing businesses to place themselves at risk of being flooded through the pursuit economic goals associated with clientele living within such areas (Crichton, 2008). In this instance, the reconciliation of economic and environmental policy within businesses can be seen as extremely limited.

However, businesses' preoccupation with the economic state of the Humber region could actually be instrumental in raising flood risk onto the business agenda. Major economic developments such as the Green Port Hull scheme are seen by Humber stakeholders as critical to the future economic health of the region (Hull Daily Mail, 17.03.2011). Nevertheless, the power of the Environment Agency as a regional coordinator appears to have been usurped by central government on what could have be a pinnacle issue for the reconciliation of economic and environmental risks due to what Klein (2003:112) describes as a decision that "is likely to be politically palatable in the near term, rather than by the nature and the scale of the threat itself".

8.4 Has concern over flood risk mitigation and economic development encouraged stakeholders to plan and execute their activities through estuary-wide governance processes?

Both Gibbs and Jonas (2001) and Counsell and Haughton (2003) highlight that the recent move towards English multi-level regional (and now local) governance, involving an increased number of participating actors and organisations, can be seen to be problematic in pursuing goals of sustainable development due to increased fragmentation within policy networks. The political responsibility of the Environment Agency in this situation is aptly described by Jessop (2000:236) as being to maintain "social cohesion in a socially divided, pluralistic social formation". However, flood risk mitigation (and its symbiotic relationship with economic development) through a governance process of governance necessitates a diverse range of agencies working in partnership in the private, public and voluntary sectors which the Environment Agency must coordinate in its role as a statutory organisation.

To an extent, the Environment Agency is in a good position to involve stakeholders on an estuary-wide basis in terms of flood risk governance, with the data suggesting that most

businesses recognised the Agency as a monolithic authority in terms of providing flood risk information. However, room for improvement in the information that the Environment Agency provides was identified, particularly with regards to the consistency of both information and the personnel communicating such information, which could undermine the role of the Environment Agency as a coordinator of the governance process (Brown and Damery, 2002; Poortinga and Pidgeon, 2003).

With such a diverse range of agencies working in partnership, Evans and Jones (2008) caution against the possibility that the different actors within any governance process may be working to different understandings of the issues in hand. In this sense, Lindley *et al.* (2007:53) see it as critical to develop "an underlying understanding of risk" for the institutions involved within the governance process and the different ways in which this can be influenced. This is particularly important for the Environment Agency as a coordinating body, especially in terms of the trust afforded by businesses, which was shown to have varied considerably between participants.

Whilst some interviewees remarked upon the professionalism of the Environment Agency in its official capacity, participants from the agriculture sector were particularly vociferous in their distrust of the Environment Agency's knowledge, although it was encouraging to note that the level of hostility displayed in this case was far less than that identified in Wynne's (1992) research. The mismanagement of previous schemes on the River Hull had also generated mistrust of the Environment Agency, although again, the effects of this appeared not to have been socially amplified (Kasperson, 1992; Masuda and Garvin, 2006) to other respondents within the same geographic cluster whose properties did not border the river, which was also encouraging.

Overall, the Environment Agency appears to be in a healthy position to effectively coordinate the flood risk mitigation process using its power as an ability to involve actors within the private business sector (Healey, 1999a). Businesses do not appear to have unrealistic expectations of what the Environment Agency can achieve in terms of flood risk mitigation, with many interviewees having acknowledged the scale of the task and the limited resources which are available to tackle the problem. Combined with the acknowledgement that businesses are also responsible for flood risk mitigation on their premises, there is a good base for collaboration to take place, with common understanding and a need for mutual assistance between the Environment Agency and the private sector (Docherty *et al.*, 2001; Brown and Damery, 2002; Phelps *et al.*, 2003).

In sharp contrast to the private sector businesses, the business lobby was found to be particularly vociferous in the flood risk governance process. However, this was not found to be caused by a lack of *capacity* for businesses to lobby and participate within governance. Moreover, a catalyst to activate the various business networks in terms of fulfilling their potential to communicate and lobby for business interests within flood risk mitigation plans was found wanting in the form of a reality test (Lange and Garrelts, 2007). As such, to this point the issue of flood risk remains off the business radar, being overshadowed by more immediate economic concerns (Van Praag, 2003; Zhang *et al.*, 2009).

The Hull Green Port scheme failed as a catalyst to launch flood risk onto Humber business agendas due to the lack of any substantial and prolonged conflict with environmental objectives as originally raised by the Environment Agency and English Nature. Whilst this serves to reinforce suggestions that central government can bypass the regional/local governance process at its whim (Bentley *et al.*, 2010; Williams, 2010a) due to short term political goals that are palatable by the population (Klein, 2003), it does not necessarily render the governance process impotent. A further conflict between two of the pillars of sustainable development on the Humber estuary may arise in the near future in terms of the role of insurance for business properties, providing the reality testrequired to activate an estuary wide governance process with active input from the private sector. However, until such a trigger event manifests itself, the ability to reconcile both economic and environmental objectives through governance, with full participation from businesses, on an estuary-wide scale in the Humber region remains very unlikely.

8.5 Theoretical implications

Sections 8.1 to 8.4 have reviewed the key findings of the research in terms of answering the four key questions that underpinned the project. However, my research has also uncovered important theoretical implications relevant to existing academic work within the arena of economic and environmental governance.

The shift from government to governance over the last thirty years within England (Rhodes, 1996; Bentley *et* al., 2010; Jessop, 2011) has served to alter the dynamic for business engagement in relation to both economic and environmental issues. Under a system of governance, companies are afforded the opportunity to participate within key decision-making processes facilitated by government agencies responsible for economic development (the RDAs and their successor LEPs) and for environmental protection (the Environment Agency). Although the data collected from interviewees largely supports Cooke and Morgan's (1998) claim that economic success is better facilitated through 'associated economies' that comprise intimate links between local [business] knowledge networks, the same networks have been observed to be less than successful in terms of resolving environmental issues in relation to flood risk mitigation. Despite business people indicating that their general concerns related to flood risk have increased over recent years, the

Environment Agency's governance-based flood risk mitigation strategy, which juxtaposes both economic and environmental issues, has not successfully engaged businesses due to the two very different knowledge networks that the process aims to exploit.

Generally, companies outside the agricultural sector reflected findings in existing academic literature (Gibb, 2000; Needle, 2004; Romilly, 2007) whereby they were primarily concerned with addressing the day to day economic issues related to their business operations. Interview data uncovered a number of different networks and mechanisms which businesses used to communicate economic knowledge in order to influence business lobbies, local politicians and the local authorities who play a key role within the new LEPs. However, although interview data suggested that these same networks could be used in order to communicate concerns relating to flood risk, this particular issue was not seen by business people as a major concern at the present time. A common justification offered by business people was that of the mismatch between economic and environmental timescales. Whilst environmental problems were viewed as a future issue, the financial health of the business was an immediate short term priority.

My research highlighted the strong tacit and event-specific properties of flood risk knowledge, and indeed the problems that this also posed for the interpretation of codified knowledge offered to business people by the Environment Agency. The data supported Polanyi's (1969) assertion that knowledge is not clear cut, thus being either explicitly tacit itself, or being interpreted within a frame of existing tacit knowledge. However, my results found that framing flood risk issues within the existing economic knowledge and understanding demonstrated by business people did help in terms of raising awareness of both business vulnerability and resilience. This supports existing research (Petts *et al.*, 1999; Tilley, 1999; Husted, 2008) advocating that environmental issues only become a priority

within companies when enforced through legislation or if they manifest themselves to have a direct financial impact upon business operations. With 99.9% of businesses in the UK comprising SMEs (DBIS, 2009), the nature of these companies' small-scale operations mean that they are unlikely to be regulated by legislation such as COMAH. However, the potential increase in insurance premiums faced by businesses within areas classified as at risk from flooding by the Environment agency was found to have some value as a tool to address the general lack of flood risk knowledge demonstrated, or indeed its misinterpretation, by the business people that were interviewed.

With businesses demonstrating vulnerability and a lack of resilience to flood risk caused by an absence of coping strategies (Bankoff, 2000; Walker et al., 2002; Allen, 2006) related to a deficiency in relevant tacit knowledge, insurance premiums may well act as a conduit to launch flood risk onto the radars of businesses and thus kick starting the governance-based flood risk mitigation process with the Environment Agency. However, it must be emphasised that insurance premiums are far from a comprehensive solution to bridging the flood risk knowledge gap for successful engagement within the flood risk governance process. A reality test (Lange and Garrelts, 2007) in the form of a major estuarine flooding event would provide the necessary tacit knowledge to business people in terms of understanding both the vulnerability and resilience of their business to such a natural disaster. As research by both Convery and Bailey (2008) and Whittle et al. (2010) has shown, recovery from a flood event is far from a linear process with the social implications of such a disaster affecting multiple aspects of people's lives which in turn may have ramifications that manifest themselves within the workplace. Whilst the interviewees demonstrated an awareness of the financial implications that increased insurance premiums could have on their business, wider social implications with their arguably greater financial implications (Whittle et al., 2010) were either not mentioned or dismissed as minor issues.

Whilst governance has generally been lauded as a successful vehicle for economic development since the Thatcher government started rolling back the nation state in the 1980s (Harmes, 2006; Jones, 2010a; Jessop, 2011), it encounters major issues in terms of its usefulness for flood risk mitigation. Despite the Environment Agency's role as a coordinator within the governance process, which Handmer (1996) views as a solution the Local Authorities' contradictory role in previous decades as both a facilitator of economic development and of environmental protection, the business flood risk knowledge networks which the Environment Agency's governance process explicitly aims to exploit can be seen as insufficient at best due to absence of an estuarine flooding reality test (Lange and Garrelts, 2007) and the hidden vulnerability and resilience issues associated with business insurance premiums.

The scale of governance has recently shifted downwards from the meso level with the introduction of LEPs. Whilst this should theoretically assist in terms of facilitating wider local engagement (Walburn, 2011) the ability of the central government to usurp the powers of local public sector participants (Bentley *et al.*, 2010; Pugalis, 2012;) over PPS25 legislation pertinent to the Green Port development in Hull has simply suppressed the relevance of the Environment Agency's effort to engage businesses in flood risk mitigation policy on the Humber, as well as scuppering a potential reality test for environmental policy. With such a non-committed approach to governance, Allmendinger (2008) highlights the potential for short term incrementalism at the expense of long term planning, equating to continued emphasis on economic development without the integration of flood risk mitigation policy on the Humber estuary.

Although the governance of flood risk mitigation is clearly failing on the Humber in terms of its ability to engage businesses in a solution which satisfies both long term economic and

environmental objectives, this thesis has addressed some key points raised by other academics working within this field. My research has answered Lindley's (2007) call for the need to develop an underlying understanding of risk to prevent the breakdown of flood risk governance, which can be usefully understood in terms of the vulnerability and resilience of Humber businesses. In doing so, a useful social dimension to the interpretation and social construction of risk has been uncovered which has addressed concerns levelled at Beck's (1992) failure to address how risk enters the political arena by both Alexander and Smith (1996) and Bulkeley (2001). This adds an interesting new dimension to the examination of governance failure alongside other prominent explanations offered such as; a disillusionment among policy makers and practitioners involved within governance that the participatory process is used to reinforce decisions which have already been made, therefore failing to realise the benefits claimed for participation (Reed, 2008; Foxon *et al.*, 2009), stakeholders reluctance to participate on account of their perception that there is no *benefit* to collaboration (Martin and Foley, 2000) and actors' unwillingness to participate within governance due to the unequal distribution of resources (Painter, 1997).

8.6 Policy recommendations

As part of the nature of the CASE research project, a concise list of policy recommendations was requested by the Environment Agency. These are as follows:

a) Use of the generic term flood risk may not communicate the intended message to businesses due to the reliance of business people on their personal experience to formulate risk perceptions. As perceptions of flood risk are seen to be locked into their causal events and not easily transferable, providing a full description of the type of flood, i.e. estuarine flood risk, may help to focus business people in their thinking. In this sense, when the information is received by the business person, it may have a greater success in filling knowledge gaps associated with different flood events.

- b) Tailoring written flood risk information specifically to businesses, with a foreword to emphasise common objectives of the Environment Agency and businesses, may be conducive to fostering a sense of trust amongst those business people who have not previously had dealings with the Environment Agency and are therefore wary of the information that is being provided.
- c) Although the flood risk return periods stated in Environment Agency distributed information were found to be open to misinterpretation, there appeared to be a more widespread concern amongst businesses that the Agency was not consistent in its information provision. Although climate change is an issue that is dominated by uncertainty and constantly changing scientific data, keeping the format of the information provision, in terms of the benchmarks used, is more likely to maintain the trust of the business people within the Environment Agency and the information which it provides. In cases where there is misunderstanding of the benchmarks used, more information tailored to this around the relevant specific flood risk may be offered to try and rectify this issue.
- d) Greater provision of information on the internet may well help to avoid the varying levels of trust attributed to Environment Agency staff as uncovered from the interviewees. With wide usage of the internet amongst the participants within this research project, business people will be able to access uniform data that may not

be subject to the apparent discrepancies in information provided by representatives of the agency.

- e) Reinstate regular newsletters or e-letters to businesses within the flood risk zones of the Humber estuary with brief yet specific advice. Businesses that were interviewed complained that information from the Environment Agency changes too rapidly and is complex. Providing regular filtered information on developments related to different types of flood risk may help to keep the issue of estuarine, or other flood risk types if applicable, within businesses minds and are likely to be more effective than pursuing a flood preparation regulation for example, which may be undertaken by the company as a one off activity and then subsequently forgotten.
- f) The financial framing of flood risk implications in terms of insurance policy premiums may assist business people to construct a better understanding of flood risk on the Humber estuary. Although my research has shown that such an understanding is likely to be limited in the absence of richer and more comprehensive tacit knowledge, a partial awareness of the need to mitigate against flood risk can be offered by tapping into short-term financial concerns that have been shown to dominate many of the businesses involved in the interviews. This action is likely to yield positive, although limited, results in terms of addressing the vulnerability and resilience of businesses in a geographical area predicted to experience more frequent and more extreme tidal surges in the future.

The above recommendations and their intended outcomes are by no way comprehensive. Although this research project has indicated that such action may be beneficial in terms of resolving specific points that were highlighted by the business participants, it must be remembered that climate change and flood risk is a dynamic and evolving issue, with no quick fixes. Addressing the concerns listed above may well increase the propensity of businesses to involve themselves within the process of flood risk governance, although evidence suggests that the primary barrier to more widespread engagement remains that of a lack of tacit knowledge surrounding flooding. Reality tests in terms of exposure to both physical flood events and to environmental legislation (PPS25 and Hull's Green Port) are both sadly lacking. However, information that is specifically tailored in a business-relevant format may assist in the event of widely anticipated increases in business insurance premiums for flood damage cover in the future (AXA, 2006, Clemo, 2008). Data gathered from the interview phase of the project highlighted the multiple business networks and communication channels which are used to address the current economic concerns of businesses. Although interviewees openly indicated that these same networks would facilitate communications concerning environmental issues which impacted negatively upon their daily business operations, thus far a trigger event to this effect has not occurred.

The Environment Agency operates at a regional level on the Humber, and remains well placed to engage with the new sub-regional level Hull and Humber LEP that replaced the Yorkshire Forward RDA in 2011. Although the new LEP boundary mirrors that of the Humber Port City Region of the old larger RDA, the greater emphasis on Local Authority involvement within the new LEPs may offer advantages for the Environment Agency. One such advantage is the greater potential for engaging smaller lifestyle businesses which were shown to be highly reliant upon relationships with local councillors within Chapter Seven.

The Environment Agency is also able to maintain its role as the coordinating agency for the mitigation of flood risk along the entirety of the Humber estuary shoreline. Although the new Hull and Humber LEP is charged with overseeing economic development in the same

geographical area as the Environment Agency, its capacity to effectively manage this is as yet unproven and concerns have been raised by Bentley *et al.* (2010) over the resources and the ability of the new LEPs to keep local authorities in check on this issue. Consequently, the Environment Agency is able to use its powers under PPS25 to challenge the LEP and local authorities on inappropriate developments within flood risk areas, affording it considerable power.

Although Bentley *et al.* (2010) and Pugalis (2012) voice concerns over the ability of central government to usurp LEPs in making key economic development decisions, this action can also be taken against the Environment Agency as demonstrated by the events surrounding the Green Port development in Hull. Whilst the new LEPs may bring benefits to the Environment Agency's flood risk governance programme, reality tests are still required to kick start the process in addition to the measures outlined above.

8.7 Further research and overall analysis

Whilst environmental policy is constructed on the basis of scientific knowledge and technical intervention (tempered by political and commercial considerations), Brand (2007:626) notes that "it can only be implemented by the modification of people's behaviour patterns across an immense range of activities". My research has provided an insight into this specific issue relating to the governance of flood risk, addressing Robert's (2006:415) remarks that "the way risks impact upon development and investment in regional and local economies is something about which we know very little".

The project has shown that far from having the desired effect of balancing economic and environmental policy on the Humber estuary, the governance process has been fragmented in its objectives at best. The Environment Agency's potential to block economic development within certain areas, owing to a focus on environmental protection, has been demonstrated to have been usurped by central government in the case of the landmark Green Port project. Far from the recommendation of the Stern Report (2006:18) that "policies should adapt to changing circumstances as the costs and benefits of responding to climate change become clearer over time", there is little evidence of the adaptation and coordinated form of sustainable development that the governance process aimed to deliver. However, rather than describing a simple open and shut case of governance failure, my project has exposed the socio-economic, cultural and political issues behind why businesses within the private sector have not been particularly bothered about involving themselves in governance due to their low risk perceptions of flooding, and the difficulty in juxtaposing short term business operations with long term environmental objectives.

At the same time, research has been carried out that has provided a new body of data addressing business specific interpretations of environmental risk, and the way in which risk perceptions and knowledge are transferred from different actors or different events (or not transferred as my research uncovered). Although there are many similarities between the way in which the public and the way in which businesses perceive and construct knowledge on flood risk, this was previously unknown.

This issue does, however, require further investigation. Although some interesting similarities have been drawn between public and business flood risk perceptions, this thesis has only collected data from the business community. With business studies literature suggesting that business people may well be more psychologically risk averse than the general public (Romilly 2007; Ashcroft *et al.*, 2009), comparing the magnitude by which previous experience effects risk perception levels for both the public and business people as separate entities would be an area whereby this project could be expanded. This would also

provide more detail on exactly *how* business objectives can be reconciled with other sectors within the governance model. Although this is a pitfall of my research described within this thesis, incorporating this aspect into my work would not have been possible due to the extra time and resources required.

The project provided a great deal of data, most of which was useful in answering the research questions. However, it became evident when analysing the results of Question 11 on the quantitative survey that the generic term "flood risk" harboured a range of perceptions dependent upon specific types of flood event. Although this was not foreseen in the design phase of the questionnaire, due to the lack of literature examining business perceptions of flood risk, it did somewhat limit the analysis of the dynamic' nature of flood risk within Chapter Six, as the large differences uncovered between different types of flood events could not be accounted for in this question. However, this section of the thesis still yielded important and useful data that complimented the other evidence which I had gathered, despite the term flood risk covering the risk from all types of flood events in just one tick box.

Another issue that arose during the research process regarded the businesses which had self selected for the interview stage. Although self-selection was chosen as both a convenient process and one that that would satisfy the Environment Agency's concern over unnecessary participant harassment, it did provide an overwhelming number of business people in the interviewee who held a key role in business associations and forums. Although this gave a particularly useful insight into the pan-Humber networks that businesses can use within the flood risk mitigation governance process, it did not necessarily give a good indication of how non-involved businesses would participate in such networks. As Leslie (Micro - Manufacturing, North East Lincs) succinctly stated "In general it's bloody cranks and people with a large vested interest that tend to get involved in these things, and what are politely called the silent majority who don't". However, trying to reach the silent majority is always a difficult task, and one that was out of the question in this research due to the involvement of the Environment Agency.

Additional research could help to strengthen the project in terms of breaking down changes in flood risk perceptions over time into more detail, as well as providing a more balanced number of interviews to counteract the high concentration of business forum position holders. However, the project design was more than adequate in terms of satisfying the original research questions and in providing reliable data for analysis.

8.8 Concluding remarks

The analysis of flood risk perceptions from a business perspective has been particularly useful in analysing the current problems which the Environment Agency is having in coordinating flood risk mitigation and economic development through a framework of governance on the Humber estuary. Whilst governance is often viewed as the *de facto* method of implementing socio-economic policy, it is not a universal framework that can be implemented in a generic fashion to any given situation and be expected to work, as this research has shown. Understanding how different actors perceive and deal with environmental and economic issues has provided an insight into the problems which can arise within the governance process, and can assist coordinating bodies such as the Environment Agency in resolving them.

In the case of balancing flood risk mitigation on the Humber estuary, an interesting analogy can be drawn with Walker *et al.*'s (2011) paper examining spaces of bad water. Whilst the Humber can be seen to embody good water in the way in which the estuary provides an

economic driver for the region's industry through the important port complexes, outside this context it can be seen as bad water in terms of its potential for destruction and the wild nature that the estuary shoreline management plans attempt to keep in check. However, in the case of this research, the bad water of the Humber estuary *currently* only seems to be visible to a limited number of businesses (those who have experienced previous flooding, and the farmers), with the thin membrane between the two types of water represented by Lange and Garrelt's (2007) reality test.

Appendix A – Questionnaire

The Humber Business Flood Risk Concern Survey (Your Survey Reference Code: 1F001)

Miss A Person Company Name Company Address Company Address COMPANY POSTCODE

Dear Miss Person,

It's important that we know what risks businesses in the region are concerned about so that we can improve future economic management.

Flood risk can pose a serious threat to business survival, especially in our region. This short survey will help policy makers identify business concerns so that they can be better integrated into flood risk management, so please take a moment to fill it in.

In return, your business will have free access to survey feedback and flood risk resources available on the project website at http://www.floodaware.org/ Participation in this survey can also count towards your Corporate Social Responsibility.

The survey forms part of my PhD project on Humber Flood Risk and Economic Development at the University of Hull. The research is jointly supervised by the Environment Agency, which is responsible for flood risk management in the region.

This is a confidential survey and your business' anonymity is guaranteed. All survey data collected is assigned a reference code in place of your company identity. The Environment Agency will not have access to any firm-specific responses to this questionnaire, and company details will not be passed on to any third parties.

Please detach this letter and return the questionnaire in the Freepost envelope as soon as possible, preferably before December 23rd. Alternatively, you may prefer to fill out the electronic version by clicking "take part" at <u>www.floodaware.org/</u>

Yours sincerely,

Carl Lewis

PhD Research Student, The University of Hull Geography Department Tel: 01482 465 039 Email: c.a.lewis@2007.hull.ac.uk





Page 1 of 1

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Survey Reference Code: 1F001

(To be used to retain company anonymity)

IF THE COMPANY HAS MULTIPLE PREMISES, PLEASE <u>ONLY</u> CONSIDER THE ONE WHICH THIS SURVEY WAS ADDRESSED TO WHEN ANSWERING THE FOLLOWING QUESTIONS. FOR <u>MOBILE</u> <u>BUSINESSES</u>, PLEASE SUBSTITUTE 'PREMISES' FOR YOUR BASE OR LOCALE OF BUSINESS.

First I'd like to ask some questions about your company to check that a good cross section of businesses are included in the survey.



Now, some questions on issues relating to flood risk concerns from the past:

	To your knowledge, were these Humber company premises deemed 'at risk' from flooding by any of the following agencies when they were first opened:			
5	 Environment Agency Estate or Property Agency Insurance Providers None of the Above Don't Know 	 Local Authority or Council National Rivers Authority*^(row defund) Surveyor or Architectural Agency 		

	Are you aware of within the last de	ny change in the flood risk status of these Humber company premises ade?
6	☐ Yes →	If <u>Yes</u> : a) Has the flood risk:
0	No	Increased Decreased
		b) Has this affected the business in any way? (please state)

	Has any flood risk company premise	informat s within t	ion from the Environment Agency been received at these Humber he last year?
	🗌 Yes 🕳	If <u>Yes</u> :	a) Please indicate what was received:
	No		Email Leaflet Tides News
			Other (please state)
7			b) Roughly when did you receive the latest of the above:
			c) Was the information helpful?
			Yes No
			d) Do you have any comments to offer on the information received? (please state)



	Have these Humb	er company premises suffered any negative effects from previous flooding?
	Yes →	If <u>Yes</u> : a) Please state roughly when this occurred:
	No	b) Please estimate the cost of damage: £
0		c) Please tick any effects that this flood had on the business:
0		 Altered insurance premiums Equipment Damaged Company lost revenue Operations suspended Customer loss Premises damaged Distribution interrupted Stock spoilt
		Other (please state)
	How important a f Humber premises	factor was flood risk for the company when originally choosing these ?
9	Very Importan	nt

Quite Important Not Important

	Now, some questions on current flood risk concerns:
	How important a factor would flood risk be for the company if it was choosing Humber premises today?
	Very Important*
10	Not Important*
	*If your response to Question 10 differs from that of Question 9, please state any reasons below:
	Please indicate what you perceive the risk of the following flood events to be with regards to these Humber company premises:
	Risk
11	High Medium Low

		High	Medium	Low
11	Flooding caused by backflow within drainage systems			
	Flooding caused by sea water overtopping estuary defences			
	Flooding caused by land relief, e.g. water pooling in low areas			
	Flooding caused by rising ground water when the water table is high			
	Flooding caused by a river bursting its banks			



Now, some questions on future flood risk concerns:

	Is the company se	eking to e	expand within the Humber region within the next 5 years?
12	☐ Yes →	If <u>Yes</u> :	Is flood risk: A major concern for this expansion A minor concern for this expansion No concern for this expansion

	Is the company av regulate develop:	are of a regulation called 'Planning Policy Statement 25' which aims ent in flood risk areas?	to
	🗌 Yes →	If <u>Yes</u> : a) Will this affect future plans for the current Humber prem	ises?
13	No No	Yes No	
		b) In what way? (please state)	

	Has flood risk in the Humber region prompted the company to consider moving elsewhere?		
14	☐ Yes →	If Yes: Where has the company considered moving to? Elsewhere in the Humber region Elsewhere in the UK Elsewhere Overseas	

	Please give a rough estimate as to how long you think it would take for the company to <u>fully</u> recover if a flood adversely affected these Humber company premises?			
15	Less than a week 1 - 4 weeks 4 - 8 weeks 2 - 6 months Over 6 months Unlikely to recover at all			



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Page 5 of 5

Appendix B – Interview Guide

The Humber Business Flood Risk Concern Survey Interview Questioning Guide Introduction

I am interested in your views on how flood risk may impact upon your business and how satisfied you are with the way in which flood risk is being dealt with in the Humber region. 1. State that research is for a PhD research project and not commercial.

- State that the Environment Arrange (EA) has part founded the project but the
- 2. State that the Environment Agency (EA) has part-funded the project, but that all data seen by the Environment Agency will be censored to protect businesses identities.
- 3. State that the recording is confidential and your name is not released. Please be honest as there are no right or wrong answers.
- 4. State that research data may be published in academic journals but will once again be appropriately handled to provide anonymity.

[Turn on recorder and note name of person, company, date and time]

Where does flood risk stand within current business priorities?

In this section I am interested in where you place flood risk amongst the other day to day risks that your business deals with. What are the biggest risks to your business operations? Are there any specific reasons that your business chose to set up at this location?

- 1. If a large scale flood event was to occur in the area, are there any factors (within human control) which you think could either limit or increase its severity?
- 2. Do you think certain types of flooding pose a greater risk than others at this location?
- 3. What makes other business risks different to those risks associated with a flood event?
- 4. Are there any aspects of this location that cause problems, or that you think may cause problems to business operations? Have such problems altered over time?
- 5. Do you think the significance of flood risk management as part of business operations will change in the future?
- 6. Do you worry more about the impact flooding may have on your home than your business?

Where do you get your knowledge about flood risk from?

How do you, as a business person, learn about flood risk issues in the Humber region. Do you rely upon any specific sources for information? Is this information easy to access? Do you know who to ask to answer questions you have on flood risk? Do you trust these sources? Have you any personal experience of flooding in the region?

- 1. In terms of flood risk policy in the Humber region do you feel well informed of current and future plans?
- 2. Can you name any current Humber projects addressing flood risk management?
- 3. How severe do you think the flood risk situation is? Are you subscribed to EA 'floodline'?
- 4. Where would you look for flood risk information? What factors influence the amount of trust attributed to different people/ organisations?
- 5. Does your local knowledge ever conflict with 'expert opinion'?
- 6. IF FLOODED BEFORE: What exactly happened during the flood event? How did you feel? Were you covered by insurance? Did the flooding alter business risk management plans?

How suitably is your business protected under the Environment Agency's current flood risk mitigation policies?

Do you feel that flood risk is defended against and communicated to you in a way that adequately protects your business? If you had a suggestion on flood risk management would you be able to communicate this to those in charge of flood risk planning? Has your business considered any ways to independently protect itself from flooding on this site?

- 1. Do you think policy-makers would listen if you were asked for your input?
- 2. Have you attended any flood risk meetings in your area? Were they useful? Do you agree with community consultation in such a format?
- 3. How far would you be willing to go to independently protect your business from flooding (financially)?
- 4. What do you understand of current planning guidelines regarding developments in the vicinity of the estuary (PPS25 etc)?

IF NO knowledge of PPS25 – summarise briefly: Do you think business needs have been included within this policy design? How would you modify them?

Are there any wider implications of flooding for business operations or decisions?

Can you think of any off-site problems that may impact your business from flooding in another area of the Humber region (logistics etc)? Are other businesses likely to suffer similar problems? Whose responsibility should it be to minimise any disruption? What size of area do you think flood risk should be managed within?

- 1. Are you concerned that your suppliers and/ or distributors may fail to deal with flooding?
- 2. Are you a member of any business forums in the Humber region? Do you ever discuss issues such as flood risk with neighbouring businesses? Do their opinions differ to yours?
- 3. Is the amount of land available for future business expansion in the Humber region likely to impact upon your business operations?
- 4. If the business were to expand, what factors would influence your choice of additional or larger premises?
- 5. What objectives do you see as being prioritised in both regional and local planning? Is this the case on both sides of the estuary?
- 6. Do you think all areas around the estuary should be managed in the same way? Why/ Why not?
- 7. Is there anything that you think flood risk policy makers need to hear from businesses such as yours that can be incorporated into their plans?

Wrap up and conclude. Thank participant
Appendix C – Interview Consent Form





Humber Business Flood Risk Awareness Survey

Interview Consent Form

- I understand that this interview will be recorded, transcribed and analysed for use in an academic research project examining flood risk mitigation and economic development at the University of Hull.
- I understand that my personal details will not be passed on to any other parties.
- I understand that my personal details **will only** be held on a single secure computer at the University of Hull.
- I understand that all information obtained during this interview is coded during analysis, providing anonymity for all participants in subsequent publications. Under no circumstances will I be personally associated with any responses I give during this interview.
- I understand the research findings (using coded data) may be published in an academic journal.
- I understand that the Environment Agency will have access to coded anonymous data from this interview which will be used to help them determine flood defence strategies.
- I understand that this sheet will be kept secure in the Geography Department at the University of Hull and will not appear in any write-up or publication of this project. It will not be possible for any parties, including the University of Hull, to trace specific interviewee responses using this form.
- Please tick this box if you would like a transcript of this interview



Email: c.a.lewis@2007.hull.ac.uk

Appendix D – Research Ethical Evaluation

ETHICAL EVALUATION FOR POSTGRADUATE RESEARCH STUDENTS BEGINNING A RESEARCH PROJECT

Department of Geography

Research Proposer(s): Carl Lewis

Programme of Study:PhD

- Research Title: Balancing Flood Risk Governance and Economic Development on the Humber Estuary
- Research (brief): My research will involve consultation with local businesses on the Humber Estuary to establish how they construct flood risk, and also how they communicate their perceptions of flood risk knowledge with other actors in regional governance. I will be examining the factors influencing businesses' perceptions of flood risk and how this impacts upon the day to day running of their business. Research will be undertaken using a questionnaire survey, and approximately 20 semi-structured interviews.

Source of Research Funding: ESRC

Proforma Completion Date: 20/05/2009

This proforma should be read in conjunction with the ethical principles. It should be completed by the researcher. It should be sent on completion, together with a brief (maximum one page) summary of ethical issues raised by the proposed research, for approval to the Geography Ethics Officer prior to the beginning of any research.

Part A

1. Will your research involve animal experimentation? NO

If the answer is 'YES' then the research/teaching proposal should be sent direct to the University Ethics Committee to be assessed.

2. Will your research involve human participants? YES

If the answer to both questions is 'NO', there is no need to proceed further with this proforma, and research may proceed (however, please send a copy of the form to the Ethics Officer). If the answer is 'YES' please answer all further relevant questions in part B

Part B

3. Will the research involve people under 18 years of age? NO

- If yes, have you taken the following or similar measures to deal with this issue?
- (i) Informed the participants of the nature of the research?
- (ii) Ensured their understanding?
- (iii) Gained the non-coerced consent of their parents/guardians?

4.Will you obtain written informed consent from the participants? **YES** *If yes, please include a copy of the information letter requesting consent If no, what measures will you take to deal with obtaining consent?*

Please find attached a questionnaire and an interview consent form. The questionnaire form explains the purpose of the research and how it will be used. If the recipient does not want to be involved (s)he is under no obligation to and can simply disregard the questionnaire

Issues for participants. *Please answer the following and where you respond YES in any case, state how you will manage perceived risks:*

- a) Do any aspects of the study pose a possible risk to participants' physical well-being? NO
- b) Will any important information about the research be deliberately withheld from the participants? **NO**
- c) Are there any aspects of the study that participants might find humiliating, embarrassing, ego-threatening, in conflict with their values, or be otherwise emotionally upsetting?* **NO**
- d) Are there any aspects of the study that might threaten participants' privacy (e.g. questions of a very personal nature; observation of individuals in situations which are not obviously 'public')?* NO
- e) Does the study require access to confidential sources of information (e.g. medical records)? **NO**
- f) Could the intended participants for the study be expected to be more than usually emotionally vulnerable (e.g. medical patients, bereaved individuals)? NO

*Note: if the intended participants are of a different social, racial, cultural, age or sex group to the researcher(s) and there is <u>any</u> doubt about the possible impact of the planned procedures, then opinion should be sought from members of the relevant group.

- 6. Might conducting the study expose the researcher to any risks (e.g. collecting data in potentially dangerous environments)? NO
- 7. Is the research being conducted on a group culturally different from the researcher? NO If yes, are sensitivities and problems likely to arise? If yes, please describe how you have addressed/will address them.
- 8. Does the research conflict with any of the Department's research principles? NO (please see attached list, page 7). If yes, describe what action you will take to address any conflicts?
- Will the research require the consent of any outside organisation? 9. YES If yes, describe how you will obtain consent.

The Environment Agency are the CASE partner. Andrew Baron from EA Humber Strategies and his manager Louise Turner have been heavily involved in the research strategy. They have approved the inclusion of the Environment Agency's logo on project related stationery.

Name of Researcher: Carl Lewis

Signature C - Lens Date 20/05/2009

This research proposed in this proforma must gain recommendation for approval from the Geography Ethics Officer. Once this is gained, formal approval will be given by the Geography Ethics Committee.

It is recommended that the research referred to in this proforma is given approval by the Geography Ethics Committee.Y / N

Name of Ethics Officer

Signature Date.....

Appendix E – Research Risk Assessment

DEPARTMENT OF GEOGRAPHY, THE UNIVERSITY OF HULL STUDENT RISK ASSESSMENT FORM FOR A FIELD PROJECT

1. Student names and mobile numbers:		Carl Lewis – 07870 989 313				
2. General Description of trip and work being assessed (do not use this form if work is outside the UK):		 PhD thesis data collection: Postal Questionnaires Interviews with various business people in the Humber Region 				
3. Number in group: 1		4. Trip Dates:		5. Pre-requisites:		
Number of students in group:	1	June 2009 – January 2010. Continuous project		Briefing & information to all participants:	N/A	
Number of assistants in group:	0			Code of Conduct understood and signed:	N/A	
6. Location, accommodation address and telephone:			7. Communication-contact details/details of reporting in procedure (note i):			
Various business sites. Will not be going further than Goole, so field work 'base' is still 137a, Cohen Building.			Mobile telephone. Reporting in/ out will only be necessary on sites visited and will require filling in a visitor book.			
8. Competency of participants to complete the task (to be completed by the supervisor see note ii):			9. Additional information:			
			N/A			

Hazard identified (see note iv)	How might someone be harmed?	Rating (HML)	Control measures
Road Traffic Accident	Car Crash	L	Drive Sensibly
Industrial Machinery on business sites	Personal Injury	L	Observe site rules
Getting Lost	Stress	L	Use a map
Lone working	Vulnerability	L	Keep a mobile phone with me

Signature:	Date:

Supervisor:	Signature:	Date:
Approved by Safety Officer (Paul McSherry)	Signature:	Date:

Notes:

- i. A suitable reporting in procedure must also be arranged following discussion with your supervisor and PMCS. If the reporting in procedure is with someone outside the University such as with parents, then they must be given clear instructions when to report to the University.
- ii. Competency of participants to complete the task. Supervisors of students should state in this section the competence required and what further training or instruction is needed for the tasks or activities described in 1.
- iii. The risk assessment should be taken into the field, along with relevant codes of practice for working in the field.
- iv. Hazard Checklist (hazard **potential** of a substance, activity or process to cause harm): THE FOLLOWING HAZARD CHECKLIST SHOULD BE USED WHEN PREPARING ASSESSMENTS ALTHOUGH IT IS LIKELY THAT OTHER HAZARDS MAY BE PRESENT:
 - TRAVELLING TO LOCATION
 - TRAVELLING ONCE AT LOCATION
 - SECURITY RISK (TERRORISM OR PERSONAL)
 - DEFECT/FAILURE OF EQUIPMENT
 - UNSAFE ACCOMODATION
 - ENVIRONMENTAL ADVERSE EFFECTS (EXTREMES OF WEATHER, SUNSTROKE/HYPOTHERMIA)
 - HAZARDS ASSOCIATED WITH AREAS OF WORK (SEA OR WATER COURSES, LANDSLIDE, ROUGH TERRAIN, WORK IN TRENCHES, AVALANCHE)
 - CONTACT WITH HAZARDOUS FLORA AND FAUNA
 - URBAN ENVIRONMENT (GETTING LOST, ROAD TRAFFIC, ABUSE, ATTACK, ROBBERY)
 - DEALING WITH OTHER PEOPLE, OTHER PEOPLES HOMES
 - DISTANCE FROM MEDICAL FACILITIES
 - SUPERVISION/LONE WORKING
 - HAZARDOUS ACTIVITIES OR SPORTS (DIVING, SNORKELLING, SWIMMING, CAVING, CLIMBING)
 - COMMUNICATION DIFFICULTIES
 - ABILITY TO DEAL WITH AN EMERGENCY
 - STUDENT BEHAVIOUR

Further reading

Health & Safety Executive, Five Steps to Risk Assessment.

Universities and Colleges Employers Association, Guidance on Safety in Fieldwork. (Copy kept in the Map Library)

Universities and Colleges Employers Association, Health & Safety Guidance When Working Overseas. (Copy kept in the Map Library)

Health and Safety Guidance for Face to Face Interviewers,

http://www.mrs.org.uk/standards/downloads/drafths.pdf

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