

The Role of Social Capital in Influencing the Response Capacity of Farmers to Bovine Tuberculosis

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Rhiannon Kate Fisher

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Dedication

This thesis is dedicated to my father, David Fisher, whose passion for farming has been a huge inspiration. His immense hard work and dedication has encouraged me to always strive to do better and he has opened my mind to the hugely important role that farmers play in providing our food and managing our beautiful countryside.

ABSTRACT

Bovine tuberculosis (bTB) is one of the principal concerns currently facing the livestock industry in England. The disease has spread dramatically in recent years and is costing the country millions of pounds each year. Tens of thousands of cattle are being slaughtered annually; a huge financial and emotional burden to affected farmers. While various measures to control the disease have been taken, none have been successful in bringing it under control. Instead bTB continues to spread unabated.

The essence of the bTB problem is that it necessitates industry buy-in in order to implement disease control measures. It is therefore not simply an issue of regulation. Current government bTB control policy emphasises communication and cooperative working across the government and the farming industry, coupled with cost and responsibility sharing. However, previous studies have shown that relationships between farmers and the government are already strained, engendered by a sense of distrust and a lack of confidence.

Although some social science work has been conducted within the field of disease control and particularly bTB, the majority focuses on farmers' attitudes towards government policy and disease control. However, in order to implement successful disease control measures it is necessary to explore the ways in which farmers currently respond to bTB, and how their responses may be recognised by, and incorporated into, successful policy. While previous research has identified the important role of the wider social context in influencing farmers' attitudes and behaviour, no studies have yet provided an in-depth analysis of farmers' social networks in relation to bTB. In response, this study uses the lens of social capital to explore the various social ties which enhance or constrain farmers' capacity to respond to bTB.

An iterative, mixed methods approach is adopted across two phases of research. The first incorporates twenty in-depth qualitative farmer interviews, exploring various aspects of bTB risk and response strategies as well as the core features of social capital. This informs a second, quantitative phase, in which data are

gathered through a self-completion postal survey of 374 farmers in the South West of England. A farmer segmentation model is developed using factor and cluster analysis and two farmer groups are identified. The first group represents vulnerable farmers who are concerned about the negative impacts of bTB, and who are internally focused with respect to their networks. Characteristically, they exhibit strong relationships with others from within the farming community. In comparison, the second group are more resilient and less concerned about the impacts of bTB on their farm business. These farmers are externally focused, mainly seeking information from the government, the National Farmers' Union and their vet.

The role of various forms of social capital is explored and an important distinction between the two farmer groups is found. Vulnerable farmers tend to be members of close networks of other farmers (bonding social capital), while resilient farmers are more likely to enjoy positive relationships with those from outside the farming community including vets (bridging social capital) and the government (linking social capital). However, while the research findings suggest that bridging and linking social capital can positively influence farmers' attitudes towards bTB, they do not necessarily lead to positive disease control behaviour. Statistical analysis of the data reveals no significant differences between the farmer groups in terms of their uptake of biosecurity measures, which represents an important disease avoidance strategy. A disjuncture between farmers' attitudes and their behaviour is therefore identified.

The research concludes that investment in social capital between the government and farmers should form a core area of policy through providing opportunities for consistent and regular contact, allowing for the development of trusting and productive relationships. The current situation, characterised by low levels of trust and limited uptake of recommended disease control measures by farmers, indicates incoherence with contemporary policy discourses. A better understanding of the role of social capital in influencing farmer attitudes and behaviour will enable policy makers to increase the ability of farmers to respond to bTB risk, either through disease avoidance or through more effective management and coping mechanisms.

AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of the University of Gloucestershire and is original except where indicated by specific reference in the text. No part of the thesis has been submitted as part of any other academic award. The thesis has not been presented to any other education institution in the United Kingdom or overseas.

Any views expressed in the thesis are those of the author and in no way represent those of the University.

Signed Date

RHIANNON FISHER

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CONTENTS

Abstract	ii
Author’s Declaration	iv
Acknowledgements	v
Contents	vi
List of Abbreviations	xi
List of Figures	xii
List of Tables	xiii
CHAPTER 1. INTRODUCTION	1
1.1 Introduction	1
1.2 A short history of bTB and current policy	2
1.3 Potential impacts, response and social capital	4
1.4 Aims and objectives	6
1.5 Thesis structure	7
CHAPTER 2. RISK AND RESPONSE	9
2.1 Introduction	9
2.2 BTB and related policy	10
2.3 bTB Risk	16
2.3.1 bTB Epidemiology.....	16
2.3.2 Impacts.....	17
2.3.3 Financial Impacts.....	17
2.3.4 Practical Impacts.....	18
2.3.5 Emotional Impacts	19
2.3.6 Attitudes towards biosecurity	20
2.4 bTB response capacity	21
2.5 Resilience and vulnerability	24

2.6	Understanding farmers’ attitudes towards risk	27
2.7	Risk perception amongst farmers	30
2.8	Farmer behaviour	32
2.9	Towards a model of farmer segmentation	34
2.10	A further exploration of the social context of farmers’ risk behaviour	38
2.11	Conclusion	40

CHAPTER 3. SOCIAL CAPITAL: A REVIEW OF THE LITERATURE**41**

3.1	Introduction	41
3.2	Defining social capital	43
3.3	The importance of structure: bonding, bridging and linking social capital	48
3.4	The nature of investment	52
3.5	Farmers, disease control and social capital	53
3.5.1	Networks	54
3.5.2	Norms of behaviour	57
3.5.3	Trust	58
3.6	Conclusion	62
3.7	A conceptual framework for this study	63
3.8	Research issues and questions	70

CHAPTER 4. METHODS

4.1	Introduction	73
4.2	A mixed methods approach	74
4.3	Ethical considerations	76
4.4	Phase 1 methodology	77
4.4.1	Positioning the study	77
4.4.2	A Social Ecological perspective	79
4.4.3	Developing an interview schedule	81
4.4.4	Piloting	81

4.4.5	Phase 1 selection of study areas.....	82
4.4.6	Selection of the participants.....	89
4.4.7	Phase 1 data analysis.....	90
4.5	Phase 2 methodology.....	91
4.5.1	Developing the survey.....	94
4.5.2	Piloting the postal survey.....	96
4.5.3	Sampling strategy.....	97
4.5.4	Problems with the sampling strategy.....	99
4.5.5	Response rate.....	99
4.5.6	Data analysis.....	100
4.6	Summary.....	103
CHAPTER 5. PHASE 1 RESEARCH FINDINGS.....		104
5.1	Introduction.....	104
5.2	Farm and farmer characteristics.....	104
5.3	Research findings.....	106
5.3.1	The role of trust and its relationship with different forms of social tie 106	
5.3.2	The role of knowledge.....	114
5.3.3	The distinction between information dissemination and knowledge transfer	116
5.3.4	The role of social networks in providing different forms of support	120
5.3.5	The potential for exclusion brought about by overly close ties.....	125
5.4	Summary of phase 1 research findings.....	126
5.5	Implications for next research phase.....	127
CHAPTER 6. PHASE 2 RESEARCH FINDINGS.....		129
6.1	Introduction.....	129
6.2	Descriptive results from the farmer survey.....	130
6.2.1	Respondent characteristics and non-response bias.....	130
6.2.2	Risk perception.....	135
6.2.3	bTB experience.....	137
6.2.4	Biosecurity.....	139
6.2.5	Seeking advice/information.....	140
6.2.6	Trust.....	142
6.2.7	Correlation analysis.....	143

6.2.8	Involvement in the farming community	147
6.2.9	Summary of the descriptive findings	148
6.3	Factor Analysis – identification of underlying strategic variables	148
6.3.1	Suitability of the data	148
6.3.2	Interpretation.....	153
6.4	Cluster analysis	156
6.4.1	Preparation and analysis of the data	157
6.4.2	Step 1. Hierarchical method.....	159
6.4.3	Step 2. Non-hierarchical method	161
6.4.4	Profiling the final cluster solution	162
6.5	Profiling of the farmer groups	164
6.5.1	Farm and farmer characteristics.....	164
6.5.2	Risk perception	167
6.5.3	bTB experience	169
6.5.4	Attitudes towards bTB control.....	172
6.5.5	Uptake of biosecurity measures	173
6.5.6	Farmer networks	174
6.5.6.1	Internal networks	175
6.5.6.2	External networks	176
6.6	Summary of phase 2 research findings	182
CHAPTER 7. DISCUSSION		184
7.1	Introduction	184
7.2	Farmer segmentation model.....	185
7.3	Farmers’ response to bTB	186
7.4	The role of social capital	189
7.4.1	Bonding social capital.....	190
7.4.2	Bridging social capital	194
7.4.3	Linking social capital	197
7.5	From influencing attitudes to influencing behaviour	202
7.5.1	Constraints to behaviour change.....	204
7.6	Theoretical considerations for the study findings	207
7.6.1	The importance of social capital	209
7.7	Summary	210

CHAPTER 8. CONCLUSION	211
8.1 Introduction.....	211
8.2 Key findings	211
8.3 Considerations for policy.....	214
8.3.1 Engagement	215
8.3.2 Encouragement	217
8.3.3 Enable	218
8.3.4 Lead by example	219
8.4 Methodological considerations and limitations	220
8.5 Areas for further research.....	222
8.6 Final concluding remarks.....	224
Appendices	250

LIST OF ABBREVIATIONS

AHO	Animal Health Officer
AHVLA	Animal Health and Veterinary Laboratories Agency
BCG	Bacillus Calmette–Guérin (tuberculosis vaccine)
BSE	Bovine spongiform encephalopathy
bTB	Bovine Tuberculosis
CLA	Country Land and Business Association
Defra	Department for Environment, Food and Rural Affairs
ELS	Entry Level Stewardship
FERA	Food and Environment Research Agency
FMD	Foot and Mouth disease
ISG	Independent Scientific Group
LQ	Location Quotient
NFU	National Farmers Union
NVZ	Nitrate Vulnerable Zone
OTF	Official TB-free status
OV	Official Veterinarian
RBCT	Randomised Badger Culling Trial
RCT	Rational Choice Theory
SoCAT	Social Capital Assessment Tool
SCI	Social Capital Initiative
SWTBFAS	South West TB Farm Advisory Service
VO	Veterinary Officer
UK	United Kingdom
TORA	Theory of Reasoned Action

LIST OF FIGURES

<i>Figure 2.1 National spread of bTB since 1986 (Defra, 2011b)</i>	10
<i>Figure 2.2 Categories of farm households in terms of risk management behaviour and approach to multifunctionality (Petrics, 2008)</i>	29
<i>Figure 3.1 Conceptual Model</i>	67
<i>Figure 3.2 A further deconstruction of social capital (A)</i>	68
<i>Figure 3.3 A further deconstruction farmers' response to bTB risk (B)</i>	69
<i>Figure 4.1. Pathways to disease control model (Ellis-Iversen et al., 2010)</i>	80
<i>Figure 4.2 Herds under restriction in South West England as a percentage of herds under restriction in England in 2009 (Defra, 2010b reproduced by Butler, Lobley and Winter, 2010)</i>	83
<i>Figure 4.3 Stages of data analysis in phase 2</i>	102
<i>Figure 6.1 Final cluster profiles</i>	163
<i>Figure 7.1 Farmer bTB response strategy</i>	188
<i>Figure 7.2 From influencing attitudes to influencing behaviour</i>	206

LIST OF TABLES

<i>Table 2.1: Comparison of studies identifying farmers' primary concerns (Coble and Barnett, 2008)</i>	<i>31</i>
<i>Table 4.1 Relative distribution of farms with bovine TB by number of holdings (Butler, Lobley and Winter, 2010)</i>	<i>84</i>
<i>Table 4.2 Percentage of herds under cattle movement restrictions by area 1998-2008 (Defra, 2010b).....</i>	<i>86</i>
<i>Table 4.3 Farm characteristics data (Defra, 2009b).....</i>	<i>87</i>
<i>Table 4.4 Farm tenure (Defra, 2009b)</i>	<i>88</i>
<i>Table 4.5 Farm size by area (Defra, 2009b).....</i>	<i>88</i>
<i>Table 4.6 Sample summary</i>	<i>90</i>
<i>Table 4.7 Key aspects of social capital as suggested by Hall (2008).....</i>	<i>93</i>
<i>Table 4.8 Number of usable survey returns by county.....</i>	<i>100</i>
<i>Table 6.1 Summary of sample by county and herd type.....</i>	<i>131</i>
<i>Table 6.2 Population data by county and herd type (Defra 2009b)</i>	<i>132</i>
<i>Table 6.3 Respondents' risk perceptions</i>	<i>136</i>
<i>Table 6.4 bTB avoidance factors</i>	<i>139</i>
<i>Table 6.5 Uptake of recommended biosecurity measures.....</i>	<i>140</i>
<i>Table 6.6 Level of likelihood that respondents would approach the listed informants for advice about bTB</i>	<i>141</i>
<i>Table 6.7 Levels of perceived knowledge among informants</i>	<i>142</i>
<i>Table 6.8 Levels of perceived trustworthiness among informants.....</i>	<i>143</i>
<i>Table 6.9 Private vet - correlation between whether respondents are likely to seek the informant's advice, levels of perceived trustworthiness and knowledge, and regularity of contact.....</i>	<i>144</i>
<i>Table 6.10 NFU - correlation between whether respondents are likely to seek the informant's advice, levels of perceived trustworthiness and knowledge, and regularity of contact.....</i>	<i>144</i>
<i>Table 6.11 AHO - correlation between whether respondents are likely to seek the informant's advice, levels of perceived trustworthiness and knowledge, and regularity of contact.....</i>	<i>145</i>

<i>Table 6.12 Defra - correlation between whether respondents are likely to seek the informant's advice, levels of perceived trustworthiness and knowledge, and regularity of contact.....</i>	<i>145</i>
<i>Table 6.13 Total variance explained for the extracted factors</i>	<i>152</i>
<i>Table 6.14 Results of principal component analysis of variables.....</i>	<i>153</i>
<i>Table 6.15 Analysis of agglomeration coefficient for hierarchical cluster analysis</i>	<i>160</i>
<i>Table 6.16 Clustering variable profile for the two cluster solution from hierarchical cluster analysis</i>	<i>162</i>
<i>Table 6.17 Farmer group profiles based on farm and farmer characteristics ...</i>	<i>165</i>
<i>Table 6.18 Farmer group profiles based on the level of control the respondent feels they have over their business</i>	<i>167</i>
<i>Table 6.19 Farmer group profiles based on risk perception</i>	<i>169</i>
<i>Table 6.20 Farmer group profiles based on bTB experience</i>	<i>171</i>
<i>Table 6.21 Farmer group profiles based on their attitudes towards bTB</i>	<i>172</i>
<i>Table 6.22 Farmer group profiles based on their uptake of recommended biosecurity measures.....</i>	<i>174</i>
<i>Table 6.23 Farmer group profiles based on internal support network</i>	<i>176</i>
<i>Table 6.24 Farmer group profiles based on attitudes towards the NFU.....</i>	<i>177</i>
<i>Table 6.25 Farmer group profiles based on contact with their private vet.....</i>	<i>178</i>
<i>Table 6.26 Farmer group profiles based on levels of trust.....</i>	<i>179</i>
<i>Table 6.27 Farmer group profiles based on levels of confidence in the knowledge of institutions, groups and individuals</i>	<i>180</i>
<i>Table 6.28 Summary of farmer group profiles.....</i>	<i>181</i>

CHAPTER 1. INTRODUCTION

1.1 INTRODUCTION

Bovine tuberculosis (bTB) is a bacterial disease found in cattle and other mammals throughout much of the world. The disease is currently having a devastating effect on cattle farms in England, particularly in the South West and West Midlands, and is now costing the country over £90 million a year in compensation and costs associated with bTB testing (Defra, 2011a). Although once almost eradicated in the United Kingdom (UK), in 2010 the disease led to the slaughter of over 28,000 cattle (Defra, 2011b). The increased prevalence of bTB has been well documented in recent years (White and Benhin, 2004; Independent Scientific Group (ISG), 2006; Ramírez-Villaescusa *et al.*, 2009). In 1986, only 235 cattle tested positive for the disease, but this increased tenfold over the following ten years (Defra, 2011b). After the Foot and Mouth crisis of 2001, the disease spread exponentially, despite increasingly stringent control measures including strict pre-movement testing and cattle movement restrictions, periodic testing and slaughter of infected cattle, and on-farm biosecurity measures. Nonetheless, the disease continues to spread unabated, often devastating cattle herds and having major financial, practical and emotional impacts on farmers.

The essence of the bTB problem is that it necessitates industry buy-in in order to implement disease control measures. It is therefore not simply an issue of regulation. In 2011 the government published its new bTB eradication programme, which promotes industry-wide cooperation, responsibility sharing, and partnership working (Defra, 2011a). Consequently, within the context of current policy discourses, bTB control is likely to be at least partly dependent on farmers' attitudes towards the disease and the government. In this sense, it is socially situated, likely to be influenced by farmers' wider beliefs, values and knowledge. To consider the ability of farmers to respond to the disease in isolation from wider social phenomena would

therefore be unhelpful and incomplete. With this backdrop, the research presented in this thesis explores farmers' bTB response capacity through the lens of social capital. The research uncovers the influence of networks, trust, and norms of behaviour which, as will be shown later, are critical for understanding farmers' capacity to respond to bTB.

The subsequent section provides a brief history of bTB and current policy, followed by an overview of its potential impacts and the actions that farmers may take in response to the disease. The role of social capital and its relevance to the study is then introduced. Following this, the aims and objectives are presented and the structure of the thesis is outlined.

1.2 A SHORT HISTORY OF BTB AND CURRENT POLICY

Tuberculosis in humans was one of England's most urgent health problems during the eighteenth and nineteenth centuries with one in four deaths attributed to the disease. Throughout the nineteenth century cases of tuberculosis began to fall as socioeconomic conditions improved. Cases further decreased when the bacterium which causes the disease, *Mycobacterium tuberculosis*, was discovered in 1882, and with the subsequent invention of the X-ray in 1895, which helped to detect the disease. The development of the tuberculosis vaccine (BCG) in 1921 further stemmed the spread of the disease in humans. However, tuberculosis was still prevalent throughout the first half of the twentieth century, with 200 deaths in every 100,000 caused by the disease in 1950 (Vynnycky and Fine, 1999).

A connection between tuberculosis in humans and cattle was first suggested at the end of the nineteenth century, when Theobald Smith identified the three different species of tuberculosis bacteria that cause tuberculosis in humans, one of which was *Mycobacterium bovis* (*M. bovis*) (LoBue, 2006a). Following this, the British Royal Commission conducted extensive research which demonstrated that cow's milk infected with *M. bovis* caused extrapulmonary tuberculosis in humans (Foster *et al.*, 1907). At the time, it was estimated that as many as 40% of the cattle in Great

Britain were infected (Goodchild and Clifton-Hadley, 2006). In response, widespread pasteurisation of dairy products began, coupled with eradication schemes in cattle herds, involving skin-testing and the slaughtering of infected animals. By the 1990s less than 1% of human cases of tuberculosis in the industrialised world were attributed to transmission from cattle (LoBue, 2006). Although bTB is no longer considered a significant zoonosis in Great Britain, the prevalence of the disease in cattle continues to be a major concern.

In cattle, bTB causes reduced productivity and premature death (Krebs *et al.*, 1997), both of which have implications for wider farm productivity and the overall viability of the dairy and beef industries in the UK. Sustained disease outbreaks in livestock can also lead to problems associated with international trade agreements, should herds testing positive to bTB reach a critical level (RELU, 2010). Control and eventual eradication of the disease is therefore essential. However, achieving this is far from simple, not least because the political context surrounding bTB is complex, with numerous stakeholders involved, many of whom hold opposing views.

The main area of contention relates to one of Great Britain's most iconic mammals, the Eurasian badger (*Meles Meles*). In the early 1970s, following the discovery of an infected badger on a farm in Gloucestershire which had recently gone down with bTB, a connection between the spread of the disease in cattle and infection in badgers was first suggested (Enticott, 2001). This led to a series of badger eradication programmes (Goodchild and Clifton-Hadley, 2006). However, towards the end of the 1990s cases of bTB in cattle began to increase, bringing into question the role of the badger in spreading the disease and with it the ethics of badger culling. A Randomised Badger Culling Trial (RBCT) was commissioned in 1997 which monitored the impacts of badger culling. However, the trial proved inconclusive. Since then, little progress has been made in relation to bTB control policy, with cases of the disease continuing to increase. More recently, the results of the trials have been revisited and the government has since put forward a new bTB eradication programme which includes the culling of badgers in two trial areas

(Defra, 2011a). The programme also emphasises cooperation, partnership working and positive relationships between farmers and the government. However, the spread of bTB, coupled with other crises in the farming industry such as the 2001 Foot and Mouth disease outbreak, BSE and other food scares, has contributed to difficult relations and a lack of trust between the industry and the government (Enticott *et al.*, 2011; Wilkinson, 2010). With little indication as to how this trust will be built and relationships developed, there appears to be a substantial rhetoric-reality gap. At a time when bTB control policy faces substantial changes, it is timely to explore farmers' attitudes towards bTB and its control. Understanding the ways in which farmers respond to the disease, and the factors that influence their response is essential.

1.3 POTENTIAL IMPACTS, RESPONSE AND SOCIAL CAPITAL

Although farmers are compensated financially for slaughtered animals, a bTB breakdown¹ is likely to have far reaching impacts on the farm business, many of which are brought about by the cattle movement restrictions that are subsequently imposed (Butler, Lobley and Winter, 2010). Additionally, farmers who experience a disease breakdown must have the bTB infected cattle slaughtered which, for some farmers, can be highly emotional (PSI, 2005).

There are various ways in which farmers are likely to respond to bTB. Farmers who are exposed to disease risk but whose herds do not actually contract the disease, will respond differently to those who must cope with, and recover from a bTB breakdown. Response incorporates a number of strategies which include measures to avoid, cope and adapt to the impacts of the disease. The main farm-level avoidance strategy promoted by government is the implementation of biosecurity measures, which limit contact between badgers and cattle and subsequently reduce the risk of disease transmission. However, research has shown that current levels of implementation among farmers is low (Enticott, 2008a; Bennett and Cooke, 2005).

¹ A confirmed breakdown refers to any herd which has had its official TB Free (OTF) status withdrawn, meaning that at least one animal has tested positive to TB in the comparative intra-dermal skin test, and either suspicious lesions have been found at the slaughterhouse on examination or *M. bovis* has been confirmed at culture.

A number of studies carried out by Enticott and colleagues (Enticott and Vanclay, 2011; Enticott and Franklin, 2009; Enticott, 2008a) have shown that farmers' disease behaviour is based on a set of deeply held beliefs about bTB that are strongly influenced by wider cultural and social dimensions. As a result, farmers portray themselves as faultless victims who rely on their own lay epidemiologies due to their scepticism of government and scientific knowledge. Enticott and Vanclay (2011) have shown that government attempts to influence these understandings have failed to recognise that it is not *what* is being communicated that is wrong *per se*, but instead the *way* that it is being communicated. The social context in which farm-level bTB control is positioned is thus far from straightforward. However, in order to implement successful policy, and to achieve the cooperative approach to disease control that the government requires, understanding this context is crucial.

While Enticott's work has usefully explored the various social influences on farmers' attitudes towards biosecurity, it does not provide a detailed analysis of farmers' social networks within a bTB context. While certain relationships have been shown to be important, for example the relationship between a farmer and his or her vet (Enticott, 2011), the way that such relationships are formed and the factors which allow them to be productive are less well understood. In order to gain a comprehensive understanding of farmers' capacity to respond to bTB, an exploration of these social networks is essential.

In response, this study makes use of the social capital framework to help understand farmers' attitudes towards, and response to bTB. The concept of social capital (defined by Putnam (2000) as the stocks of social trust, networks and values that people can draw upon in order to improve their livelihoods), has received substantial interest from academics and policy makers in recent years (Grootaert and Van Bastelaer, 2002; The World Bank, 2009). The concept allows for a thorough exploration of productive relationships at household, community and institutional levels. It also allows both horizontal and vertical linkages to be addressed. In this study, the social capital framework is used to help explore the various relationships which provide access to resources that enable farmers to respond to bTB

successfully. Such resources may include physical or financial capitals, or less tangible assets such as knowledge and emotional support. In so doing, this study will contribute to the field of livestock disease control which, in the past, has seen a particular emphasis on epidemiology and ecology (see, for example, Independent Scientific Group (ISG), 2006; McDonald *et al.*, 2008). Within this field, the social science perspective has been somewhat neglected despite policy discourses which increasingly focus on cooperation and partnership working across government and the agricultural industry (Defra, 2011a). In fact, understanding farmers' attitudes and behaviour has been shown to be essential in implementing appropriate and successful policy (Morris *et al.*, 2000; Wilson *et al.*, 2001; Gorton *et al.*, 2008; Barnes *et al.*, 2009).

1.4 AIMS AND OBJECTIVES

The aim of this thesis is to explore the role of social capital in influencing the response capacity of farmers to bTB in England. In order to fulfil this aim, six central objectives will be met:

1. To critically review the academic literature on social capital and risk within the context of English farmers.
2. To develop a conceptual framework that allows the relationships between social capital, risk, vulnerability, resilience and response capacity to be explored.
3. To determine farmers' current bTB response strategies and the role of social capital within them.
4. To explore the social capital of farmers in terms of the various relationships within their social networks, and the resources to which each relationship provides access.
5. To use statistical methods to generate a segmentation model of farmers with respect to their bTB response capacity and their social capital.
6. To recommend policy interventions that will help to enhance the ability of farmers to successfully respond to bTB risk.

This study makes a unique contribution to the academic and policy literature in two main ways. Firstly, the empirical study will inform the literature on livestock disease control, especially with regard to farmers' response to bTB and farm-level control strategies. Secondly, by gaining a thorough understanding of the role of social capital in influencing farmers' ability to respond to bTB, it aims to inform policy making, which in the context of disease control, has tended to focus almost exclusively on top-down regulation (for example, compulsory testing and cattle movement restrictions), neglecting the importance of local knowledge and the complex relationships present between the various stakeholders involved.

1.5 THESIS STRUCTURE

In the subsequent chapter various aspects of bTB risk are introduced, including the financial, practical and emotional impacts associated with the disease. Drawing on literature relating to risk and risk perception, a discussion around the ways in which farmers respond to the disease is provided. Three key terms are then presented: vulnerability, resilience and response capacity. The factors influencing behaviour, and their potential relationship with wider social dimensions, are then discussed. This relates closely to the research that has been undertaken on farmer segmentation, which is reviewed in the penultimate section of the chapter.

This is followed by a detailed review of the social capital literature. A discussion of the main theoretical debates which surround the concept is provided. Through this, the approach of a number of influential social capital theorists is critiqued and a definition of the concept is put forward. Focusing on social capital among farmers, the core components of the concept are then introduced. At the end of the literature review, a conceptual framework for the study is set out and a series of research questions are put forward.

In the fourth chapter an explanation of the research methods that were adopted is provided, together with details relating to the sampling strategies and methods used for analysing the data.

An analysis of the results from twenty qualitative farmer interviews is presented in Chapter Five. Various relationships are explored, including those between farmers and the government and between farmers and their private vets. The nature, extent and significance of relationships between farmers and within farming families are also explored. Following this, the findings from a quantitative analysis of a self-completion postal survey are presented in Chapter Six. A farmer segmentation model is developed in order to further explore and clarify the relationship between social capital and the capacity of farmers to respond to bTB.

Chapter Seven presents a series of observations based on the research findings. The relationship between farmers and the government is a main area of discussion, focusing on the role of social capital in increasing levels of trust in government policy, and thus encouraging cooperation and support from farmers. A discussion of the limitations of the study and recommendations for further research are then put forward in the final chapter and a number of pragmatic policy recommendations are outlined.

CHAPTER 2. RISK AND RESPONSE

2.1 INTRODUCTION

Although the risk posed by bTB to farmers is well documented (Johnston *et al.*, 2005; Butler *et al.*, 2010; Defra, 2011a) there has been limited research into how farmers respond to it. In fact, very little social science research has been conducted in relation to bTB in general. The social science studies that do exist generally focus on farmers' attitudes towards disease control measures, particularly biosecurity (Bennett and Cooke, 2005; Enticott, 2008b; Enticott, 2008c; Enticott *et al.*, 2011). However, farmers' response to bTB is key to the implementation of successful disease control policies, particularly at a time when the government is emphasising cooperation and partnership working across government and the farming industry (Defra, 2011a).

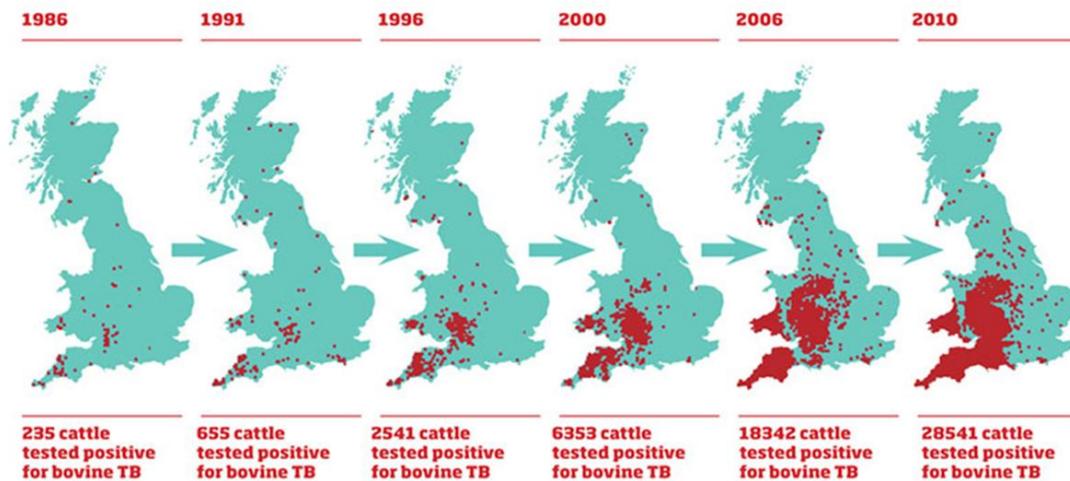
This chapter therefore explores the concept of response capacity, and the various strategies that can be taken by farmers to respond to bTB, including avoidance, coping, or adaptation. The chapter begins by summarising the current disease situation and providing an overview of the development of bTB control policy. This identifies the complexity of the policy context, emphasising the influence of social and cultural understandings of disease. The chapter then explores the various impacts associated with bTB which affect farmers financially, practically and emotionally. The various strategies that are currently in place to address these are also discussed. Two key terms associated with response capacity, vulnerability and resilience, are then explored and defined. In this context it is important to note that risk is partly subjective and may impact upon individuals very differently. Understandings of risk and risk perception are therefore addressed and models of farmer behaviour are discussed. Throughout the chapter the importance of various social dimensions in exploring farmers' attitudes and behaviour are emphasised. This is addressed more fully at the end of the chapter when the concept of social

capital is presented and its role in this study is introduced. A detailed review of the social capital literature is provided in the following chapter.

2.2 BTB AND RELATED POLICY

In order to stem the spread of bTB and make moves towards eradication, the implementation of control measures is essential. In 1935 the Attested Health Scheme was introduced, which was initially a voluntary scheme through which farmers could have their herds tested. By the 1950s cattle testing became compulsory, with great success, almost leading to the eradication of the disease in the 1960s (Goodchild and Clifton-Hadley, 2006). However, small numbers of outbreaks persistently occurred in areas of Gloucestershire and Cornwall and disease outbreaks began to increase at the beginning of the 1980s. Since then, numbers of outbreaks have increased dramatically, as shown in Figure 2.1.

Figure 2.1 National spread of bTB since 1986 (Defra, 2011b)



Compulsory periodic testing of cattle has continued. Cattle are tested every one to four years depending on the level of disease in the parish (see Appendix 1). The test itself has not changed since it was initiated in the 1930s and is commonly known as

the *tuberculin skin test*². Farmers are compensated for slaughtered animals based on table values which reflect average sale prices of cattle. There are 51 cattle categories which encompass a variety of characteristics such as an animal's age, gender, type (beef or dairy) and whether or not it is pedigree (Defra, 2012b). If one or more animals react to the skin test, the herd's official TB free (OTF) status is suspended. Post-mortems or tissue sample tests are then carried out on reactors that have been slaughtered in order to confirm infection. If infection is confirmed the OTF status is withdrawn. As soon as the herd's OTF status is lost (either suspended or withdrawn), the herd is subject to strict movement restrictions which prevent farmers from moving cattle off their farm unless they are going straight to slaughter (Defra, 2008). The herd remains under movement restrictions until all the cattle have passed two further bTB skin tests at 60-day intervals. Once they have passed, two more tests are carried out at six and twelve months. If the herd passes all of these tests they revert to their routine testing frequency (Animal Health, 2012). The loss of OTF status is more commonly referred to as a bTB breakdown.

In addition to the routine bTB tests required by law, all farmers in one or two yearly testing areas (Appendix 1) are required to have their cattle tested before they are moved. Any animal aged 42 days or over must have tested negative for bTB within the 60 days before it is moved. This is known as pre-movement testing and must be arranged and paid for by the farmer (Animal Health, 2012).

The Animal Health and Veterinary Laboratories Agency (AHVLA), an executive agency working on behalf of Defra, is responsible for administering bTB testing and movement restrictions. However, often the bTB tests are carried out by private practice veterinarians in their role as Official Veterinarians (OVs) which requires

² The testing procedure involves injecting a small amount of avian and bovine tuberculin into two separate areas in the skin on the neck of a cow, which will cause an allergic reaction (in the form of localised swelling) if an animal is infected with bTB. If swelling occurs, the two lumps are measured and if the swelling associated with the bovine tuberculin is over 4mm greater than that caused by the avian tuberculin, the animal is considered to be infected with bTB and is called a 'reactor' (as it has reacted to the test) and is removed from the herd and slaughtered. If the difference between the lumps is between 1 and 4mm the animal is considered to be an inconclusive reactor and is retested after 60 days (Animal Health, 2012).

them to undertake work of a statutory nature. If bTB is detected in a herd, a farmer is often visited by a Veterinary Officer (VO) from the AHVLA, who will discuss the situation with the farmer (Animal Health, 2012).

In addition to Defra's bTB test and slaughter programme, farmers are encouraged to reduce the risk of disease in their herd through the implementation of a number of biosecurity measures to limit contact between badgers and cattle. For example Defra (2007b) recommends securing feed stores and covering silage clamps. Farmers are also encouraged to breed their own replacement stock in order to maintain a closed herd. When VOs visit a farm after a breakdown, they provide advice to farmers on how they can improve their biosecurity practices (Defra, 2011a).

While current bTB control policy is focused on controlling the disease in cattle, the government has also begun to address the disease in badgers. In 2010, the first badger vaccine was licenced and the Badger Vaccination Deployment Project is currently being undertaken in an area in Gloucestershire to assess the practicalities of administering the vaccine (Defra, 2012a). After the change of government in 2010, the Coalition published its proposals for bTB eradication (Defra, 2011a). The proposals emphasise the need for the continuation of bTB testing and movement restrictions but also highlight the need for the increased implementation of on-farm biosecurity measures. In addition, the document makes clear the government's commitment to addressing the disease in wildlife, through badger vaccination and culling.

The proposal to instigate badger culling follows a long history of contested evidence on the impact of such measures on the levels of bTB in cattle and has consequently been met with a great deal of debate. In 1997 the Krebs review on bTB in cattle and badgers concluded that there was "*compelling*" evidence that badgers were involved in transmitting the disease to cattle (Krebs *et al.*, 1997). However, the report also suggested that the development of appropriate badger control strategies was difficult due to the lack of quantifiable data to prove the effectiveness of badger culling.

Additionally, the report highlighted the need for a more proactive response from farmers, particularly in relation to improved husbandry to reduce the risk of contact between cattle and badgers. The report suggested that guidelines published by the Ministry of Agriculture Fisheries and Food (MAFF, now Defra), were often not followed by farmers (Krebs *et al.*, 1997). Fifteen years on, little has changed. Enticott and Vanclay (2011) found that farmers remain sceptical of scientific knowledge and lack trust in the government to eradicate the disease.

Despite a large scale trial into the efficacy of badger culling undertaken by the Independent Science Group on Cattle TB (ISG) between 1998 and 2006, as recommended by the Krebs report (1997), the evidence base remains contested. The study, known as the Randomised Badger Culling Trial (RBCT), was conducted in thirty 100km² areas in south west and central England, each of which was recognised as a disease hotspot. Within the thirty areas, three disease control methods were undertaken: proactive culling, whereby all badgers in the area were culled; reactive culling, where badgers were culled on or near farmland where there had been recent outbreaks of bTB; and no culling, whereby only surveys were undertaken in order to provide an experimental control for comparison. The final report resulting from the RBCT explicitly concluded that badgers contribute significantly to the spread of bTB in cattle. However, while the ISG concluded that badger culling could reduce numbers of bTB breakdowns in the areas where it was undertaken, it found that breakdowns were likely to increase in surrounding areas due to the perturbation of badger populations, whereby once disturbed, badgers flee to other areas. The study therefore concluded that badger culling could not contribute to a meaningful reduction of bTB in cattle (ISG, 2007). However, the results of the RBCT were contested due to the suspension of the trial during the Foot and Mouth epidemic in 2001 and again when reactive culling was thought to lead to an increased risk of bTB in cattle (Godfray *et al.*, 2004). Some reviewers strongly argued against the ISGs conclusion which warned against culling, including the government's Chief Scientific Advisor, Sir David King (2007). Additionally, some studies carried out more recently have argued that in the long-term, the perturbation

effect is reduced, increasing the efficacy of badger culling (see for example Fenwick, 2011).

Despite the findings of the ISG, in 2006 Defra launched a public consultation on badger culling. Somewhat surprisingly, in the consultation document Defra (2005a, p.5) clearly stated that “*the scientific evidence shows that intensive culling of large areas can be effective in helping to prevent the spread of bovine TB in cattle*”. The consultation received 47,000 responses, only 4% of which were in favour of badger culling (Defra, 2006). The ISG responded, stating that the results of the RBCT had been misinterpreted and arguing that the consultation document had not accurately portrayed the scientific evidence (ISG, 2006). Based on overwhelming public opposition, the government made a decision not to go ahead with badger culling and called for further scientific evidence. However, based on recommendations made by the ISG, the government extended pre-movement regulations to include younger cattle (Wilkinson, 2010). With this came a move towards responsibility and cost sharing between the government and farmers, which has been an increasing focus of bTB policy. The government agreed to continue to cover the costs of compulsory routine herd surveillance testing but required farmers to pay for pre-movement testing of their cattle. This move was in line with the Strategic Framework for the Sustainable Control of bTB which required the farming industry to take more responsibility for the financial impacts of the disease, aiming to “*improve stakeholder buy-in, [and] encourage a shared vision and ownership of the problems*” (Defra, 2005b, p.15).

Following years of inconclusive policy direction and the continued contestation of the scientific evidence base, the Coalition Government’s commitment to implementing a badger cull has provoked a huge amount of public controversy. Badger culling has been met with mixed reactions, with the Badger Trust taking the proposals to judicial review in June 2012 on grounds of inconclusive evidence to support the approach (Badger Trust, 2012). However, the Badger Trust lost its legal challenge in the Court of Appeal on the 11th September 2012 (The Telegraph,

11/09/2012). The culling of badgers was set to go ahead in the autumn of 2012 but has now been postponed to the summer of 2013. The cull will take place in two trial areas to examine the effectiveness, safety and humaneness of the controlled shooting of badgers (Defra, 2012c).

The frequent changes in policy direction that have occurred over the past fifteen years have led to confusion and frustration among the public and the farming industry (Wilkinson, 2010; Enticott and Vanclay, 2011). Enticott and Franklin (2009) go so far as to suggest that years of policy uncertainty has led to an 'institutional void' whereby a new political space has been created in which farmers have begun to challenge traditional disease control measures, particularly biosecurity. In doing so, the expertise of government is superseded by local knowledge and experience. Enticott and Franklin (2009) argue that in order to resolve this institutional void, the varying, and at times divergent, policy discourses which are occurring at different scales must be in some way mediated and unified. The situation is framed by wider social and cultural understandings, such as those identified by Cassidy (2012) who discusses the paradoxical representation of the badger in the media. Cassidy (2012) explains the complex role of the badger, which is portrayed both as an iconic symbol of the UK's native wildlife which has become victimised in the bTB debate, and as a vicious and diseased culprit, wholly responsible for the spread of the disease. The various representations have shaped both the public's and farmers' understandings of the disease.

The social context of bTB policy is essential in understanding farmers' responses to it. This is particularly pertinent at a time when current government policy emphasises cooperation across government, veterinary and agriculture industries, as well as responsibility and cost sharing. However, with relationships between farmers and the government already strained (Hall and Pretty, 2008b), it is arguable whether this approach is realistic.

In order to further address the social context of bTB, it is first necessary to explore the various impacts associated with the disease and the responses available to farmers. This is undertaken in the following sections.

2.3 bTB RISK

Risk is defined as “exposure to unfavourable consequences” that may lead to a transformation (Hardaker *et al.*, 2004, p.5). In the context of this thesis, bTB risk is considered to be the exposure of a farmer to the unfavourable consequences associated with a potential or actual bTB breakdown in their herd. Unfavourable circumstances may occur without a herd actually contracting the disease due to stress and worry, as well as practical and financial implications associated with bTB testing.

Various risk factors have been identified in the literature which relate to disease transmission between cattle as well as between cattle and other wildlife. This is explored in more detail in the following section.

2.3.1 bTB Epidemiology

There are two main causes of a bTB breakdown in a cattle herd: either bTB has persisted in the herd or its environment since the previous disease breakdown, or because bTB has been introduced into the herd since it was last tested for the disease. In order to understand the risks associated with each of these, it is important to address the factors that lead to either persistence or introduction of the disease.

Persistence of the disease is attributed to infected cattle that are not successfully identified by the tuberculin skin test remaining in the herd and infecting other cattle. The introduction of the disease can be from one of two sources: other cattle or another species. Cattle-to-cattle disease transmission can occur within herds or through the movement of infected animals. Various risk factors have been identified including proximity between cattle, ventilation and the length of time that the disease survives outside of the host (Goodchild and Clifton-Hadley, 2001).

In terms of transmission from other species, while other mammals have been shown to host and transmit the disease, badgers have been identified as a particularly prevalent disease transmitter with a number of studies finding a clear link between disease in cattle and in local badger populations (Krebs et al, 1997, Woodroffe et al, 2003). The badger is the UK's largest carnivore and shares its preferred habitat with cattle. Its diet consists mainly of earthworms but, being opportunists, its diet differs by season and by what is available in its territory, potentially leading to foraging in farm buildings, particularly in winter (Corner, 2007). bTB can be transmitted between badgers and cattle through direct aerosol or respiratory transmission or through indirect transmission through cattle contact with infected badger excreta (Allen et al., 2011).

The relative importance of badger-to-cattle and cattle-to-cattle disease transmission is unknown; however, a general consensus exists that the disease must be addressed in both cattle and badgers in order to prevent its spread (Corner, 2007). This entails various control policies, which have been outlined in the previous section.

2.3.2 Impacts

bTB risk is also associated with the various impacts associated with the disease. These are wide ranging and can affect farmers in a number of ways. Impacts of bTB can be broadly categorised into three groups: financial, practical and emotional. An overview of these impacts is provided below.

2.3.3 Financial Impacts

The financial impacts of bTB are well documented at both national and farm-level. According to a recent Defra report (2011a), the disease is costing the country over £90 million each year. However, farmers also incur substantial financial losses due to bTB. Defra (2011a) estimates the average cost of a bTB breakdown in which OTF status is withdrawn to be around £30,000. The majority of this cost falls to the government which compensates the farmer for slaughtered animals, as well as covering the direct cost of testing (e.g. the vet's time). However, there are a number

of consequential losses that fall to the farmer, including the on-farm cost of testing (e.g. additional labour, lost time), lower milk yields due to the stress caused to cattle, and the disruption to business caused by cattle movement restrictions.

An in-depth study carried out by Butler *et al.* (2010) into the economic impact of bTB in the South West found monthly losses associated with a bTB breakdown of between £505 and £3,184 among interviewed farmers. The study emphasised the indirect costs incurred by farmers including labour, feed and bedding costs and animal welfare issues, which can, in some cases, impact upon organic certification requirements and cross-compliance.

While the cost of compulsory tests is covered by the government, farmers are required to pay for pre-movement testing themselves. This can be a substantial cost, particularly in large herds. Bennett (2009) estimates the average cost of pre-movement testing to be £8.84 per animal although the study found that costs varied between farmers with some incurring costs of up to £20 per animal.

Some farmers may also incur financial impacts through investing in biosecurity measures to reduce the risk of their herd contracting bTB. Such measures include securing feed stores and raising feed and water troughs. Farmer attitudes towards such measures are discussed further in section 2.3.6.

2.3.4 Practical Impacts

Many of the practical impacts associated with bTB are directly related to the financial implications detailed above. For example, Christley *et al.* (2011) found that the costs associated with pre-movement testing were likely to limit the number of cattle movements undertaken by a farmer. Additionally, farmers located in low risk areas were found to be less likely to buy cattle from higher risk areas. Overstocking brought about by movement restriction is also likely to have practical implications relating to the availability of appropriate housing and the cost of additional feed and bedding.

Other practical impacts associated with bTB may come in the form of avoidance strategies. While the low uptake of biosecurity measures is well documented

(Enticott *et al.*, 2011; Enticott, 2008b; Bennett and Cooke, 2005), for farmers who do implement such measures there are likely to be a number of practical implications. For example, government advice encourages farmers to avoid contact between cattle and badgers and between different cattle herds. Farmers who follow this advice may be forced to avoid grazing certain areas of their farms, or be restricted in terms of where they can graze their cattle at particular times.

2.3.5 Emotional Impacts

In a study of the longer-term impacts of bTB, carried out by the University of Exeter and ADAS (2008), animal disease was identified as being a key contributor to stress among farmers. They suggest that animal disease often creates uncertainty for farmers as outbreaks occur suddenly and unexpectedly. With particular reference to bTB, the study found that farmers also became stressed when they were unable to market their cattle at an appropriate time due to movement restrictions. Farmers experiencing the highest levels of stress were those who had been under restriction for an extended period of time and those who had lost the most animals (University of Exeter and ADAS, 2008). A Policy Studies Institute (PSI, 2005) study found that a disease outbreak is likely to cause stress for the whole farm workforce, in particular for the farmer's spouse and adult children working on the farm. This is likely to be due to the close emotional ties that people working on farms have with the animals, with premature deaths considered 'unnatural' or a 'failure'.

While a disease breakdown is likely to cause stress to a farmer, the risk of disease can also have significant impacts, even if the risk is never realised. Enticott (2008b) suggests that farmers often feel that there is no way out due to the constant risk of bTB, driving them to commit desperate acts including the illegal culling of badgers and, in extreme cases, suicide. In a qualitative study of 61 cattle farmers in England and Wales, Enticott (2008b) found that some dairy farmers were forced to shoot bull calves at birth to reduce problems associated with overstocking when under bTB restriction. Such approaches are likely to have major emotional implications for some farmers.

2.3.6 Attitudes towards biosecurity

The implementation of on-farm biosecurity measures remains a key aspect of the government's approach to bTB control (Defra, 2011a). Current government proposals focus on encouraging farmers to take ownership of the disease, highlighting a move towards a more neoliberal approach to disease management. Farmers are encouraged to voluntarily implement localised forms of biosecurity as part of their responsibility to maintain the health of their livestock.

The focus on biosecurity emerged following concerns that other approaches (such as badger culling) were insufficient to eradicate the disease (Independent Scientific Group (ISG), 2006) and research which found that badgers infected with bTB were likely to forage in feed stores and livestock housing at night, potentially spreading the disease to cattle (Garnett, Delahay and Roper, 2002). In response, in 2007 the government published a number of biosecurity guidance leaflets, focusing on keeping badgers away from cattle feed, making farm yards less attractive to badgers and restricting grazing on high risk pasture (Defra, 2007a, 2007b). However, uptake of such measures has been consistently low (Enticott *et al.*, 2011; Enticott, 2008b; Bennett and Cooke, 2005) and a number of researchers have explored farmers' attitudes towards biosecurity in an attempt to understand this. Enticott (2008b) suggests that the overarching aim of the government's push to encourage the implementation of on-farm biosecurity measures was to present a certain style of farming which reduces the risk of a herd succumbing to bTB. However, the government appears to have overlooked the importance of wider cultural and social dimensions that influence farmer behaviour. Vanclay (2004) uses the concept of cultural styles of farming to understand farmer decision making. Farming styles, Vanclay (2004) argues, are heavily influenced by a wide range of social variables which shape farmers' understandings and values. As a consequence, changing farmers' decision-making processes is extremely difficult (Enticott, 2008b; Vanclay, 2004).

By exploring the wider social context of bTB, Enticott (2008b) examines the lay epidemiologies developed by farmers to explain the spread of bTB, which have

subsequently influenced their attitudes towards biosecurity. These understandings can often contradict government biosecurity advice. Enticott (2008b) suggests that the strength of farmers' beliefs about bTB is likely to override any other advice that they may receive. He explains that while farmers are aware of the risks associated with bTB, they are unlikely to change their animal health practices. Instead, many farmers are fatalistic and emphasise luck and the uncontrollable nature of the disease, often highlighting the fallibility of biosecurity measures. These findings stress the importance of understanding farmers' own beliefs about bTB, as well as their attitudes towards those attempting to influence their behaviour. These are both key to understanding the way that farmers respond to bTB risk.

The following section goes on to further explore farmers' attitudes towards bTB, and in particular the ways in which they respond to it. As this section has shown, the social context is key and is thus discussed throughout.

2.4 BTB RESPONSE CAPACITY

Response can be defined as any action taken by a region, nation, community or individual to tackle or manage change, in anticipation of or after the change has occurred (Tomkins and Adger, 2005). Therefore response capacity can be defined as a nation's, region's, community's or individual's ability to adopt the appropriate strategies to enable change to be managed successfully. In other words, response capacity refers to the ability to manage both the causes and the consequences of change.

There are a number of ways that farmers may respond to bTB. Firstly they may take steps to *avoid* their herds contracting the disease, through actively pursuing preventative measures. Secondly, if bTB is found in a farmer's herd their response may be to *cope* with, and recover from, the disease breakdown. A third response may be to live with, or *adapt* to the disease. This is particularly relevant to farmers who are placed under bTB restrictions for long periods of time. Not all farmers will have to face a bTB breakdown, but many of those living in disease hotspot areas will be very much aware of the risk it poses. Although they may not take physical action

to avoid the disease, these farmers may be confronted with emotional impacts such as stress and worry.

Many writers distinguish between mitigation and adaptation as being principal strategies to respond to risk. According to Perrings (2005, p.314), mitigation refers to “*actions designed to affect the probability of an outcome*” and adaptation to “*actions designed to affect the value of an outcome*”. In the simplest of terms, mitigation can be defined as *prevention* and adaptation as *protection*. Within the framework of avoidance, coping and adaptation suggested above, mitigation strategies are likely to be implemented in an attempt to both avoid and reduce potential impacts, helping farmers to respond more effectively.

In the context of bTB, a number of strategies are taken at both institutional and individual levels in response to bTB. In the past, badger culling has been carried out in disease hotspot areas in order to reduce the risk of bTB. The policy proposals published by Defra in 2011 are also aimed at reducing the risk of disease spread between cattle and wildlife through badger culling and vaccination (Defra, 2011a). Mitigation strategies also comprise cattle control measures, which include the government’s test and slaughter policy, bTB testing and movement restrictions. Biosecurity measures are also included in the mitigation category, aimed at reducing the risk of disease transmission. However, considerably fewer strategies are in place to enable farmers to cope with, or adapt to the disease. Government compensation for slaughtered cattle is perhaps the most obvious measure which helps to reduce the impact of a bTB breakdown. While this goes some way to address the financial impacts of the disease, far less attention has been paid to the practical and emotional impacts. This is where an individual’s own response strategies come to the fore. Enticott (2008b) explains that while some farmers may be overcome by a bTB breakdown and take extreme measures, others find ways to adapt their practices and ‘farm around’ the disease. For example, due to movement restrictions a farmer who breeds store cattle (cattle to be sold for fattening) may adapt their system to enable them to finish the animals and sell them straight to slaughter, which is permitted while under restriction. Farmers may also seek support, both practical and

emotional, from other farmers, their vet or family members (PSI, 2005), an issue which will be explored further later.

The ability to adapt is determined by a number of biological, psychological and social influences (Cicchetti and Garmezy, 1993). These influences control both individual and group responses to stress, the strength of these responses and the resources that can support them. It is therefore essential to consider the wide range of social settings and conditions of an individual's network, and the social interactions that are present. For example, Cannon *et al.* (2003) note the importance of strong social ties for increasing social protection and improving livelihoods, thereby reducing vulnerability.

Understanding the physical act of response is also important, but according to Tomkins and Adger (2005), in order to do this, it is necessary to establish the pre-conditions that allow responsive behaviour to occur. For example, they point out that different groups require different characteristics and tools to respond to various hazards and stresses. It is therefore important to note that there are a number of factors, either enabling or constraining response capacity. For example, a farmer's capacity to respond to the threat of bTB is likely to be determined by many factors, one of which is the availability of the resources required to implement biosecurity measures. However, this alone would not be enough as the farmer would need to have access to the information required to find out about the measures, as well as the financial capital necessary to purchase the resources required. Response is also likely to be constrained by a farmer's own beliefs and willingness to listen to warnings and guidance.

The importance of the social context of response capacity was noted by Reed *et al.* (2002) whose study of the adaptability of farm households found a significant reduction in levels of social capital due to farmers being forced to work longer hours, preventing them from taking part in wider community life. A downward spiral of increasing isolation led farmers to become progressively more disconnected

from the networks through which they had previously gained knowledge and awareness of successful business and coping strategies. This gradual erosion of social capital was found to be as significant as economic pressure in restricting a farmer's ability to cope. Farming families with limited social capital were also found to be more susceptible to other pressures and were therefore considered to be more vulnerable as a result.

2.5 RESILIENCE AND VULNERABILITY

The capacity of an individual to respond to risk (i.e. their response capacity) will dictate their level of resilience or vulnerability in the face of the said risk. While both vulnerability and resilience are well used terms, their definition has proved problematic. Birkman (2006) found more than 25 different definitions of the concepts, many of which relate to different contexts, including disaster management, child development and healthcare. However, in general terms, vulnerability is taken to refer to "*the susceptibility of a person, group or system to loss*" (Buckle, Marsh and Smale, 2001). Similarly, Gallopin (2006, p.294) suggests that:

"Vulnerability is thought of as a susceptibility to harm, a potential for a change or transformation of the system when confronted with a perturbation, rather than as the outcome of this confrontation."

Resilience on the other hand, refers to the capacity of a person, group or system to "*absorb shocks while maintaining function*" (Buckle, Marsh and Smale, 2001, p.4). Egeland, Carlson and Sroufe (1993, p.517) describe resilience as "*the capacity for successful adaptation, positive functioning or competence...despite high-risk status, chronic stress, or following prolonged or severe trauma*".

The conceptualisation of vulnerability and resilience is certainly complex. Vulnerability is multi-dimensional and differential, varying substantially both between and within different social groups. The analysis of both concepts is also scale dependent in terms of the level of analysis, be it at individual, household,

regional or system level. Emphasising the complexity further, both concepts are extremely dynamic, as their characteristics and driving forces change constantly over time (Vogel and O'Brien, 2004).

The degree of resilience or vulnerability at community level is strongly influenced by the economic and political structures within the community, in addition to the strength of its social networks and institutions (Morrow, 2008). Each of these perspectives can be examined at household and individual level where the concepts are associated with all available resources. Cannon *et al.* (2003) propose that community resilience is directly linked to the strong baseline conditions present in a community. These include nutrition, health, and general wellbeing, all of which, they suggest, can be secured through increased 'self-protection' or through access to support provided by government institutions or civil society. Within the farming context, Reed *et al.* (2002) also take a resource perspective when considering the vulnerability of family farms. They put forward a vulnerability continuum whereby 'safe' farmers have adopted a positive survival strategy, and those that are more vulnerable are less able to do so. However, the researchers note that families can easily become vulnerable if a resource (or capital) essential for their survival strategy is lost or eroded. For example, they note that a sudden change in vulnerability status can occur if death or illness occurs within the family. They therefore accentuate the cultural and social aspects of vulnerability, as well as those associated with economic factors.

Response capacity exists on the 'internal side' of vulnerability, which relates to a system's capacity to anticipate and cope with stress and to resist and recover from it. The 'external side' of vulnerability, on the other hand, refers to the physical exposure to risks and shocks (Bohle, 2001). Fussel (2007) suggests that the external and internal can also be used to distinguish between vulnerability factors. He suggests that structural socioeconomic factors, as explored through human ecology, political economy and entitlement theory represent external vulnerability, whereas agency-orientated factors as investigated in access-to-assets models, crisis and

conflict theory, and action theory approaches are positioned on the internal. A system may be vulnerable to a risk, but may persist without problems for as long as it is not exposed to it. Therefore, from the perspective that incorporates exposure as a component of vulnerability, a system that is not exposed to a risk would be considered non-vulnerable. In the case of bTB it is important to note that exposure does not necessarily mean a herd must experience a breakdown. Instead, exposure to the risk of a breakdown may be enough to impact a farmer negatively.

The differentiation between the internal and the external has been identified by many researchers (see for example Turner *et al.*, 2003; Ellis, 2000; Chambers, 1989) and has become known by some as the double structure of vulnerability (van Dillen, 2004). This framework emphasises that the level of vulnerability directly results from the interaction between exposure to external stresses and the response capacity of the affected individual or group (Birkmann, 2006). Gapollin (2006) provides a simplified example of flooding to distinguish between exposure and response capacity. He suggests that often the poorest homes are located in the areas most susceptible to flooding; this can be defined as the level of exposure. Households with better resource access have greater means to repair water damage, which relates to their level of response capacity.

Throughout the various methods put forward for assessing resilience and vulnerability, the concept of 'risk' is a key area of focus. As explored in section 2.3, this is not a clear-cut concept. A number of issues must therefore be considered when faced with the analysis of resilience and vulnerability in relation to perception and awareness. For example, if an individual is unaware of a risk for any reason, they will be vulnerable despite their own perceived level of resilience. Also, an individual's level of awareness, knowledge and perception of a particular risk will vary in relation to the accuracy or availability of relevant information. Additionally, an individual may be fully aware of a risk but may feel that any benefits outweigh the possible risks. For example, a person may choose to live on a steep slope because of the beautiful views, although they are aware of the risk of landslides.

Conversely, another resident may have been forced to live on the hill due to the lower house prices brought about by the landslide risk (Buckle, March and Smale, 2001). Clearly, the analysis of the perceived and actual vulnerability of each individual will be likely to show very different results.

In order to fully understand the ways in which farmers respond to bTB it is necessary to explore the various factors that influence their attitudes. Such factors may be financial or practical, or less tangible such as knowledge or beliefs. These factors are explored in more detail in the following section.

2.6 UNDERSTANDING FARMERS' ATTITUDES TOWARDS RISK

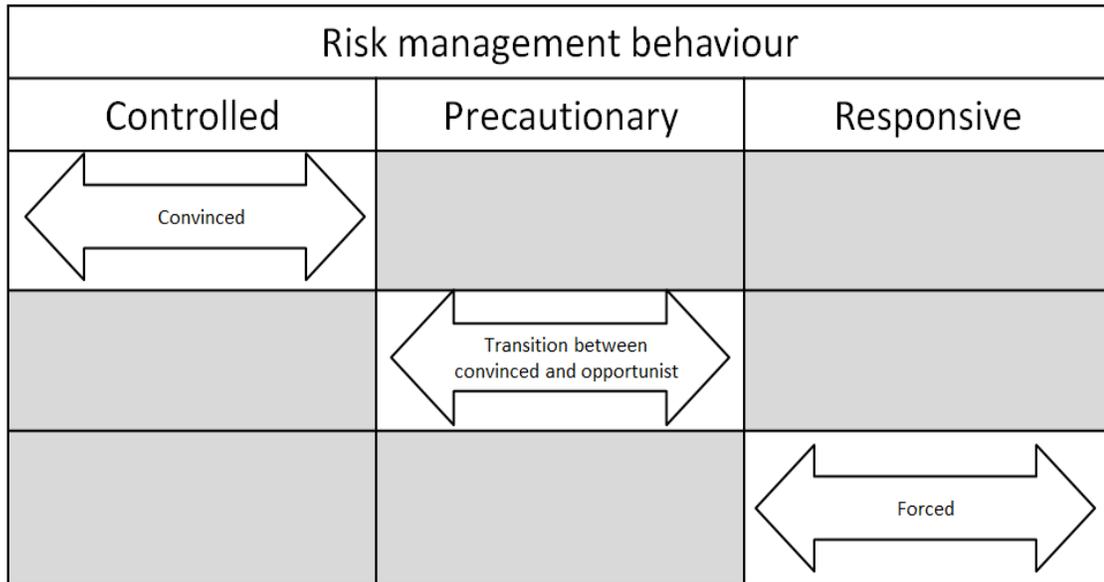
Farmers continually make business decisions in a risky environment caused by huge uncertainty in relation to production (for example weather or disease) and market and price fluctuation. Oerlemans and Assouline (2004) suggest that over the last twenty years, a diversity of strategies have been developed ranging from conversion to organic agriculture to nature conservation and agro-tourism in order to reduce the financial risks that are inherent in the industry. Research conducted on farmers' attitudes towards diversification provides an interesting context through which to understand their risk aversion behaviour (Clark, 2009; McNally, 2001; Harwood *et al.*, 1999; see for example Bhende and Venkataram, 1994).

Coming from the sustainable rural development paradigm and focusing on multifunctionality, Van de Ploeg and Reep (2003) suggest that risk aversion strategies are likely to include the diversification of farm products; taking advantage of new market opportunities; adding value to products; and the better use of resources. Where such activities are present, an innovative boundary shift takes place, transferring the farm business into a more complex rural enterprise engaged in the production of new products or services. Consequently, it is involved in more markets, or perhaps more importantly, in markets of a different type. These markets

may be focused on agricultural commodities or markets for tourism, services or energy, for example.

Hajnalka and Alajos (2009), quoting Van de Ploeg and Roep, make an interesting connection between multifunctional agriculture, risk management and social capital. They suggest that risk management reduces dependency on financial capital, global commodity markets and big retailers, and instead 'regrounds' agricultural production on social and cultural capital. Hajnalka and Alajos draw on work carried out by Petrics (2008) which found that multifunctionality is often used as a risk management solution. Petrics (2008) puts forward a model of farmers' risk management behaviour (shown in Figure 2.2), which suggests that farmers convinced of and committed to risk management have a strong level of control over their circumstances. Such farmers were found to have strong values and were passionate about farming. Farmers that were found to be partially committed to risk management were shown to have a prudent approach to risk, predicting and avoiding major problems. In comparison to those falling within the 'controlled' category, such farmers are driven by profit rather than the value of farming, and introduce changes to their livelihood strategies only when necessary. Before that point, they generally show a lack of control. Farmers who are considered to be 'responsive' in terms of their risk management strategies, respond to on-going circumstances, alleviating the consequences of what is happening or has already happened. Responsive farmers make changes to their management strategies because they have to, not because they want to, and their response to and perception of risk is based on external pressures (shock, crisis) rather than potential opportunities.

Figure 2.2 Categories of farm households in terms of risk management behaviour and approach to multifunctionality (Petrics, 2008)



Other researchers have also identified different types of response to risk. Based on a number of studies exploring agricultural risk, Coble and Barnett (2008) identified three responses among farmers: risk aversion, risk neutrality and risk-seeking (or risk loving). A risk adverse farmer avoids risk wherever possible whereas a risk-seeking farmer is likely to take risk despite being faced with uncertainty. Risk neutral represents the middle ground whereby a farmer would not purposely avoid or seek to take risks. Looking at eleven different studies which address risk, Cobel and Bennett (2008) report that only two of the studies identified farmers who displayed risk neutral or risk-seeking behaviour, concluding therefore that it can generally be assumed that farmers exhibit at least a degree of risk aversion.

The risk frameworks put forward by Petrics (2008) and Coble and Barnett (2008) are instructive in understanding how farmers may respond to bTB risk. Some farmers are likely to take proactive action to avoid the disease, for example by implementing biosecurity measures, while others are likely to be more reactive, responding to the impacts of the disease when forced to do so. As in Petric's model (2008), proactive farmers will be committed to taking precautionary action, convinced that it is likely to reduce the level of risk. In comparison, those who are

forced to take action may be more fatalistic, assuming that precautionary measures are unlikely to reduce bTB risk. It is important to note that risk perception plays an essential role in shaping these choices and is therefore explored further below.

2.7 RISK PERCEPTION AMONGST FARMERS

In order to understand the ways in which farmers approach risk and the choices they make in relation to their response strategies, it is necessary to note the importance of risk perception as there can be substantial differences in the way different people perceive risk.

Firstly, the reaction of individuals can vary substantially depending on the type of risk that is present. For example Beck (1992) describes how people react differently towards risks posed by natural disasters when compared to those related to ‘manufactured’ or ‘man-made’ risks. Secondly, Maye *et al.* (2008) suggest that ‘new’ risks are likely to evoke different reactions to risks that may be familiar. For example, they suggest that a wheat farmer may perceive risks associated with ‘known’ diseases as relatively low when compared to risks related to ‘alien’ diseases about which they are likely to be less knowledgeable. Maye *et al.* (2008) also argue that it is often difficult to change a person’s perception of a risk once a judgment is made, particularly if the individual is knowledgeable about the subject. It is therefore likely that a farmer will be more easily persuaded about the best ways to avert the risk of a ‘new’ disease of which they have little or no knowledge.

While no studies have focused specifically on farmers’ bTB risk perception, there is a large empirical literature that explores risk perception towards agricultural risks more generally. Such studies often adopt a rating system, whereby farmers are asked to rate concerns in perceived risk order. In a study carried out by Cobel *et al.* (1999), farmers rated price risk and yield risk as their primary concerns. In a similar study on beef producers carried out by Hall *et al.* (2003), drought and price variability were rated the highest. Meuwisen *et al.* (1999) reported output prices as farmers’ principal concern, closely followed by disease. An interesting comparison

carried out by Flaten *et al.* (2005) relating to risk perception among organic and conventional farmers, found that organic producers gave more weight to institutional factors relating to their production systems, whereas conventional farmers were more concerned about input costs and animal welfare policy.

Table 2.1 below provides a comparison carried out by Coble and Bennett (2008) of studies looking at perceived risk. Overall, output price is the greatest concern, with four studies ranking it the highest and the remaining two studies ranking it second. It is interesting to note that disease risk was perceived as the second highest risk factor in two studies, both of which were focused on livestock producers. However, in a study of Norwegian dairy farmers, disease was rated fifth, below farm programme uncertainty, animal welfare policy and input and output prices. The disparities between the studies highlight the importance of context, but also emphasise the different levels of risk perception between different groups of farmers.

Table 2.1: Comparison of studies identifying farmers' primary concerns (Coble and Barnett, 2008)

Authors	Coble et al. (1999)	Blank, Carter, McDonald (1997)	Patrick et al. (2007)	Hall et al. (2003)	Flaten et al (2005)	Meuwessen et al. (1999)
Producer Group	U.S. Row Crop Producers	California Specialty Crops	Independent U.S. Hog Producers	U.S. Beef Cattle Producers	Norwegian Dairy Farmers	Dutch Livestock farmers
<i>Ranking of top five perceived risk</i>						
Production risk	2	2		1		
Disease		4	2		5	2
Freeze (Extreme Cold)		3		5		
Input Price	3		5	3	4	
Output Price	1	1	1	2	2	1
Pests		5				
Environmental Regulation	5		3	4		
Market Access			4	N.A.		
Farm Program Uncertainty	4				1	
Animal Welfare Policy					3	
Illness or death of operator					5	3

As shown by the table above, a significant amount of research has been conducted on risk perception in the US, as well as a limited amount in Europe. However, it is interesting to note that no research has focused specifically on farmer risk perception in England, something this study aims to remedy.

There are a number of factors which influence perceptions of, and responses to risk. According to Botterill and Mazur (2004), these include the characteristics of the individual facing the risk, the characteristics of the risk itself, as well as the social and environmental context in which the risk is placed. For example, beliefs, knowledge and values have been shown to have an important impact on the ways in which farmers perceive the risks posed by climate change. A study carried out by Weber (1997) found that farmers are more likely to adapt their practices if they believe climate change to be a reality. This emphasises the central difference between risk and uncertainty. The importance of knowledge was also highlighted in a study of Australian farmers which found that a range of situational factors as well as knowledge, beliefs and attitudes influence perceived risk and consequently impact upon levels of innovation adoption (Wyatt and Henwood, 2006). The study found that farmers who did not fully understand the nature of the risk, those who could not make an easy comparison between new, alternative and old practices, those who had bad past experiences, and those who were fearful of losing control of agricultural production were least likely to adopt innovation. Risk perception is clearly influenced by a wide variety of factors, many of which are likely to be socially situated. The ways in which farmers perceive risk and their capacity to respond to it will have a strong influence on their behaviour. This is explored in the following section.

2.8 FARMER BEHAVIOUR

Interpreting farmer behaviour is key to understanding risk perception and the reasons why farmers choose to respond to risk in certain ways. In recent years, countless ‘theories of behaviour’ have been developed within the academic

literature. Many of these fall within the Theory of Reasoned Action (TORA) and the Theory of Planned Behaviours, which discuss the main internal and external social influences on behaviours. Although the behaviour of farmers is likely to have a substantial impact on the spread of bTB, there has been very little research which addresses it. A small number of exceptions exist, such as a study carried out by the University of Liverpool (2009) which explores changes in farmer behaviour as a result of the introduction of pre-movement bTB testing. Using the Theory of Planned Behaviour, the researchers examine three sets of beliefs: behaviour beliefs (about the outcome of certain actions); normative beliefs (about what others may or may not approve of); and control beliefs (about the factors that may facilitate a certain behaviour). Moral obligations and habits were also included in the model. The study incorporated 21 qualitative interviews, followed by a quantitative postal survey of 250 farmers. The study identified a number of beliefs which influence the behaviour of farmers, including their beliefs about how disease is spread. Additionally, views about the government were seen as important. Many of the farmers lacked trust and confidence in the information provided by Defra and often felt that the department was too distant and difficult to contact. One of the key conclusions of the study, which is of particular relevance to this thesis, is that farmers' decisions are socially situated, dependent on the views of their family, friends and vets. The researchers therefore suggest that in order to influence behaviour, policy makers must focus on farmers' wider networks, as they suggest that gaining the support of farmers' closest informants is the most appropriate way of influencing the behaviour of individual farmers.

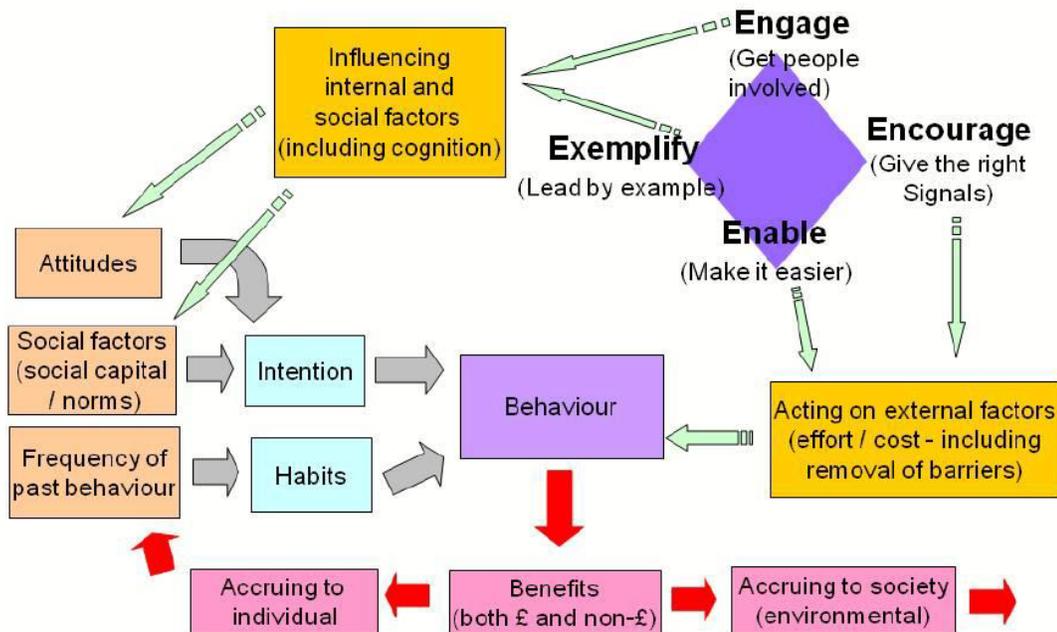
Other studies focus more specifically on farmer behaviour in the context of biosecurity. This has been explored in section 2.3.6, although a number of additional points are worth noting here. Farmers' beliefs about the outcomes of particular actions, and their understandings of the 'subjective norm', have been shown to influence farmer behaviour in relation to biosecurity. A study carried out by Gunn *et al.* (2008) divided farmer beliefs into positive and negative responses to biosecurity. Positive responses related to on-farm impacts such as disease prevention and good

husbandry whereas negative responses were associated with bureaucracy and rules that had been externally imposed. The researchers emphasise the need for further study into improved knowledge transfer and the role of all stakeholders in relation to improved farm-level biosecurity.

2.9 TOWARDS A MODEL OF FARMER SEGMENTATION

Farmers can be characterised fairly easily based on external factors that may impact on decision making such as farm size, tenure or farm type. However, Pike (2008) argues that in order to fully understand farmers' decisions relating to their practice, it is necessary to explore their underlying attitudes, motivations and objectives. Building on work by Garforth and Rehman (2006), Pike (2008) developed a conceptual framework for exploring farmers' attitudes. Within the framework, he suggests that the intention to undertake a particular behaviour is influenced by attitudes, past behaviours, perception of the behaviour and social factors such as the views of others. Pike's model is shown in Figure 2.3 and identifies attitudes, social norms, habits (internal factors) and external factors (including cost and policy interventions) as the basic components of behaviour. He goes on to suggest the use of behaviour economics which makes a clear link between the internal and external factors that influence behaviour. He notes that often, decision making cannot be assumed to be based solely on cost-benefit analysis, but is instead influenced by a wide range of personal factors.

Figure 2.3: Pike's (2008) integrated approach to influencing farmer behaviour



The diversity and indeed complexity of farmers in terms of their values, goals and needs is increasingly being recognised. Defra has recently moved towards models of farmer segmentation, recognising diversity in farming and aiming to understand how it affects decision making (see for example Collier *et al.*, 2010; Pike, 2008). Studies carried out by Defra exploring farmer segmentation have drawn influence from wider studies such as research carried out by the University of Reading (Collier *et al.*, 2010) which aimed to explore farmers' behaviour and motivations in response to policy changes. The study focused on attitudes towards Single Farm Payment through a postal survey of 683 farmers. A behavioural typology was devised using principal component analysis and clustering, resulting in five distinct farmer types. Interestingly, the farmer segments were similar in terms of size, type and region, but displayed clear differences when attitudes were included. Although it was found that responses to a small number of statements could correctly assign respondents to segments, it was emphasised that the boundaries between the segments were 'fuzzy' in that the characteristics present in one group may also be partly present in another. For example, the study showed that it was not only farmers who were categorised as

‘custodians’ who care for the environment, but it was a more prevalent theme within that group.

A number of agricultural economics studies have attempted to identify the main values held by farmers that influence their behaviour and their decision making. Perhaps the most influential study is that carried out by Gasson (1973, p.527), in which the following dominant values were identified: “*security; money; status and prestige; working with people; service to others; using abilities and aptitudes; [and] being creative and original.*” Importantly, Gasson (1973) also distinguishes between the various functions of farming. She identifies *instrumental, social, expressive and intrinsic* functions. Instrumental functions consider farming to be a means to an end, purely focused on income and security while maintaining a pleasant working environment. Social functions focus on maintaining relationships, while expressive functions centre on personal fulfilment. Intrinsic functions focus on the enjoyment of farming as an activity in itself. Gasson’s (1973) definitions of these values and goals are shown in Figure 2. .

Figure 2.4 Farmer Functions (Gasson, 1973)

<p><i>Instrumental</i></p> <ul style="list-style-type: none"> Making maximum income Making a satisfactory income Safeguarding income for the future Expanding the business Providing congenial working conditions: hours, security, surroundings
<p><i>Social</i></p> <ul style="list-style-type: none"> Gaining recognition and prestige as a farmer Belonging to the farming community Continuing the farming tradition Working with other members of the family Maintaining good relations with workers
<p><i>Expressive</i></p> <ul style="list-style-type: none"> Feeling pride of ownership Gaining self-respect for doing a worthwhile job Exercising special abilities and aptitudes Chance to be creative and original Meeting a challenge, achieving an objective, personal growth of character
<p><i>Intrinsic</i></p> <ul style="list-style-type: none"> Enjoyment of work tasks Preference for a healthy, outdoor, farming life Purposeful activity, value in hard work Independence – freedom from supervision and to organise time Control in a variety of situations

Gasson’s (1973) study found that farmers predominantly subscribe to the *intrinsic* orientation, which supports Pike’s (2008) emphasis of the non-economic influences on farmer decision making and behaviour. While all farmers appreciated the intrinsic values, smaller farmers tended to value them the most while medium and large farmers were more likely to put greater emphasis on instrumental and social aspects.

Since Gasson's (1973) research, many other studies have attempted to categorise farmers based on the values that influence their behaviour. Although Gasson's study was mainly descriptive, the majority of studies undertaken since have used multivariate analysis, most often principal component analysis, to categorise farmers into broad behavioural types such as 'dedicated producer – flexible strategist – lifestyle' (Fairweather and Keating, 1994), or 'business-orientated behaviour – environmentally orientated behaviour' (Willock *et al*, 1999). What such studies have made clear is that farmer decision making and behaviour is influenced by a wide range of factors, not simply those associated with economic or political contexts. Instead, various social dimensions are increasingly being shown to play an essential role, as emphasised in the following section.

2.10 A FURTHER EXPLORATION OF THE SOCIAL CONTEXT OF FARMERS' RISK BEHAVIOUR

It is important to note that decisions are very rarely made with full knowledge of all costs, benefits or risks. Behaviour and decision making is often influenced by group dynamics and social norms especially when decisions relate to commons such as climate change, water abstraction or disease prevention, when individuals are unlikely to act unless others do so as well (Pike, 2008). Johnston and Bryant's (1992) farmer decision making model recognises a range of factors that can influence farmer adaptations: attributes of the farm operation, such as existence of an heir or the skill set of the farm operator; attributes of the local community, including the availability of farmland or community concerns about particular farm practices; and off-farm factors, such as commodity market prices. The model goes on to identify three types of farmer adaptations: positive adaptations, such as adding non-traditional enterprises or intensifying production on the existing land base; normal or managerial adjustments characteristic of the entire agricultural sector, such as the adoption of a standard agricultural technology (e.g. hybrid seeds); and negative adaptations, such as exit from farming or a reduction in production intensity in anticipation of the future sale of farmland to developers. Sharp and Smith (2003, p.915) argue that the adaptations missing from this model are the

“farmer adaptations focused on altering the constraints and limitations created by the local social setting.” This type of adaptation involves a farmer building trust and understanding about potential offensive farm practices with neighbours in order to prevent future misunderstanding or conflict. Sharp and Smith (2003) draw on the social capital literature to justify their claim that ‘neighbouring’ should be considered a valid adaptive strategy. They conclude, in agreement with many social capital researchers, that *“people who know and trust one another are more likely to be able to work together to find a solution to problems that are mutually acceptable to everyone.”* They suggest that social capital among farmers and non-farmers is likely to provide several benefits for both the farmer and the wider community, including benefits relating to increased resilience. In many cases, when faced with risk, farmers have a number of options in terms of their response. It is at this point that the various mechanisms that influence farmer behaviour are important.

This chapter has explored the social dimensions of risk, vulnerability and resilience. While the terms have been widely used across a variety of disciplines, throughout the research the importance of the wider social context has emerged as central to our understanding of why individuals respond to risk in the way that they do. Knowledge, beliefs and values have been shown to be key, as have social interactions and networks. While the importance of the social context has been emphasised by social scientists exploring farmers’ attitudes towards bTB and its control (Enticott and Vanclay, 2011; Enticott and Franklin, 2009), no in-depth exploration of farmers’ social networks in relation to bTB has been undertaken. As detailed further in the following chapter, the construct of social capital provides a framework through which these networks can be explored, identifying the various factors that influence the development of productive relationships which enable farmers to successfully respond to bTB.

2.11 CONCLUSION

The risks associated with bTB have been explored, identifying a number of financial, practical and emotional impacts. The way that farmers respond to these is likely to be strongly influenced by their level of risk perception and their knowledge and beliefs about the disease and its control. While biosecurity measures remain the primary farm-level mitigation strategy, uptake among farmers remains low. This is likely to be due to the lay epidemiologies developed by farmers which have led them to devise their own measures which may contradict those recommended by the government. While biosecurity represents an avoidance strategy, other responses to bTB risk may include both coping and adaptation strategies.

A number of studies have identified different types of farmers according to their response to risk. These include farmers who readily take measure to avoid risk, those who respond to it when necessary and those who are forced to cope with the risk once it is realised. Where a farmer is positioned within these categories is likely to influence their level of resilience or vulnerability.

Although a large amount of work has been done to advance our understanding of the concepts individually, there is limited research that brings social capital and risk together, despite the wide recognition that an individual's understanding of, and response to risk is strongly influenced by the social context in which they are positioned. In order to respond to risk, farmers not only require knowledge about the risk that they face, but also the resources that will allow them to effectively respond to it. Understanding the networks in which information and resource acquisition can take place is therefore essential. The mechanisms which encourage or restrict resource transfer are also important. These include core aspects of social capital such as trust, norms and values, which are each explored in the following chapter.

CHAPTER 3. SOCIAL CAPITAL: A REVIEW OF THE LITERATURE

3.1 INTRODUCTION

The concept of social capital has gained a huge amount of attention both from policy makers and academics. There is therefore a wide and varied literature which is reviewed in this chapter to provide a context for the current study. The definition of the concept is first discussed followed by an exploration of various theoretical perspectives. A widely accepted three-way social capital classification (bonding, bridging and linking) is introduced and the various benefits of the concept are outlined. Following this, a discussion of a number of studies that have addressed the role of social capital amongst farmers is presented. However, before going on to explore the concept further it is important to note that it has not been accepted without criticism. In particular, the use of the word ‘capital’ to describe a non-economic term has been strongly opposed by some academics. Some economists have strongly argued against the use of the word, especially in terms of *social capital*, most notably Arrow and Solow (2000). The argument generally follows that social interactions should be regarded as factors that reduce transaction costs, making it easier to work together but without describing it directly as a form of capital (Paldam and Svendsen, 2000).

A family of capital theories has evolved over recent years, but all can be traced back to Karl Marx who began his conceptualisation of ‘capital’ in the mid nineteenth century (Marx, [1894] 1981, [1867] 1976). Marx defined capital as the surplus value captured by the capitalists, or bourgeoisie, who control the means of production in the transition of commodities and money between the points of production and consumption. This condition maintains a circulatory culture in which workers are paid for their labour, allowing them to purchase commodities

such as food and shelter in order to sustain their lives. The commodities produced can then be circulated and sold into the consumption market at a higher price.

Marx's definition of capitalism concentrates very strongly on the dehumanising effect of money and explains that before the capitalist era people had sold commodities in order to buy more commodities. However, in the capitalist society, instead of selling to buy, people bought commodities to sell at a higher price to increase their monetary profit. The significance of money and, most importantly profit, Marx believed, had become the manifestation of social power and the only form of social bond remaining in an increasingly fragmented society (McLellan, 1995). Although Marxism relates mainly to political and economic philosophy, a sociological emphasis runs alongside many of the concepts. Above all, Marx was a socialist revolutionary concerned with exploitation within society and class inequalities as summed up in the opening line of the introduction to the Communist Manifesto, which states: "*The history of all hitherto existing society is the history of class struggles*" (Marx and Engles, [1848] 2005). Marx introduced the idea of class consciousness, which refers to the awareness that a social class possesses both in itself and in the world around it, thereby allowing it to act in its own interest. Class consciousness was central to building a successful revolution against the ruling classes, and hence encouraging cooperation and shared values between individuals and communities within the working class.

Marxist theory has been frequently criticised on a number of grounds. For example, Marxism is deemed to place too much emphasis on production and class, while reducing the significance of other economic and social phenomena such as race, gender and the environment (Fine, 2001). The social content of capital is also a complex issue which has been widely disputed (Halpern, 2005; Fine, 2001; Baron, Field and Schuller, 2000). However, Fine (2001) argues for the acknowledgement that capital and capitalism are based, at least in part, in class relations and therefore have a clear social grounding.

A number of new social movements, including feminism, have moved away from Marx's view of an organised society which essentially concentrates on class

inequality and exploitation of the proletariat. Instead, widespread group-based instrumental collectivism, neo-conservatism and the growth of cultural and social resources are setting a base on which patterns of social life and social struggles are becoming more disaggregated. Within western economies, the disaggregation of capitalism is producing a relatively 'class-less' structuring of contemporary social life. This transition to disaggregated capitalism is causing a power shift from large organisations, workplaces and cities to a heightened presence of social situations unconstrained by an individual's class, city, region or nation. Similar contemporary economic thought has dominated economic research in recent years, opening up capitalism to social analysis, in other words, allowing for a comfortable, although not undebated accession of social interactions into the realm of economics and capital.

Although the use of the phrase 'social capital' remains controversial, it has become a conceptual tool with which to integrate economic principles into non-economic analysis. Its use is a realisation that the economy is affected by, or dependent upon, aspects of life which relate to the non-economic. It is also an important addition to what is first and foremost a concept which is wholly asocial, relating solely to the physical or productive properties of a resource.

3.2 DEFINING SOCIAL CAPITAL

In recent years, there has been a rapid growth of interest in the term 'social capital' (Bourdieu, 1986a; Putnam, 1995; Fukuyama, 2000; Grootiaan and Bastelaer, 2002; Halpern, 2005; The World Bank, 2009). There are three leading figures in the development of social capital theory, namely, Pierre Bourdieu (1986a), James Coleman (1994, 1988) and Robert Putnam (2000, 1995). Bourdieu is attributed with developing the concept of social capital during the 1970s and 1980s, followed by Coleman who attempted to fuse sociological and economic concepts together through the Rational Choice Theory (RCT). More recently, Putnam has inherited and evolved Coleman's conceptualisation of individuals in pursuit of their own interests to encapsulate the idea of association and civic activity as an integral aspect of social relationships and personal well-being (Field, 2003). While there are many

theoretical interpretations of the term, the model most often adopted by policy makers is that developed by Putnam (2000, 1995), which defines social capital as the stocks of social trust, networks and values that people can draw upon in order to improve their livelihoods, the benefits of which have been widely documented. For example, social capital has been shown to increase political participation, decrease government corruption, promote cooperative movements and enhance judicial efficiency (Putnam, 1995; LaPorta *et al.*, 1997; DiPasquale and Glaeser, 1999; Goss, 1999; Paldam and Svendsen, 2000; Putnam, 2000).

While Putnam's definition is the most widely used, his conceptualisation of social capital can be criticised on a number of counts. Most notably, within his work there is a lack of theorising in terms of the origins of the concept. Instead, Putnam emphasises the self-reinforcing nature of its various components, and therefore social capital itself. Putnam's focus is on the historical patterns associated with social capital, such as the civic traditions in Italy, the subject of his seminal work on the concept (Putnam, 1993). Putnam argues that social capital produces more social capital; he therefore gives little consideration to its initial formation. His conceptualisation can also be criticised for its focus on horizontal ties, limiting his exploration to relationships between individuals of equal power and status. Instead, others, including Coleman (1988) and Bourdieu (1984) include vertical ties in their conceptualisations, encompassing the hierarchical relationships between individuals of unequal power.

Despite the criticism afforded to Putnam, his work remains highly influential. However, other social capital theorists have put forward alternative definitions of the concept, emphasising different aspects. For example, Fukuyama (1995, p.10) defines the concept as "*the ability of people to work together for common purposes in groups and organisations*". Echoing the functionality of social capital raised by Fukuyama, Coleman (1994, p.S98) suggests that:

"Social capital is defined by its function. It is not a single entity, but a variety of different entities having two characteristics in common: They all consist of some aspect of social structure, and they facilitate certain actions of individuals who are

within the structure. Like other forms of capital, social capital is productive, making possible the achievement of certain ends that would not be attainable in its absence.”

While Putnam’s conceptualisation of social capital is focused at the community level, Coleman’s approach concentrates on the household scale. However, although Coleman’s perspective is focused at a more comprehensive scale of analysis, his approach has been criticised by some on its use of micro-economic theory to explain human behaviour (Archer and Tritter, 2000).

Other writers have emphasised different aspects of social capital. For example, according to Narayan and Pritchett (1997, p.2) social capital represents the “*quantity and quality of associational life and the related social norms*”. Ostrom (2000, p.176) takes a similar stance and emphasises “*the shared knowledge, understandings, norms, rules and expectations about patterns of interactions that groups of individuals bring to recurrent activity.*” These definitions focus on the positive outcomes of social capital. However, Woolcock (1998, p.137) describes the consequences of an absence of social capital. He suggests that in such instances “*seemingly obvious opportunities of mutually beneficial collective action can be squandered*”.

Social capital has been shown to play an important role in increasing resilience to risk. For example Adger (2003) suggests that networks of reciprocity with high levels of social capital can help to increase access to resources and information at times of crisis. However, although recognising that social capital is important for coping, Dasgupta (2003) points out that it does not necessarily facilitate proactive adaptation to cope with change, and can in fact impede adaptation in the face of external pressures as strong, closed networks can limit access to resources.

The possibility of both positive and negative impacts resulting from social capital increases the complexity of its analysis, and emphasises the necessity for context specific research. Therefore, simply to detect the presence of social capital is not enough; instead, the identification of resulting externalities is important, alongside

the examination of the route that determines whether the results of investment will be beneficial.

Bourdieu, Coleman, and Putnam share similarities in their examination of social capital, but have all been influenced by different aspects of social, political and economic research and so have developed different theoretical approaches to the concept. They also differ in how they attempt to resolve a fundamental theoretical tension; the cohesion versus conflict debate. This relates to whether social capital is a product of social cohesion and ‘togetherness’, often resulting in positive externalities, or whether it bears more relation to class conflict and inequality whereby distinct groups are formed, from which outsiders are excluded. Resource access is therefore only possible if an individual’s social ties extend into a wide range of networks.

A number of writers, including Coleman (1994) and Putnam (2000, 1995) have approached social capital analysis from a social cohesion perspective. Social capital theorists approaching the concept from this perspective generally identify its positive externalities and tend to neglect negative impacts such as exclusive networks. In comparison, Lin (1999), who works within the economic sociology discipline, assumes that most resources are concentrated in the hands of the relatively few, situated on the higher rungs of the social ladder. He therefore proposes that an individual’s social capital can be determined by how far their social networks extend into the social hierarchy. Lin (2001) suggests that the greater the hierarchical distance between the actors within a network, the more difficult the acquisition of resources will be. He suggests that: “*interacting partners, aware of the inequality in differential command over resources that can be brought to bear, need to assess each other’s willingness to engage in exchange*” (2001, p.47). Like Lin, Bourdieu’s definition of social capital makes the distinction between the resources available to an individual and the social structures that enable their access. According to Bourdieu (1986a, p.249):

“The volume of the social capital possessed by a given agent...depends on the size of the network of connections he can effectively mobilise and on the volume of the

capital (economic, cultural or symbolic) possessed in his own right and by each of those to whom he is connected”.

Bourdieu emphasises the role of class conflict, noting that certain class factions will have greater access to resources, dependent on their social position. In this sense, Bourdieu’s social capital analysis, associated with his “species of capital” theory, can be linked with the Marxist paradigm, in which the concept of capital sits firmly within the political and economic forums. Following this, it is apparent that much of the social capital research remains partly rooted in Marxist theory, in particular within the neo-Marxist paradigm. This approach to social capital research is typified by the work of Bourdieu, whose definition of the concept places an emphasis on issues of power within a society (Bourdieu, 1986b; Bourdieu, 1985). Following Bourdieu and Lin’s approach to social capital, inequality and the concept of hierarchical society dictate that certain individuals will be unable to climb the theoretical network ladder and will therefore have limited access to resources. Such individuals will only have access to the same resources as their social equals (Lin, 1999).

While social capital is of considerable interest to both academics and policy makers, overuse (and misuse) of the term has attracted criticism (Pelling and High, 2005a; Fine, 2001; Portes, 1998). This is often due to difficulties surrounding its definition. While there is a general consensus in relation to the key aspects of social capital, such as trust, values, and norms of behaviour, the relationships between these remain keenly debated. Trust, for example has been identified as a requirement for social capital development, but also as an outcome (Grootaert and van Bastelaer, 2001). Additionally, trust has often been used as a proxy measure for social capital. In some instances this has been done without sufficient consideration for the context, limiting political acceptance of the concept in some quarters (Field, 2003; Harriss, 2001). Throughout the conceptualisations offered by many social capital theorists, it is often difficult to distinguish between what social capital *is* and what it *does*.

The individual and group nature of social capital has also been contested. Some social capital theorists argue that social capital occurs at the personal level, differing

in both quality and quantity between individuals (Halpern, 2005; Coleman, 1994; Bourdieu, 1986a). Others argue that social capital only occurs at the group level, representing a public rather than a private benefit (Flora and Flora, 2005; Putnam, Leonardi and Nanetti, 1993). Others have suggested that both approaches are valid, highlighting that while social capital can exist at the individual level, its benefits are most obvious within the group context (Glaeser, 2001).

The social structures that enable the development of social capital have also been debated. This is a core area of this thesis as it allows for the identification of the particular ‘types’ of social tie which are most productive in terms of influencing the capacity of farmers to respond to bTB. A useful three-way categorisation has been identified: bonding, bridging and linking social capital. This is discussed in more detail in the following section.

3.3 THE IMPORTANCE OF STRUCTURE: BONDING, BRIDGING AND LINKING SOCIAL CAPITAL

Coleman (1988, p.100) defines social capital as “*a particular kind of resource available to an actor*”. These resources accrue to actors who take advantage of the social structures in which they are positioned (Scholz, 2003). Social structures are essential for the development of social capital. For example, Coleman (1994, p. 302), notes that social capital is defined by a variety of entities, all of which “*consist of some aspect of social structure, and they facilitate certain actions of individuals who are within the structure.*” He goes on to argue that social capital is a function of social structure, which produces an advantage, whereas Bourdieu (1986a) sees social capital as a resource that results from social structure. Although controversy surrounds the cause and effect of social capital in relation to social structure, social structure can be viewed as a certain kind of capital that can create, in certain circumstances, a competitive advantage either for individuals, groups or institutions. In fact, Burt (2000, p.3) goes as far as to assert that “*better connected people enjoy higher returns.*” However, he also notes that it is not as simple as it seems; he points out that it is not easy to define what is meant by ‘*better connected*’. For example, he

argues that strong ties do not necessarily imply a large or accessible network; in fact, often the converse is true.

While it is clear that social structure is a core component of social capital, it would be unhelpful to assume that all social ties lead to the development of social capital. While some theorists promote strong, closed networks engendered by horizontal links between actors, others argue in favour of weaker ties which span networks and increase resource access. Here, Putnam's (2000, 1995) distinction between bonding and bridging social capital is useful. The former refers to strong ties between similar individuals such as between family members, friends or colleagues, while bridging social capital describes the weaker links between individuals in different groups and social contexts. Pretty and Smith (2003, p.633) provide the following distinction between the two: bonding social capital represents "*the links between people with similar outlooks and objectives*" while bridging social capital refers to "*the capacity of groups to make links with others that may have different views, particularly across communities*". However, as noted earlier, the vertical ties that have been emphasised by Coleman (1988) and Bourdieu (1984) have been overlooked in Putnam's two-way classification. More recently, the merits of what has become known as *linking* social capital have been noted. This represents the hierarchical ties between individuals with different levels of wealth, power or influence (Scholz, 2003).

Although noting an important role of vertical ties, Coleman (1994, pp. 310-311) maintains the importance of strong *bonding* social capital. He suggests that in closed or dense networks, in which everyone is connected, "*a set of effective sanctions that can monitor and guide behaviour*" can be developed. He goes on to argue that "*reputation cannot arise in an open structure, and collective sanctions that would ensure trustworthiness cannot be applied.*" Coleman (1994, 1988) believes that closed networks can increase access to information and develop trust between members. Supporting Coleman's arguments, in a study of a dairy farmer co-operative, as part of a larger study examining how social capital can increase the adaptive capacity of organisations, Pelling and Hall (2008, p.18) found that where

strong bonding social capital was present, commitment to the group was considerable and there was a positive attitude among members towards risk and innovation.

The issue of the unequal and the often hierarchical nature of social networks has been neglected to a certain extent by some theorists (particularly Putnam), who fail to consider the impacts of social capital at a combination of different levels of analysis, for example at individual level, class faction or society. Instead, on the whole, social capital is considered to be universally beneficial, as social organisation encouraged by social capital is thought to be 'good' while its absence is assumed to be 'bad'. For whom social capital is 'good' or 'bad' and under what circumstances are important questions that have been neglected. The view that social capital has generalised benefits disregards the issues of class and other forms of social conflict and inequality.

Taking a more critical view of social capital, other theorists have identified a number of negative aspects resulting from strong bonding ties. For example, Portes (1998, p.15) suggests four negative consequences of bonding social capital: "*exclusion of outsiders, excess claims on group members, restrictions on individual freedoms, and downward levelling norms.*" He argues that the strong ties of bonding social capital that bring benefits to group members often have the potential to exclude others, limiting their resource access. In a study of the adaptability of family farms, Reed *et al.* (2002) also identified the potentially destructive nature of bonding social capital. Strongly embedded norms and values led to peer-pressure which pushed some reluctant farmers to restock after the Foot and Mouth crisis. Such cultural pressures lock individuals into pre-existing patterns of behaviour and can stifle innovation and adaptation.

Members of closed networks can also be affected by reduced resource access if they are only able to use the resources available within the group, rather than the additional resources present in other groups. An ethnographic study carried out by Anderson (1990) found that certain 'social codes' connected to the development of social capital in deprived areas encourage the threat or use of violence. Similarly,

Venkatesh (1997) suggests that in extremely disadvantaged areas, gangs emerge as substitutes for families, within which bonding social capital is very high. Such negative externalities of social capital, or what Levi (1998) labels ‘*unsocial capital*’ have been overlooked by many writers who commonly view it in an uncritical light.

Coleman’s over-emphasis of the importance of close or strong ties within communities has led him to neglect the weaker ties or *bridging* social capital that have been identified by other researchers, including Lin (1999, 2001) as the fundamental linkages for the creation of productive social capital. Granovetter (1983, p.203) is the leading advocate for the importance of weak ties as he suggests that “*far from creating alienation... [they] are actually vital for an individual’s integration into society.*” In comparison to Coleman’s focus on bonding social capital, Putnam emphasises the importance of bridging ties. He offers a macro level approach whereby individuals and groups are seen as embedded within, and potentially influenced by their social environment. The Structural Functionalist approach of Putnam and other theorists such as Fukuyama (2000) sees social capital as a miscellany of social structures and norms that may be beneficial for society. These can vary significantly from the efficient functioning of a participatory group, to general civility and neighbourliness or a wide variety of other social phenomena. Such norms and structures are seen as preventing utility-maximisation, whereby individuals act at the expense of others to achieve selfish goals (Scholz, 2003).

The distinction between bonding and bridging social capital has been identified by almost all social capital researchers. However, some have neglected to recognise the role of institutions, government or other hierarchical relationships in the development of social capital. This omission has been identified by a number of social capital theorists, most notably Lin (1999), who emphasises the importance of *linking* social capital. This form of social capital has some commonalities with Bourdieulian social inequality constructs due to its emphasis on connections between people of different social strata. Agriculture is very much an industry governed by policy and regulation, so by its nature hierarchical relationships are prevalent throughout. Linking social capital therefore plays an important role in

forming positive relationships between policy makers and farmers. In a study exploring the relationship between linking social capital and sustainable land management, Hall and Pretty (2008) found that farmers with sustainable farms had higher levels of linking social capital and welcomed farm visits from advisors and regulators. In comparison, they found that farmers with polluting or illegal processes present on their farm were far more wary of interaction with government agency staff.

The various forms of social structure are a main focus of this study. In order to explore the role of social capital in influencing farmers' capacity to respond to bTB, it will be necessary to establish the role of different social ties. This study therefore adopts the three-way social capital conceptualisation that has emerged from the literature, and the various relationships between farmers and their contacts will be defined as either bonding, bridging or linking social capital. Also key to understanding such relationships is the idea of 'investment', which refers to how the relationships that develop into social capital are formed and cultivated. This is addressed further in the following section.

3.4 THE NATURE OF INVESTMENT

Throughout the literature, social capital is discussed in terms of 'investment'. As with 'capital', this is a loaded term, implying a productive return and, arguably, a conscious action. However, in contrast to Bourdieu (1986a), who sees investment in social capital as a purposive action, Coleman's theory of social capital concludes that its creation is largely unintentional and generally emerges as a 'by-product' of activities intended for other purposes (Schuller, Baron and Field, 2000). He therefore believes that "*there is often little or no direct investment in social capital*" (Coleman, 1994, p.312). In comparison, Bourdieu assumes that all forms of capital respond to direct investment, although certain forms of capital can give rise to others. For example, in his favoured example of social capital within family networks, Bourdieu (1986a, p.292) points out that "*a network of family relations can be the locus of an unofficial circulation of capital*", which can give rise to "*an extraordinary concentration of symbolic capital*". In this context, 'investment' refers

to an individual's efforts to build social relationships to increase their own access to resources. Coleman and Bourdieu's debate regarding conscious or unconscious investment in social capital is an important issue in terms of designing productive policy measures to encourage the development of positive social capital, and should be explored further. Similarly, an understanding of the grounds on which an individual 'invests' is also of interest.

3.5 FARMERS, DISEASE CONTROL AND SOCIAL CAPITAL

Due to the nature of their work, farmers often work alone, within fragmented networks, many having limited or no support from colleagues, employers or close neighbours (Boys, 2007). On first inspection, it may therefore be assumed that farmers are lacking in social capital. However, the literature suggests that social capital has a complex, yet productive role within the farming community. For example, a number of studies have shown that farmers with well-developed networks tend to be better informed, keen to embrace new opportunities and adapt positively to change (Shucksmith, 1993; Ward and Lowe, 1994; Lobley *et al.*, 2005).

Civic matters remain the focus of much of the social capital research, with large, mainly urban communities, businesses or institutions forming the main area of study. However, a number of exceptions have been presented by researchers focusing on rural issues (see for example Falk and Kilpatrick, 2000; Kilkenny and Nalbarte, 2000; Onyx and Bullen, 2000) and more specifically on farmers. For example, Burton *et al.* (2005) have examined the relationship between the level of a farmer's social capital and the provision of public goods. Mills *et al.* (2008) found that social capital plays a key role in successful farming co-operatives and Munasib and Jordon (2006) concluded that farmers with higher levels of social capital are more likely to adopt environmentally friendly practices. Other studies have found that social capital can have a positive influence on natural resource management (Hall and Pretty, 2008a; Pretty, 2003; Pretty and Smith, 2003), relationships with agricultural agencies (Hall and Pretty, 2008b) and attitudes towards conservation (Mathijs, 2002; Cramb, 2004; Munasib and Jordan, 2006). Each of these studies has

noted the importance of horizontal linkages within the farming community as well as the vertical ties that extend a farmer's social network to include individuals from outside the farming community, as well as businesses and organisations. Munasib and Jordon's (2006) study showed that such links play an important role in the creation of information channels, a benefit that has been noted by numerous social capital researchers. Various components of social capital have been identified, including networks (Atterton, 2007; Burt, 2000), norms of behaviour (Putnam, 1995) and trust (Harper, 2001; Lyon, 2000; Putnam, 1995). These are each explored in the following sections.

3.5.1 Networks

Networks are an important element of social capital and form the means by which social ties are developed, norms of behaviour are established and trust is gained. According to Oerlemans and Assouline (2004), farmer networks provide an important form of response to change through creating opportunities to develop new ways to secure the livelihoods of farmers. These 'networking strategies' include opportunities for knowledge transfer, cooperative behaviour, and diversification. Network structure is important in terms of access to resources, which is essential for enabling successful response to change (Baker, 1990; Knoke, 1999; Lyon, 2000; Reagans and McEvily, 2003; Oerlemans and Assouline, 2004; Maneschy, 2006; Sabatini, 2009).

An important aspect of social capital is the function of cooperative behaviour in sustaining community groups. This has been noted by a number of researchers within the farming context. For example, Adler and Know (2002) suggest that bridging social capital can facilitate cooperation between farmers through creating opportunities for information dissemination and increased access to resources. Cooperative management practices have been shown to not only have positive impacts on the management of natural resources, but also on engendering good working relationships between farmers, encouraging knowledge and skill transfer and increasing resource access, thereby enhancing farmers' response capacity.

In order to encourage cooperation between individuals from different groups, who are likely to have access to diverse resources, bridging social capital is essential. Cooperation between groups can also avoid the negative externalities associated with bonding social capital, such as the development of exclusive networks. Bridging social capital has also been shown to be essential in increasing access to information. For example, Burt (2000) emphasises the importance of brokerage within a network. This refers to the state of information diffusion and the consequential opportunities created by structural holes, a theory which gained interest during the 1970s through Cook and Emerson's (1978) work on exchange networks; Freeman's (1977) on betweenness centrality; Granovetter's (1973) on the importance of weak ties; and Burt's (1980) on the structural autonomy brought about by complex networks. Burt (2000, p.9) defines structural holes as:

“The weaker connections between groups....These holes in social structure – or more simply, structural holes – create a competitive advantage for an individual whose relationships span the holes.”

Structural holes create the opportunity for the brokerage of the flow of information between people from either side of the hole. In other words, they connect people from different groups or networks (Burt, 2000). Individuals who have networks with many structural holes will generally know about, be involved in, and have control over more rewarding opportunities. In short, they have more social capital (Burt, 2000). Burt (2000) suggests that the presence of structural holes increases access to resources and information, providing opportunities to learn from others within the network. The connection between education and response capacity has been identified by many researchers. For example, Milestad and Darnhofer (2003, p.85), drawing on the work of Carpenter *et al.* (2001) and Jiggins and Roling (2000), identify *“the ability to build the capacity for learning and adaptation”* as a distinctive feature of a resilient system.

Key to education and learning is knowledge transfer (see, for example, Inkpen and Tsang, 2005; Reagans and McEvily, 2003; Uphoff, 2000). Only a very small proportion of the research that has been carried out on knowledge transfer is focused

on the farming context, or makes explicit reference to the role of social capital. Within the limited research that has been carried out, the consensus is that social capital plays an important role in increasing access to information and knowledge transfer among farmers. For example, Mills *et al.* (2008, p.48) suggest that formal group participation can be more beneficial in terms of knowledge transfer than one-to-one interactions between two farmers. They argue that, “*as social capital is built within the group, members are more willing to provide advice and mutual support.*” From their study of a series of farmer cooperatives, Mills *et al.* (2008) found that members valued the supportive culture of the group as much as, or more than the financial benefits they received. Additionally, they found a number of examples where farmers were willing to make a financial sacrifice in return for knowledge or support.

Social learning is particularly important at times of intense policy change. However, the success of communication and information transfer can often be limited, particularly where levels of social capital are low (Slee, Gibbon and Taylor, 2006). Some studies have found that farmers are reluctant to share information with those outside their immediate network and actively exclude weaker farmers (Ingram and Morris, 2007; Pelling *et al.*, 2007). Nonetheless, social capital and the information transfer that results, has been found by some to be highly influential on farmers’ behaviour and decision making. For example, in a study of 59 Belgian farmers, Mathijs (2002, p.7) found that both education and social capital had a “*positive and significant*” impact on farmers’ willingness to adopt agri-environmental schemes. Mathijs (2002) concludes that access and use of information are both essential elements in the adoption of innovation, and suggests that the importance of information access increases with the complexity of the innovation. With specific reference to farm resilience, Milestad and Darnhofer (2003) note the significance of farmers’ learning, particularly in relation to their ability to respond to changes and adapt management practices appropriately. They suggest that learning mechanisms are essential components of adaptation, for example, the ability of a farmer to respond to change and integrate the experience into future management practices. Munasib and Jordan (2006, p.5) note that associational involvement may provide

farmers with the opportunity to, “*learn new techniques and know-how, obtain informal trainings from others who have adopted such practices, and even obtain help implementing various practices*”. Although the adoption of new technologies does not necessarily suggest increased resilience, access to knowledge and training is essential in developing resilience, as farmers are far more likely to be able to cope with impacts if they have access to the relevant information and skills that would enable them to do so. Additionally, these findings stress the important connection between social capital and knowledge transfer, both of which have been shown, in many cases, to increase levels of resilience (see, for example, Rolfe, 2006; Adger, 2003; Milestad and Darnhofer, 2003).

There is clear evidence that social capital plays an important role in shaping the management practices of farmers and their related behaviour and decision making patterns. Farmers are influenced by the actions and values of both farmers and non-farmers, within and outside their immediate network. Numerous studies have emphasised the importance of network structure. For example, bridging ties have been shown to be essential in building social cohesion (Pretty and Ward, 2001) and encouraging collective action (Mills *et al.*, 2008) as the positive externalities resulting from bridging social capital can, in theory, increase access to resources, thereby increasing resilience. Although bonding social capital is essential for the development of trust within a network, excessive bonding social capital has been shown to result in exclusive networks where resource access may be limited for those both in and outside the group (Lobley *et al.* 2002). This emphasises the complex nature of social capital and the importance of considering both the positive and negative impacts associated with social capital investment.

3.5.2 Norms of behaviour

Another key component of social capital is the norms of behaviour which develop within a social network. As noted in the previous chapter, central to understanding farmers’ decision making processes in relation to bTB, are the norms of behaviour that are present within the farming community, which may be shaped by farmers’

beliefs, the actions of their peers, or the norms which have been passed on to them by previous generations.

Social capital has been found to have an important influence on shaping farmers' behaviour. For example, in a study of the relationship between social capital and environmental awareness, Musasib and Jordan (2006) found that social capital between farmers had a positive effect on their decision to adopt environmentally friendly practices. Additionally, they found that social capital had a positive effect on the extent to which farmers adopted these practices. Other studies support this view: for example, Jacobs (2002) found that increased community involvement is likely to increase an individual's concern for the global environment. These examples indicate the important connection between social capital and the way farmers behave and the decisions that they make. This suggests that levels of social capital could have a significant influence on how farmers choose to cope with risk and the response strategies that they develop.

Norms of behaviour are constructed collectively through mutual consensus and upheld by cultural mechanisms (Pretty and Ward, 2001; Paldam and Svendsen, 1999). By its nature, throughout history farming has been dominated by behavioural norms, often echoed by policy and sanctions. For example, after the Second World War, production maximisation was the trend, with pressure put on reluctant farmers to intensify by the public, other farmers and finally by the law. In comparison, since the mid-1980s, norms of behaviour, intensified by changing societal values, have emphasised environmental management and biodiversity enhancement. Where social capital is low, opposition to such norms or sanctions is likely to be common as feelings of social responsibility are often diminished (Svendsen, 2006). Additionally, Ostrom (2000) suggests that when externally-imposed rules are implemented without consideration for existing norms, new norms of opposition are likely to develop.

3.5.3 Trust

The final key component of social capital explored here is trust. It is widely accepted that trust is essential for the development of social capital at bonding, bridging and

linking levels (Bruni and Sugden, 2000; Lyon, 2000; Putnam, 2002) . However, the direction of the causal relationship between the two concepts is often unclear. It can be argued that trust is required for the development of social capital, or conversely, that social capital is necessary before trust can be established. Curry and Fisher (2012) suggest that, while there are many characterisations of trust, in all cases there remains a strong relationship between trust and connectivity: either trust *leads to* some sort of connectivity outcome, *comes before* a connectivity outcome, or changes connectivity relations over time. There is clearly a strong relationship between trust and social capital, which within the context of the current research will require further examination.

The decision to trust can either be a response to incomplete information or a general outlook on life (Bohnet and Baytelman, 2007). Curry and Fisher (2012) distinguish between rational trusting, whereby an individual's trust is based on knowledge and experiences, and the 'leap of faith' whereby an individual has limited knowledge of that in which he or she is putting their trust. A 'leap of faith' is taken when the risks associated with not trusting are deemed higher than those with trusting. Unknowns, and therefore the leap of faith, can be reduced through increased social capital (Curry and Fisher, 2012). For example, Brownlie and Howson (2005) suggest that in the health context, discussions with professionals, families and friends can reduce the leap of faith. This does not necessarily increase levels of knowledge but instead increases feelings of reassurance, and, reiterating the elements of social capital discussed above, enhances feelings of shared norms and values.

A number of researchers have identified trust as key to the way risk is constructed and perceived by individuals (Palmer, Fozdar and Sully, 2009; Sligo and Massey, 2007; Brownlie and Howson, 2005; Poortinga and Pidgeon, 2003). For example, Sligo and Massey (2007), drawing on the work of Giddens (1990), explore the multi-layered contexts in which a social being may experience both risk and trust. They suggest that trust plays an essential role in risk aversion, particularly in relation to knowledge seeking. A number of studies examining the relationship between trust and risk have been undertaken; for example, Poortinga and Pidgeon (2003) suggest

that trust is a prerequisite for effective risk communication. They argue that trust in risk management and in the institutions charged with governing particular risks constitutes an essential component of risk perception.

In terms of farmers' perceptions of, and responses to disease risk, trust has been shown to be significant. For example, Enticott (2010), Palmer *et al.* (2009) and Pellizzoni (2001) all identify trust in government as a key influence on farmers' behaviour. Renn and Levine (1991) identify five core components of trust: perceived competence, objectivity, fairness, consistency and faith. Similarly, Kasperson *et al.* (1992) suggest four components: commitment, competence, caring and predictability. It is realistic to expect confidence and trust to be key obstacles in terms of perceptions of, and response to disease risk. For example, past experience has been shown to impact upon farmers' levels of trust in government institutions. Palmer *et al.* (2009) citing the work of Slovic (1999), Poortinga and Pidgeon (2004) and Walls *et al.* (2004) suggest a general decline in levels of trust in public institutions. In addition to dealing with animal disease threats (for example, bTB, BSE, Foot and Mouth disease (FMD) and blue tongue), farmers have also become concerned with issues such as subsidy payments (Caplan, 2010) and financial losses caused by flooding, for example (Food and Farming Group, 2007). The ways in which the government, and more specifically Defra, has dealt with these problems is likely to impact upon levels of trust and potentially levels of cooperation with disease control strategies.

Farmers have faced a number of widespread animal diseases in recent years including the 2001 FMD crisis, which led to the slaughter of 4,078,000 livestock (McConnell and Stark, 2008). McConnell and Stark (2008, p.18) describe a number of government failings in tackling the disease. They note the:

“Ineffective implementation of the crucial 24-hour [culling] policy, accompanied by an unwillingness to initiate additional culling policies that would have halted the disease earlier in the campaign. This ultimately exposed a ministry (MAFF) suffering from institutional malaise and a fragmented civil service, incapable (at

least in the early stages) of providing a 'joined-up' response to match the scale of the crisis."

In view of the government's failings, at least in the early stages of the crisis, many farmers and farming unions lost confidence in the government's disease management strategies. This was emphasised by the widespread opposition from the farming unions to a cattle vaccination programme put forward by the government. Additionally, polls indicated that the public felt that the government had not handled the crisis well (McConnell and Stark, 2008). Past experience of poor performance of regulatory institutions is likely to shape perceptions of untrustworthiness (Pellizzoni, 2001). A study carried out by Poortinga *et al.* (2004) found that respondents generally considered the FMD crisis to be a system failure, widely criticising the way that the government conducted its control policies. Similarly, in a study conducted by Peck *et al.* (2002) on the psychological impacts of FMD, many respondents commented on the poor support offered by MAFF (now Defra).

The ways in which the government deals with agricultural crises is likely to impact upon the general levels of confidence that farmers have in the government's ability to form appropriate policy, emphasising the importance of developing positive relationships between farmers and authority. Based on a study of sustainable land management, Hall and Pretty (2008) suggest that farmers with high levels of linking social capital communicated regularly with those in authority, were successful in accessing information and financial support and were less likely to express feelings of disempowerment. In this context, trust in authority to develop appropriate disease control policy, as well as trust in the accuracy and effectiveness of guidance on disease control offered by institutions such as Defra and the NFU, is likely to have important implications for farmers' attitudes, behaviour and management decisions.

In addition to trust in government and institutions, trust in other farmers is also important. For example, trust between farmers has been shown to enable knowledge transfer between peers (Juntti and Potter, 2002) and cooperation between farmers, leading to better management of shared resources and the potential for such things as machinery sharing (Pretty, 2002).

3.6 CONCLUSION

In the previous chapter, the importance of the wider social context in understanding the capacity of farmers to respond to bTB risk was highlighted. In this thesis, the framework of social capital is used to explore the social factors that may influence farmers' attitudes towards the disease and their resulting response behaviour. As this chapter has shown, social capital provides a lens through which various social dimensions can be examined in order to assess their influence on the ability of farmers to respond to bTB effectively. Such dimensions include farmers' social networks, their norms of behaviour and levels of trust, all of which have been identified as key components of social capital.

The various conceptualisations of the concept put forward by the leading social capital theorists have been explored and various shortcomings noted. While the conceptualisations of Putnam, Coleman and Bourdieu make important contributions to our understanding of the concept, no particular theoretical interpretation was felt to be entirely appropriate for exploring the role of social capital in influencing the capacity of farmers to respond to bTB. While Putnam's distinction between bonding and bridging social capital is important, his neglect of the vertical, inter-hierarchical relationships, which have been defined as linking social capital, is a major shortcoming. Similarly, while Coleman explores both horizontal and vertical linkages, his overemphasis on close, bonding ties neglects the potential for the development of exclusive networks which have been noted by others. While the Bourdeulian interpretation of social capital is arguably the most theoretically well developed, and goes some way in addressing the shortcomings of Putnam and Coleman's conceptualisations, it does not fully distinguish between the various forms of social capital developed through the relationships between different individuals and groups. Therefore, the theoretical focus of this study is the three-way categorisation of social capital which has emerged, contributed to by many social capital theorists: bonding, bringing and linking. This categorisation has served as a useful theoretical framework in a number of social capital studies. For example,

Pretty and Smith (2003) used the framework to explore the role of social capital in influencing biodiversity management, while Pelling *et al.* (2005b) adopted the bonding, bridging, linking triplet to address adaptive capacity in the context of climate change.

This categorisation allows for a thorough exploration of both horizontal and vertical linkages, in addition to an examination of strong, close ties as well as those which are weaker and more distant. As explained in Chapter Two, bTB has the potential to impact farmers financially, practically and emotionally. It is unlikely that the same social ties will provide access to the resources that allow farmers to respond to all of these impacts. Instead, different ties are likely to play specific roles in farmers' response capacity. It is therefore an aim of this study to establish these roles and to explore the ways in which certain types of social capital may be used productively.

The methods adopted in this study to explore the role of the different forms of social capital in influencing the capacity of farmers to respond to bTB are outlined in the following chapter. In order to clearly position the study, a conceptual framework for the thesis is first provided.

3.7 A CONCEPTUAL FRAMEWORK FOR THIS STUDY

A conceptual framework aims to organise a set of concepts in a logical way and identify the relationship between the concepts. This enables the concepts revealed in Chapters Two and Three relating to bTB response capacity and social capital to be explored within a logical framework. The conceptual framework for this research involves several interrelated concepts, namely risk, vulnerability, resilience, response capacity and social capital. As discussed in section 2.3, **risk** can be defined as “exposure to unfavourable consequences” that may lead to a transformation (Hardaker *et al.*, 2004, p.5). **Vulnerability** is a susceptibility to harm or a potential for change or transformation when exposed to risk (Gallopín, 2006), while a more **resilient** person, group or system can absorb shock while maintaining function (Buckle, March and Smale, 2001, p.4). It is sometimes said that vulnerability is the antonym of resilience (Folke *et al.*, 2002). However, this is

an oversimplification; while a resilient system is less vulnerable than a non-resilient one, the relationship is far from symmetrical. Instead, vulnerability represents a scale where resilience implies a lower degree of vulnerability (Gallopín, 2006). **Response capacity** is the ability of a system to “*adjust to a disturbance, moderate potential damage, take advantage of opportunities, and cope with the consequences of a transformation that occurs*” (Gallopín, 2006). The research will further explore the dynamics within these relationships by considering the role and significance of investment in **social capital** in developing response capacity. Social capital is broadly defined here as the features of social life – networks, norms and trust – that contribute to resource mobilisation among actors within a network. However, as the critique provided in this chapter reveals, the debate around its meaning is on-going amongst policy makers and academics. While the relationship between social capital and response capacity will form the focus of this thesis, risk, resilience and vulnerability are recognised as important components of response capacity and will therefore be considered as part of the research.

A diagrammatic representation of the conceptual model for this thesis is presented in Figure 3.1. A further deconstruction of social capital is provided in Figure 3.2 and of farmers’ response to bTB risk in Figure 3.3. Starting with Figure 3.1, social capital is shown at the top of the diagram. Its core components, norms of behaviour and trust are included. Closely related to this is social structure. There exists a two way relationship between social structure and social capital and in this conceptualisation, they are seen to be mutually reinforcing as suggested by Putnam. However, following the criticism put forward earlier in this chapter regarding Putnam’s neglect for the initial formation of social capital, it is important to explore this in more detail here.

In this thesis, social capital is considered to result from social structure combined with core social capital components, such as trust and norms of behaviour. That is to say that social ties do not become productive (i.e. become social capital), until trust and/or norms are formed. However, in order for these components to be established,

some form of relationship first needs to be present. The social capital components are therefore seen as catalysts through which a social relationship becomes productive. Once social capital is formed, depending on the type of tie (i.e. bonding, bridging or linking), the investor is likely to gain access to additional social contacts, which, in time, may also be formed into social capital. The deconstruction of social capital shown in Figure 3.2 further illustrates the relationship between social structure and social capital. At the top of the diagram, a farmer makes the decision (consciously or otherwise) to invest in a social tie. Depending on the nature of the tie, combined with trust and norms, the relationship becomes bonding, bridging or linking social capital. Such ties provide access to a range of resources, both tangible and intangible, including knowledge and information transfer. The result of the social capital investment is likely to influence a farmer's future decisions relating to relationships with either the same, or another, contact. For example, if a relationship between a farmer and a government representative works to build trust and provides access to useful information that provides the farmer with a new business opportunity, the farmer is likely to continue to invest time and effort into that relationship. Additionally, the farmer may be more inclined to invest time in relationships with other government representatives. Conversely, if the relationship is unproductive or the information provided inaccurate, the farmer may be less inclined to reinvest in future.

Going forward to Figure 3.1, social capital is shown to have various outcomes. While others have been noted, these are considered to be most relevant in the context of this study. In addition to providing access to additional resources and knowledge and information transfer, social capital has been shown to enforce a sense of shared experience and lead to the development of collective norms. All of these are likely to influence farmers' attitudes, knowledge and behaviour.

When bTB is incorporated into the model, it is important to distinguish between actual and perceived risk. Farmers' attitudes and knowledge are likely to have a strong influence on their levels of risk perception. For example, shared experiences

with other farmers who have regularly been under bTB restriction may increase a farmer's perception of the risk that the disease poses. Together with the resources to which a farmer has access, his or her attitudes, knowledge and behaviour will influence their capacity to respond to the disease. A farmer's eventual response, coupled with the potential impacts of bTB, will influence their level of resilience or vulnerability. The model shows a cyclical relationship whereby levels of vulnerability or resilience in turn influence levels of resource access, knowledge and information transfer, shared experience and collective norms.

In Figure 3.3 the way in which farmers respond to bTB risk is further deconstructed. The model shows the various impacts associated with a bTB breakdown (financial, practical and emotional), but also emphasises the role of uncertainty. That is to say that farmers are likely to experience certain impacts (particularly emotional), when faced purely with the risk of the disease, not necessarily an actual disease breakdown. As the model shows, farmers can respond to the disease in three ways: they can take measures to avoid or adapt to it, or simply cope with it once the risk is realised. As noted in Figure 3.1, farmers' responses will be influenced by their attitudes, knowledge and behaviour, as well as the resources to which they have access. These are all influenced by social capital.

Figure 3.1 Conceptual Model

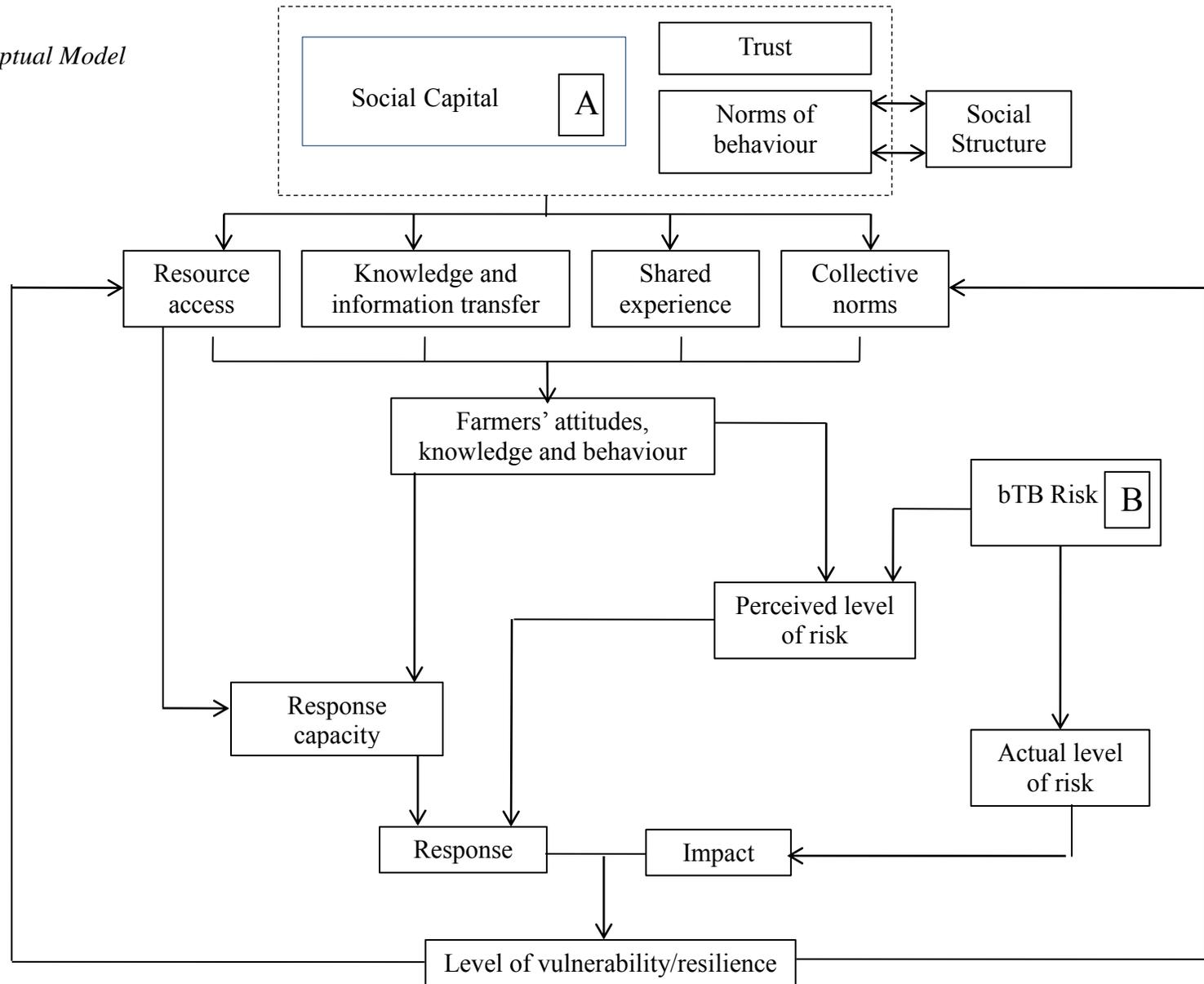


Figure 3.2 A further deconstruction of social capital (A)

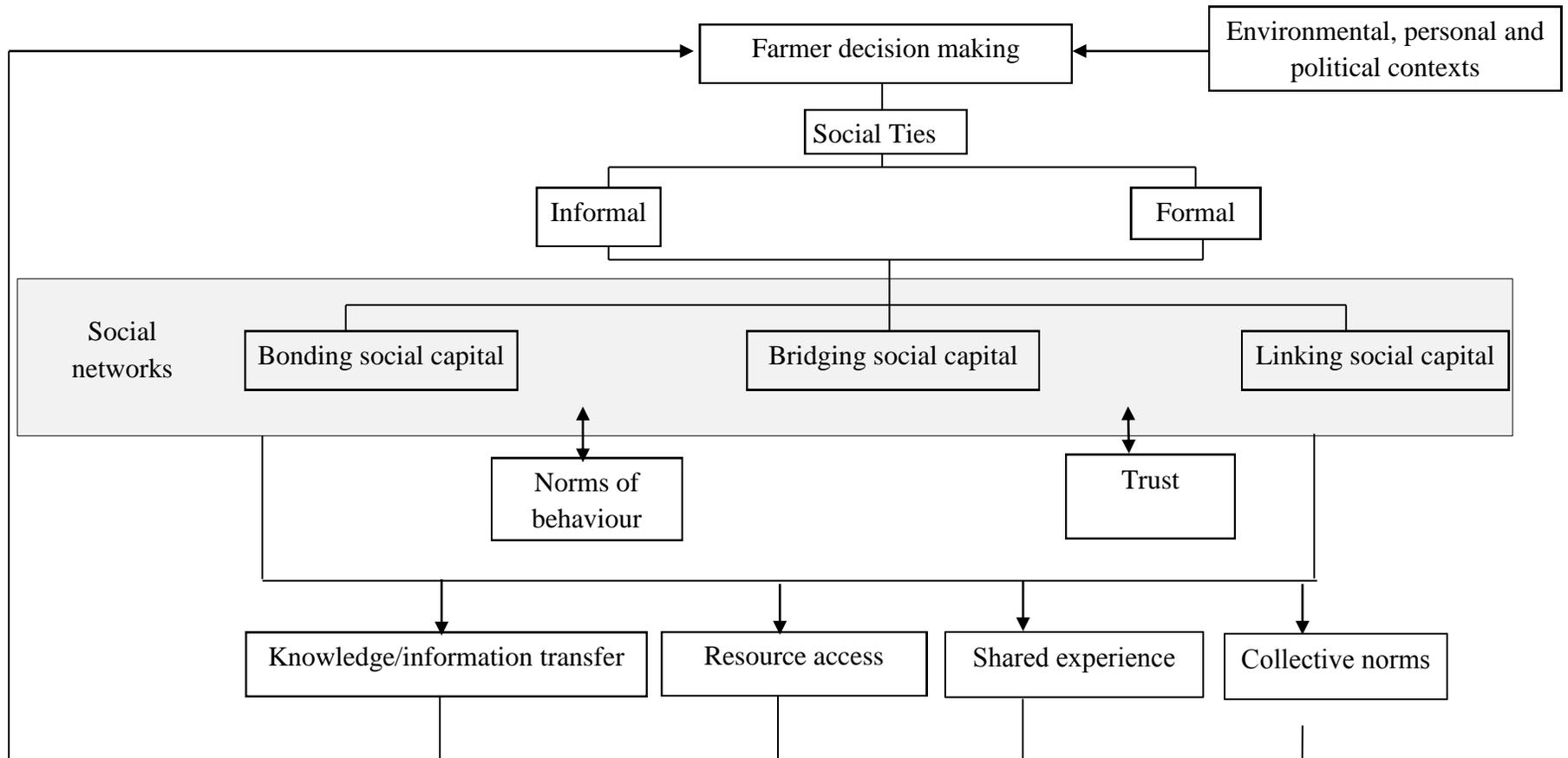
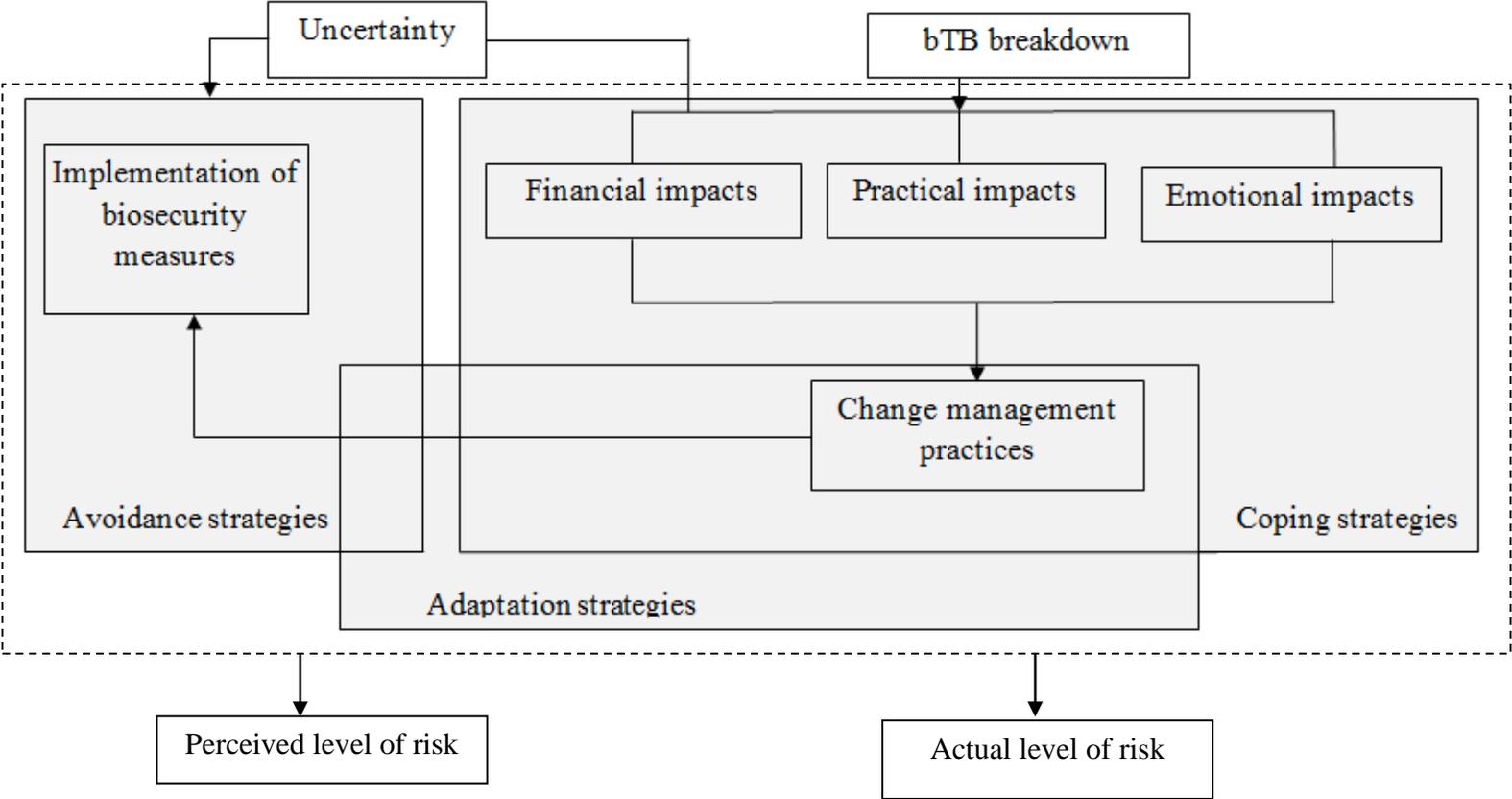


Figure 3.3 A further deconstruction farmers' response to bTB risk (B)



3.8 RESEARCH ISSUES AND QUESTIONS

Based on the literature reviewed in Chapters Two and Three and the conceptual framework put forward in section 3.7, a number of core research issues have been identified. These are used to devise a set of concise research questions which will form the focus of the research.

There has been limited attention given to bTB within the social sciences (Enticott, 2008a), with previous research focusing mainly on farmers' attitudes towards various control strategies. Although it has been shown that bTB poses a number of substantial risks to farmers, no research has yet been undertaken to explore farmers' ability to respond to the disease. This research therefore aims to contribute to this important debate.

Essentially, the literature reviewed in the previous two chapters highlighted the socially embedded nature of risk, emphasising an individual's beliefs, values and knowledge as highly influential in terms of their risk perception and the response strategies that they devise. Social capital therefore provides a useful lens through which to explore the mechanisms that enhance or constrain a farmer's ability to respond to bTB.

In order to assess the relationship between social capital and bTB response capacity, understanding risk and, perhaps more importantly, risk perception is important. Risk perception is key to understanding farmers' attitudes and behaviour in relation to managing risk. Although farmer risk perception has been studied by a number of researchers in the United States, it has received limited attention in the UK. The current research therefore aims to go some way in rectifying this gap, which introduces the first research question:

- 1) How is bTB risk perceived by farmers, and to what extent does risk perception differ between farmers?

The overriding focus of this thesis – the role of social capital in increasing the response capacity of farmers – brings together all of the principal concepts that have been

introduced in the conceptual framework: social capital, risk, vulnerability, resilience, and response capacity. Social capital has been shown to have an important influence on cooperative behaviour, knowledge transfer, and resource access, all of which influence levels of response capacity. The second research question will therefore specifically focus on the relationship between social capital and response capacity:

- 2) What is the current response capacity of farmers and to what extent can this be improved through investment in social capital?

In order to understand social capital more fully, it is important to explore the ways in which farmers are currently investing in it and the routes of such investment. The various forms of social capital, bonding, bridging and linking, have been identified and both the positive and negative consequences of social capital investment noted (Mills *et al.*, 2008; Widmald, 2005; Cramb, 2004; see for example Adler and Kwon, 2002). However, with the exception of Hall and Pretty (2008) and Burton *et al.* (2005), little attention has been paid to the routes of social capital investment among farmers in England. This is important to understanding the type of social capital that is created through different forms of investment and in turn, the impact of different forms on levels of bTB response capacity. Therefore, the third question that will be addressed as part of this research is:

- 3) To what extent are farmers currently investing in social capital and what form does this investment take?

As noted previously, the conceptual focus of this thesis in relation to social capital is the three way categorisations of bonding, bridging and linking. The fourth research question will therefore explore the different relationships between farmers and their contacts to distinguish between the various forms of social capital and to establish each of their roles in influencing farmers' bTB response capacity:

- 4) What are the differences between the various forms of social capital (bonding, bridging and linking) in terms of influencing the ability of farmers to respond to bTB?

The final research question relates specifically to the policy context of this study. Based on the findings of the other four questions, the fifth research question asks the following:

- 5) Based on the findings of the study, what are the policy recommendations for increasing the bTB response capacity of farmers?

In order to address each of these research questions it was necessary to adopt appropriate methods which allow for an in-depth exploration of the issues at hand. The methods for this study were therefore selected with careful consideration for the research questions. The following chapter provides a detailed explanation of the methods adopted, including a rationale for their selection and a description of how they were implemented.

CHAPTER 4. METHODS

4.1 INTRODUCTION

The conceptualisation and analysis of response capacity, social capital, and the related concepts is inherently complex. However, in order to develop appropriate interventions, analysis plays an essential role in making the connection between research and policy. Research on social capital in the context of farmers, and bTB risk in particular, remains a work in progress, as does the advancement of context specific measurement tools. Nevertheless, as with social capital, resilience and vulnerability often exist at an extremely local level and what may impact negatively upon one individual may not affect, or impact positively upon another (Birkman, 2006; Carpenter *et al.*, 2001). Therefore, generic, cross-context, comparable measurement tools are impractical, and instead the use of a broad framework that can act as a base on which to build locally relevant tools, driven by community participation, is likely to be far more constructive (Grootaert and Van Bastelaer, 2002). In order to address these issues, an integrated, pragmatic approach was required comprising both qualitative and quantitative techniques. The selection of appropriate data collection methods was therefore based on these overarching criteria.

The research strategy was divided into two phases. The first phase involved twenty in-depth qualitative interviews with farmers in Gloucestershire and Devon, which provided a thorough exploration of the core concepts of the study within the specific context of interest. This informed the development of a second, quantitative phase which, through a postal survey of cattle farmers in the South West, provided representative data suitable for statistical analysis. Both research phases are described below.

The chapter also identifies potential difficulties relating to the research design and the ethical considerations that underpin the study. Data analysis techniques are then

discussed with a particular emphasis on the integration of the qualitative and quantitative approaches.

4.2 A MIXED METHODS APPROACH

In order to address the research questions outlined above, a mixed methods approach has been taken in this study. Mixed methods have grown in popularity in recent years. It has become known as the “*third research paradigm*” (Johnson and Onwuegbuzie, 2004, p.15), and has been described by Greene (2007) as “*multiple ways of seeing and hearing*”. Creswell and Plano Clark (2010) explain how mixed methodologies provide a natural outlet to explore everyday life. They emphasise how the media consistently report quantitative trends coupled with personal experience and as a consequence the public, as well as social researchers, consider it an accessible approach to enquiry. According to Tashakkori and Creswell (2007, p.4):

“Mixed methods research is defined as research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches in a single study or program of inquiry”

Another definition put forward by Creswell and Plano Clark (2007, p.5) explains that the use of qualitative and quantitative methods in combination can provide “*a better understanding of research problems than either approach alone*”.

In order to further understand the benefits of a mixed methodology, it is useful to note the specific attributes of each approach. Qualitative data provide a detailed understanding of a research problem. Merriam (2009, p.5) explains that:

“Qualitative researchers are interested in understanding how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences.”

In comparison, quantitative inquiry is based on the examination of the responses of a large number of people to a pre-determined set of variables. Both approaches have their limitations and one type of evidence may not tell the complete story or fully address the research problem. The benefits brought about by combining the approaches have been described by some writers as triangulation (Denzin, 2006; Teddlie, 1998; Jick, 1979). The triangulation metaphor is derived from navigation and military terminology which describes the use of multiple reference points in order to derive the precise position of an object. The use of triangulation can therefore increase accuracy. In the same way, social researchers can increase the accuracy of their inquiry by collecting different forms of data to address the same research problem (Jick, 1979).

There are various approaches within the mixed methods paradigm. According to Greene (2007) these can be divided into four categories: convergence, extension, iteration and blending. Convergence refers to the most widely used category of mixed method approaches, whereby multiple methods are used to measure the same phenomenon for the purposes of triangulation. The second category, extension, refers to the use of different methods to assess different phenomena within the same study. Within this approach, each method is chosen for its application to a specific aspect of the research problem. Mixed method approaches classified as iteration use one method to inform the development of another. The methods are therefore implemented sequentially. The last category, blending, refers to the use of two or more methods to explore different facets of the same complex phenomenon.

Based on the research questions, an iterative approach was considered most appropriate. As explained earlier, the core concepts of interest in this study (social capital, risk, vulnerability and resilience) are context specific and occur at very local levels. To explore the concepts quantitatively without a thorough understanding of the context would therefore be inappropriate. However, one of the main objectives of the study was to develop a segmentation of farmers based on representative data. For these reasons it was necessary to devise a research strategy that would enable a comprehensive exploration of the study context in order to inform subsequent quantitative data

collection. The research strategy therefore comprised two phases: an initial qualitative phase (1) followed by a quantitative phase (2), as outlined below:

Phase 1: A qualitative approach was taken, with data collection taking the form of 20 in-depth face to face interviews with farmers. The aim of this first phase of the research framework was to gain a thorough understanding of the issues faced by farmers in relation to bTB and their perception of the risk that it poses. Their current and potential response strategies were also discussed in addition to more general questions relating to trust in policy and government, an important issue identified in a number of previous studies (Enticott *et al.*, 2011; Gunn *et al.*, 2008). Central to this thesis is the role of social capital in shaping these attitudes. The wider social context in which farmers are embedded was therefore also explored. Additionally the first phase allowed for the ‘localisation’ of the core concepts in terms of gaining a context specific understanding of the issues. This helped to inform the second phase in terms of the questions asked, as well as the language used and the social interactions/situations that were discussed in relation to social capital.

Phase 2: The design of the second phase was based on the findings of phase 1 in order to gather large scale, representative data through a postal survey of 374 farmers. The aim of this phase was to inform the development of a farmer segmentation model based on levels of social capital and bTB response capacity. In addition to an exploration of social capital, phase two was designed to provide a quantitative assessment of bTB risk perception among farmers.

4.3 ETHICAL CONSIDERATIONS

Before describing the methodological approach taken in the two research phases, it is useful to outline a number of ethical considerations that are relevant to this study. Most importantly, it is necessary to note the controversial and emotive nature of bTB. The research, particularly the in-depth interviews in the first phase, could therefore potentially cause discomfort to some respondents, especially those who had experienced recent bTB breakdowns, had lost large numbers of cattle or were experiencing financial difficulties as

a result of the disease. This was considered when devising the interview schedule and advice was sought from the South West Bovine TB Farm Advisory Service, which has had regular contact with farmers dealing with bTB. No particular issues were encountered but if there had been, the interviewees would have been directed to the advisory service for advice and support.

Guaranteeing confidentiality and anonymity was also essential as some of the interviewees discussed controversial issues (such as the illegal culling of badgers). Respondents were given the opportunity to request the audio recorder to be switched off at certain points during the interview. The interview transcripts were given identification numbers in order to preserve interviewees' anonymity. Quotes from the interviews presented in this thesis are therefore non-attributable to particular farmers³.

The covering letter of the postal survey also emphasised confidentiality and anonymity. As explained in section 4.5.4 below, data protection regulations prevented the researcher from having access to the respondents' contact details. None of the survey responses could therefore be attributed to a particular farmer and all were given unique identifiers for the data analysis.

4.4 PHASE 1 METHODOLOGY

This section provides an overview of the data collection and analysis methods selected for the first phase of the research. In order to do this, the study is positioned in relation to relevant methodological approaches taken in similar studies. Following this, an appropriate operational framework and methodology for this research phase is identified.

4.4.1 Positioning the study

There exists a large and varied literature surrounding social capital and risk within a wide range of disciplines. In order to address the research questions put forward by this thesis, it is necessary to develop a methodological framework which allows bTB risk to be

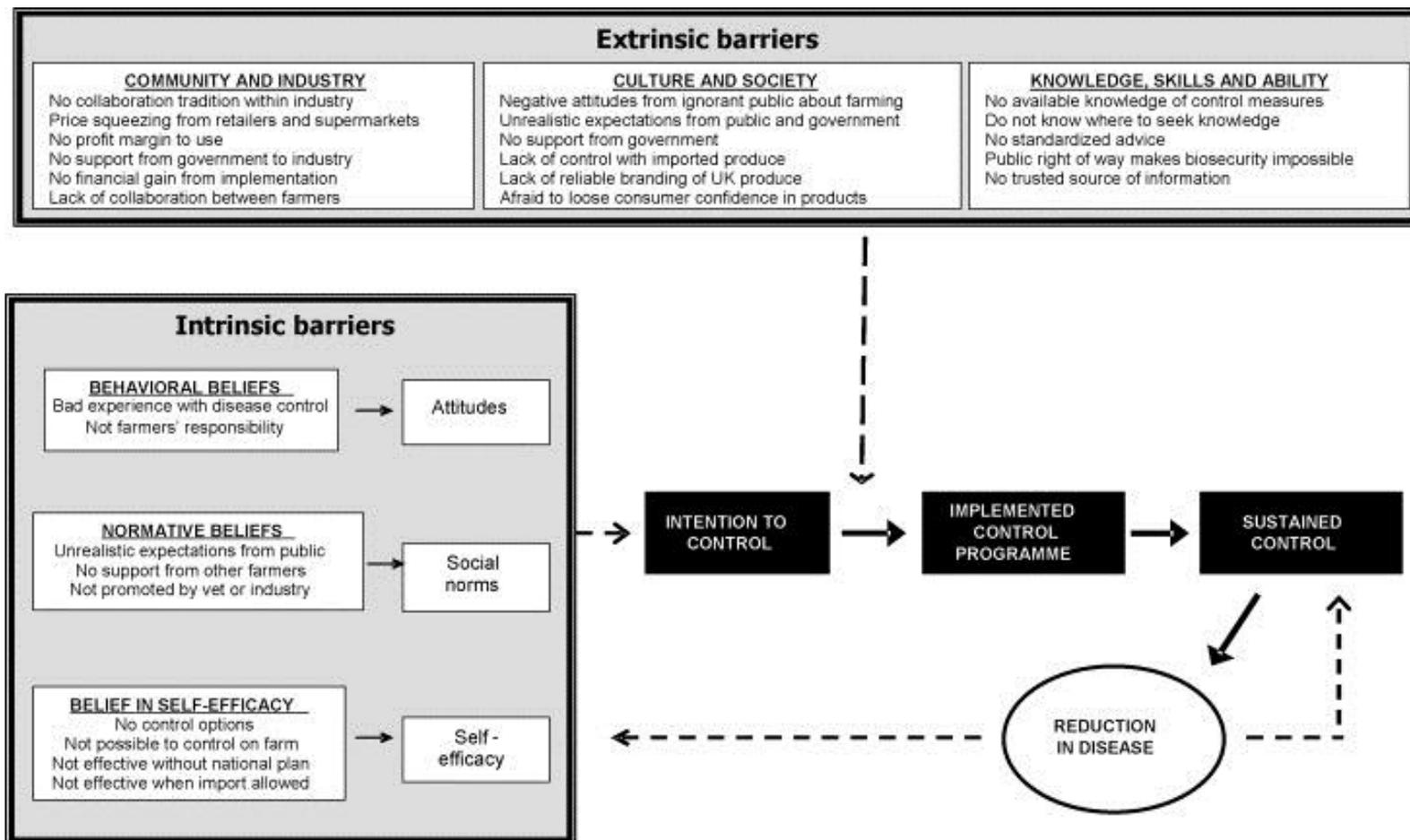
³ The University of Gloucestershire's ethics principles were referred to when preparing the formal degree registration form (RD1) at the end of the first year of study. It was ensured that any ethical considerations such as issues relating to confidentiality and anonymity were addressed in line with the University's principles.

considered within a wider social context in order to establish the social structures that may affect farmers' perception of, and reaction to the disease. There are a number of key constructs that are essential for the development of social capital, and three core social capital components have been identified: trust (Harper, 2001; Lyon, 2000; Putnam, 1995), norms (Putnam, 1995), and networks (Atterton, 2007; Burt, 2000). Each of the social capital components also appears in the risk literature, and on occasion an explicit connection is made between them (see for example Palmer, Fozdar and Sully, 2009; Sligo and Massey, 2007; Poortinga and Pidgeon, 2005; Peters, Covello and McCallum, 1997). Of most relevance to this study is the research that focuses on bTB risk from a social science perspective. However, other than a small number of exceptions, much of the literature which looks at bTB risk falls within the fields of ecology, zoology and epidemiology (see for example Tuytens *et al.*, 2001; Pollock *et al.*, 2000) and is less concerned with the social perspective. It is therefore necessary to broaden the context slightly to incorporate research into animal disease risk. For example, Bruni and Sudgen (2000) and Sligo and Massey (2007) consider the impact of trust levels (a key component of social capital) on farmer attitudes towards disease management, and Heffernan (2008) explores collective action among farmers in relation to the implementation of biosecurity measures as a response to animal disease. Although each of the studies provides an interesting perspective on risk and the mechanisms which shape farmers' attitudes towards it, one particular study was identified as being especially relevant to this study in terms of the methodological approach that was adopted. This study, conducted by Ellis-Iverson *et al.* (2010) explored the implementation of on-farm biosecurity measures to reduce the risk of E-Coli in cattle. Using the social-ecological model developed by Panter-Brick *et al.* (2006), the researchers explored a wide range of internal and external contexts in order to further understand farmers' attitudes, behaviour and decision making. The social ecology model provides a comprehensive approach through which the social context of risk can be explored in depth and it is therefore discussed in more detail below in relation to how it was used to inform the development of the present study.

4.4.2 A Social Ecological perspective

The various constraints to bTB response capacity have been noted, many of which are shaped by the wider social context. In order to explore this further a social ecological perspective, adopted by Ellis-Iverson *et al.* (2010) in their study on farmers' attitudes towards E-Coli, was used to inform the development of the interview schedule to be used in phase 1. Ellis-Iverson *et al.* (2010) interviewed 46 farmers, focusing on a number of themes that had been identified through discussion with vets, food safety scientists and risk analysts. The findings of the study suggest that the implementation of biosecurity measures is an act of farmer behaviour change which is likely to be substantially influenced by the wider social context. The researchers considered their findings using the socio-ecological model developed by Panter-Brick *et al.* (2006) which explores the transition between no intent, intent, implemented control and sustained control. The model, renamed by Ellis-Iverson *et al.* (2010) as the pathway to disease control model, suggests three groups of intrinsic circumstances which are likely to influence intent: behavioural beliefs, influenced by core values and attitudes; normative beliefs, shaped by social norms; and beliefs in self-efficacy. Once intent is established, the model suggests that extrinsic circumstances then influence the transition to implemented control and sustained control. Using the framework of the pathway to disease control model, the findings of the study are shown in Figure 4.1.

Figure 4.1. Pathways to disease control model (Ellis-Iversen et al., 2010)



N.B. Black boxes = steps in behaviour change process; circle = wanted outcome; grey boxes = barriers; non-dashed arrows = movements towards wanted outcome; dashed arrows = barriers hindering movement between steps.

The social ecological model adopted by Ellis-Iverson *et al.* (2010) emphasises the significance of inter-personal transactions across several levels, including personal, familial, cultural and institutional. It also notes the importance of attitudes, norms and self-efficacy in influencing behavioural change in relation to disease management. Panter-Brick *et al.* (2006) suggest that determinants of behaviour change are positioned within much wider social and physical contexts than is often assumed, influenced by both micro and macro levels of community support in addition to levels of external support in the form of resources and infrastructure. The emphasis on the wider social context in the social ecological model makes visible various inter-personal relationships at a number of different levels. Panter-Brick *et al.* (2006) originally developed the social ecology model to understand participants' behaviour in relation to the usage of bed nets as a method of malaria prevention. However, Ellis-Iverson *et al.*'s (2010) successful adaptation of the model to assess farmers' behaviour in relation to the control of E. Coli, is of relevance to this thesis. The latter's model was therefore used in this study as a framework in which to consider farmers' attitudes and behaviour towards bTB risk within a broad social context.

4.4.3 Developing an interview schedule

The pathways to disease control model devised by Ellis-Iverson *et al.* (2010) was used to guide the development of the interview schedule for the in-depth interviews in phase one. In Appendix 2 the model is considered in combination with the findings of the literature review to develop a semi-structured framework for this interview phase. The framework was then used to construct a semi-structured interview schedule. The table in Appendix 2 identifies the various aspects of risk and social capital that warrant further exploration in the face-to-face interviews. For each point, a cross reference is provided to indicate the interview question which was devised to address it. The interview schedule itself is presented in Appendix 3.

4.4.4 Piloting

The interview schedule was piloted on two farmers in order to ensure that the questions being asked would stimulate discussion around the appropriate subjects. The timing of

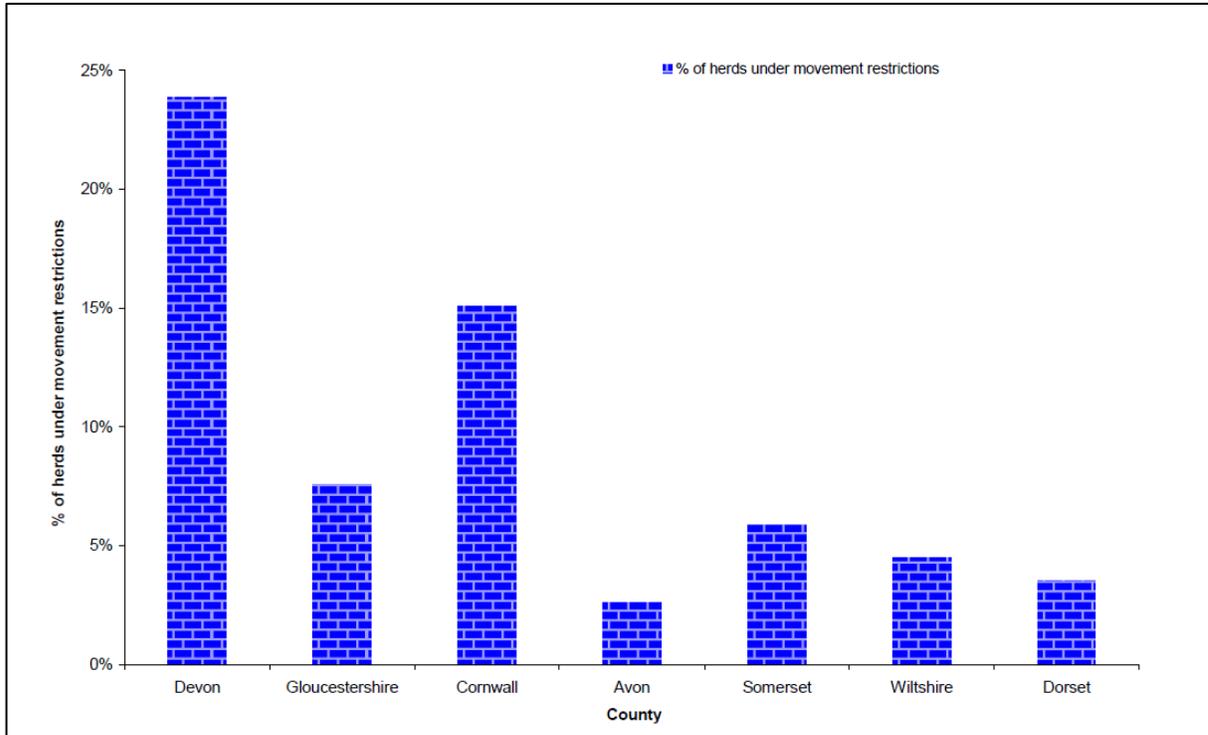
the interview was also checked in order to ensure that the length was manageable (between one and one and half hours). The farmers who were interviewed in the pilot were asked to point out any unclear wording or terminology. As a result a small number of changes were made to the schedule.

4.4.5 Phase 1 selection of study areas

As this thesis is concerned with the role of social capital in influencing farmers' responses to bTB risk, it was considered necessary that the research should be undertaken in areas of high bTB incidence. Farmers based in areas with a low incidence of bTB may not have any experience of the disease. It would therefore be difficult to explore the relationship between social capital and bTB response capacity in such areas. Looking at Figure 2.1 in Chapter Two it is clear that the areas with the highest incidence of bovine TB are in the South West of England and in South Wales. It was decided that this study should focus on England rather than the UK as bTB policy is devolved and the differences in policy would make data comparison difficult. Additionally, the main focus of this study is social capital and its role in increasing bTB response capacity rather than attitudes towards the different national policies designed to tackle the disease. It was therefore felt that the study areas should be confined to England to prevent the differences in policy approach becoming an additional factor for which to control.

The South West of England experiences the highest level of bTB incidence in the UK with 52% of all UK breakdowns occurring in this area in 2009 and over one quarter of farms in the region likely to suffer a bTB breakdown within a twelve month period (Butler, Lobley and Winter, 2010). It was therefore decided that the participants for the first research phase should be selected from within the region, in which there are seven counties: Gloucestershire, Cornwall, Avon, Wiltshire, Devon, Dorset and Somerset. In order to establish the counties in which bTB incidence is highest, Figure 4.2 provides an overview of the percentage of herds under cattle movement restriction in each county in 2009. Cattle are put under movement restriction when bovine TB is suspected or found in the herd and the OTF status is withdrawn. As Figure 4.2 shows, in 2009 Devon had by far the highest percentage of herds under TB cattle movement (TB2) restrictions.

Figure 4.2 Herds under restriction in South West England as a percentage of herds under restriction in England in 2009 (Defra, 2010b reproduced by Butler, Lobley and Winter, 2010).



However, these figures represent absolute numbers of cattle affected, which may mask the relative intensity of the disease in certain areas. In order to overcome this, Butler *et al.* (2010), drawing on work by Ilbery *et al.* (1999), adopt the Location Quotient (LQ) methodology to establish the relative, rather than absolute, spatial concentration of the disease by controlling for the varying size of the counties and unitary authorities involved. The following calculation was used:

$$\text{LQ ratio} = \frac{\text{Number of farms with movement restriction in county or unity authority} \div \text{Number of farms with movement restrictions in England}}{\text{Number of farms in county or unitary authority} \div \text{Number of farms with movement restrictions in England}}$$

The results of the LQ ratio calculations are shown in Table 4.1.

Table 4.1 Relative distribution of farms with bovine TB by number of holdings (Butler, Lobley and Winter, 2010)

County	LQ ratio based on the total number of cattle holdings in the county	LQ ratio based on the total number of cattle in the county
Gloucestershire	3.26	3.58
Cornwall	2.41	2.13
Devon	2.35	2.37
Wiltshire	1.73	1.49
Avon	1.56	1.26
Dorset	1.31	0.74
Somerset	1.14	0.82
South West England	2.04	1.84

A LQ ratio of 1 indicates that a county has neither more nor less of its share of farms under bTB restriction than the overall number of holdings or cattle numbers would suggest. A LQ ratio above 1 indicates that the number of bTB incidence in the county is more than expected for its size or number of cattle. As the results in Table 4.1 show, based on numbers of cattle holdings, each of the counties in the South West has a high concentration of bTB. However, based on cattle numbers, both Dorset and Somerset have relatively low levels of bovine TB incidence. Gloucestershire has the highest level of bTB, both in relation to the number of cattle holdings and the number of cattle in the area. Both Cornwall and Devon also have high levels of bovine TB incidence, with Cornwall having the highest concentration based on the numbers of holdings in the area, and Devon the highest in relation to cattle numbers. In terms of numbers of cattle slaughtered, Butler *et al.* (2010) found that after Gloucestershire, Devon had the highest number in relation to the number of cattle in the county.

An additional indicator of the impact of the disease is the number of cattle movement restrictions in an area. As noted above, herds are put under movement restriction if their OTF status is withdrawn. Movement restrictions can put a number of pressures on a business, such as additional feed costs or difficulty housing additional cattle. In 2008, Gloucestershire had the highest number of restricted herds (33%), followed by Cornwall (26.6%) and Devon (25.6%) (Defra, 2010b). These counties have experienced high levels of bTB throughout the last decade. It is therefore likely that the majority of cattle farmers in the three counties have either experienced a bTB breakdown, or feel that the disease poses at least some risk. As shown in Table 4.2, Gloucestershire has consistently experienced the highest annual number of movement restrictions, although Cornwall and Devon have been subject to slightly higher increases in the number of restrictions in the last ten years.

Due to its high level of bovine TB incidence, Gloucestershire was selected as the first study area in which to conduct the initial fieldwork. It was decided that a second study area should be selected in addition to Gloucestershire in order to incorporate a wider variety of farm characteristics. Although not the main focus of the case studies, a degree of comparison is useful, not solely between areas, but also across farm types, farm size and management approach, etc. Therefore, it was decided that either Devon or Cornwall should be selected as the second study area due to the high incidence of bovine TB in both areas. A number of farm characteristics for Gloucestershire, Cornwall and Devon were therefore examined in order to identify any differences which would provide opportunities to explore a variety of farm and farmer characteristics, and where appropriate, interesting areas for comparison.

Table 4.2 Percentage of herds under cattle movement restrictions by area 1998-2008 (Defra, 2010b)

	Gloucestershire	Cornwall	Devon
1998	14.6%	6%	4.6%
1999	16.0%	7.3%	4.9%
2000	20.1%	7.6%	5.8%
2001	10.8%	5.6%	3.8%
2002	24.8%	14.2%	10.3%
2003	30.2%	18.3%	15.6%
2004	25.2%	17.5%	17.2%
2005	27.4%	18.8%	21.7%
2006	25.2%	18.1%	21.5%
2007	28.0%	19.7%	23.1%
2008	33.0%	26.6%	25.6%
Total % increase	18.4%	20.6%	21%
Average annual increase	1.8%	2.1%	2.06%

As shown in Table 4.3, beef farming is more prevalent than dairy in all three counties. However, both Cornwall and Devon have a slightly higher proportion of dairy cattle than Gloucestershire. A comparison between beef and dairy farmers in relation to their perception of and responses to bTB risk may provide an interesting aspect of this study as a number of potential differences have been identified in the literature. For example, Ramirez-Villaescusa *et al.* (2010) argue that farms with dairy cattle are more likely to experience bTB breakdowns than those without. They suggest that this is due to dairy cattle living longer than beef, therefore increasing the amount of time that the animals

may be exposed to and infected by the disease, and giving longer to incubate infection. Management may also increase the risk of bovine TB among dairy herds. For example, it has been suggested that spreading slurry on grazing land, which is done by a large proportion of dairy farmers, may increase bTB risk (Ramirez-Villaescusa *et al.*, 2010; Phillips *et al.*, no date).

Table 4.3 Farm characteristics data (Defra, 2009b)

	Gloucestershire	Cornwall	Devon
Number of holdings	5400	9875	17392
Total number of cattle	124759	340066	584021
Total dairy	44197	128899	230475
% Dairy	35.43%	37.90%	39.46%
Total Beef	80562	211167	353546
% Beef	64.57%	62.10%	60.54%

In order to choose between Devon and Cornwall as a second study area, a number of other farm characteristics were examined in order to establish any differences to the Gloucestershire area. Firstly, data on farm tenure show that Devon has the highest proportion of owner occupiers and Cornwall the lowest. It has been suggested that land tenure may influence farmers' behaviour, and therefore the management decisions that they make (Pike, 2008; Soule, Tegene and Wiebe, 2000). It is therefore important that both tenant farmers and owner-occupiers are represented in the sample. However, as the data in Table 4.4 show, the proportion of owner occupiers and tenant farmers does not vary dramatically across the three areas, suggesting that it would be possible to access farmers with each type of tenure within any of them.

Table 4.4 Farm tenure (Defra, 2009b)

	Gloucestershire	Devon	Cornwall
% Rented	30.13%	25.71%	32.80%
% Owned	68.71%	70.08%	63.63%
% Other	1.16%	4.21%	3.57%

Similarly, as can be seen in Table 4.5, farm size does not vary substantially between the three areas so was not considered in relation to the choice of study area.

Table 4.5 Farm size by area (Defra, 2009b)

	Gloucestershire	Devon	Cornwall
<5ha	47.5%	46.3%	47.1%
5<20ha	20.4%	20.3%	21.0%
20<50ha	12.7%	13.9%	13.3%
50<100ha	8.6%	10.7%	10.2%
>=100ha	10.9%	8.3%	9.0%

Considering the farm characteristics data presented above, there appears to be little difference between Cornwall and Devon in terms of farm type, size and tenure. However, there are some differences between the two areas when compared with Gloucestershire, most notably in terms of herd type. The argument presented above has shown that either area would provide an appropriate study area in which to carry out the initial fieldwork in terms of having high bTB incidence and providing opportunities to explore additional farm and farmer characteristics.

As the farm characteristics data presented above do not identify a clear distinction between the two areas, it was decided that Devon would be chosen as the second study

area based on its larger size and greater number of cattle holdings. Devon also contains part of Exmoor National Park and all of Dartmoor National Park. The majority of land located within the National Parks is upland and classified as Less Favoured Areas (LFA). By its nature, farming in these areas poses different challenges and requires different management practices to lowland farming. Additionally, the land is mainly rough grazing and therefore provides far less opportunity for diversification in relation to farming methods or land use than its lowland counterpart. However, as with any National Park, tourism is an important component of the economy in the area and may provide farmers with opportunities to diversify, for example by offering B&B (Burton *et al.*, 2005). The presence of both upland areas and National Parks in the county provides interesting characteristics to explore further and allows for comparisons to be made where appropriate.

4.4.6 Selection of the participants

A total of 20 face-to-face interviews were carried out, 10 in each study area. The sampling strategy for this study first involved identifying cattle farmers in Gloucestershire and Devon. This was done through searches in telephone directories and on the internet. As there are few data on cattle farmers in the public domain, it was not possible to select participants purposefully based on farm size, cattle numbers, or bTB incidence, for example. The sampling procedure was therefore limited to two criteria: whether the farmer had cattle, and location. Potential participants were then contacted initially by letter to establish whether they would be willing to participate in the research. Farmers who responded positively were then contacted by telephone to arrange a convenient time to be interviewed. A summary of the sample participants is provided in Table 4.6.

Table 4.6 Sample summary

	<i>Gloucestershire</i>	<i>Devon</i>
Number of cattle farmers interviewed	10	10
Range of farm size	40-280 hectares	25-364 hectares
Range of herd size	30-275	26-700
Age range of respondents	29-75	33-69
Average age of respondents	54.6	53.2

4.4.7 Phase 1 data analysis

All participants were interviewed in their homes, and with the participants' consent, all were recorded and transcribed verbatim. The analysis of the interviews then followed Kolb's (1985) learning cycle approach, which incorporated three key stages. The first stage relates to the researcher's *concrete experience* which forms the basis of the analysis (Kolb, 1985). This initial data analysis process therefore began during the interviews themselves and their subsequent transcription. Ideas and issues were recorded in field notes and aide memoires, which began to inform the construction of the coding framework. This was used later in the analysis process. The next stage involved *reflexive observation* whereby informal readings of the interview transcripts led to intimate familiarity with the data. Throughout this process the issues being raised by the data were carefully considered and the coding frame was further developed and amended as appropriate. This was followed by a formal coding process using the qualitative analysis software NVivo9. Drawing on principles of Grounded Theory, the framework was adjusted by revisiting the literature and while working through the data until robust. The final stage of the analysis process involved *active experimentation* whereby key themes were extracted from the data. These were then considered in the context of the conceptual framework for the research and reflected on in relation to *concrete experience* in terms of the reality of the research process, thus returning to the start of Kolb's (1985) cyclical model.

The main themes emerging from the data were:

- The role of trust and its relationship with different forms of social ties.
- The distinction between information dissemination and knowledge transfer.
- The role of different social networks in providing various forms of support.
- The potential for exclusion brought about by overly close ties.

The findings of the qualitative research phase are presented in the following chapter and formed the basis for the development of the second research phase. The interviews identified core areas of interest worthy of further investigation, as well as revealing the context specific nature of social capital and bTB risk. This enabled the development of a quantitative postal survey as described in the following section.

4.5 PHASE 2 METHODOLOGY

The second phase of the research built on the findings of the first phase and was designed to inform the development of a farmer segmentation model based on levels of social capital and bTB response capacity. Various aspects of the literature reviewed in Chapters Two and Three were therefore drawn on to inform the development of an appropriate methodology for this research phase.

The first research phase provided a detailed context for the study and identified a number of areas requiring further analysis. Essentially, relevant aspects of social capital were identified. In order to develop this further, and to devise a postal survey to collect quantitative data, the *theory of behaviour*, devised by Pike (2008) and discussed in Chapter Three, was carefully considered. As a result, core themes were identified including attitudes, norms and habits as well as external factors such as policy intervention. Using the findings of the in-depth interviews, questions were devised to address these themes within the context of bTB risk.

In addition to understanding farmer behaviour, it was also necessary to incorporate the measurement of social capital into the postal survey. As Grootaert and Van Bastelaer (2002) point out, social capital lends itself to a mixed-methods approach as it is context

specific and requires an in-depth understanding at the local level before broader generalisations can be made. They therefore suggest that a tool for measuring social capital in any context is more likely to be useful and reliable if qualitative and quantitative methods are combined. Various aspects of social capital were therefore explored in the first interview phase to allow for the development of context specific yet quantitative survey questions in the second phase.

Although studied from different perspectives, and within different fields, the general consensus remains that a ‘one size fits all’ approach to social capital measurement is inappropriate and ignores the importance of the local context. Of particular interest to this thesis is a study carried out by Hall (2008) which adopts the World Bank’s Social Capital Assessment Tool (SoCAT), developed by Grootaert and Van Bastelaer (2002), to measure social capital among farmers in relation to encouraging more sustainable land management practices. The SoCAT used in the study provides a structured, quantitative survey designed to allow adaptation to reflect the local context. It covers a number of key themes, including: social cohesion and inclusion; engagement in groups and networks; information exchange and communication; collective action and cooperation; trust and feelings of empowerment and subsequent political action (Grootaert and Van Bastelaer, 2002). In addition to these, Hall (2008) added questions on conflict, crime and farmers’ relationship with the market-place. Essentially, these additional issues were identified by Hall (2008) in previous research phases, in which in-depth discussions with farmers identified key areas relevant to the development (or disintegration) of social capital. According to Grootaert and Van Bastelaer (2002, p.19) the SoCAT provides a “*loose-tight*” framework for social capital analysis: “*loose or flexible in the details but tight on the essential concepts*”. For example, the types of groups or social situations that participants are asked about can be determined by discussion with relevant actors. The survey used by Hall (2008) assessed the key aspects of social capital as suggested by the SoCAT and her locally relevant research which explored bonding, bridging and linking social capital. Hall (2008) assesses these at micro, meso and macro levels, referring to different levels of society, from community to institutional, as shown in Table 4.7.

Table 4.7 Key aspects of social capital as suggested by Hall (2008)

	Micro: Bonding	Meso: Bridging	Macro: Linking
1. Social cohesion and inclusion	Number of potential contact points with other farmers: regularity of engagement	Number of potential contact points with non-farming neighbours: regularity of engagement	Number of potential contact points with government officials and buyers; regularity of engagement
2. Farmers' engagement in groups and networks	Membership, attendance, and leadership of farming groups	Membership, attendance and leadership of village groups	Use of farming or other organisations to engage with government (e.g. NFU) or buyers (farmer controlled businesses)
3. Information and communication	Information exchange and communication between farmers	Information exchange and communication with non-farmers	Information gathering: use of the internet
4. Experience of cooperation	Past, present and future cooperation with farmers (e.g. machinery sharing)	Past, present and future cooperation with non-farmers (e.g. joint projects to benefit the local community)	Past, present and future cooperation with government agencies(e.g. using farm for training events/farm trails)
5. Social norms and trust	Feelings of trust towards other farmers. Areas of conflict	Feelings of trust towards non-farmers. Areas of conflict	Feelings of trust towards government officials and buyers. Areas of conflict
6. Empowerment and political action	Feelings of empowerment: contribution to agricultural policy undertaken with other farmers	Feelings of empowerment: contribution to agricultural policy undertaken with other members of the local community	Feelings of empowerment: personal engagement with agricultural and rural policy

As Table 4.7 suggests, different forms of social capital occur at different levels. For example, in relation to cooperative action, Hall (2008) proposes that bonding social capital (close ties within closed networks) occurs when farmers cooperate with each other. Bridging social capital is developed when different types of people interact, and in this case, cooperation between farmers and non-farmers is suggested. Linking social capital, which refers to inter-hierarchical relationships, is created when individuals with different levels of power or influence interact, such as in the case of cooperation between farmers and government representatives. Hall's (2008) framework was used to develop the social capital component of the postal survey. Questions were devised to explore each of the six components at bonding, bridging and linking levels. As with Hall's (2008) approach, some of the questions were taken directly from the SoCAT, but others were developed based on the findings of the interviews carried out in phase 1.

4.5.1 Developing the survey

One of the main aims of the second research phase was to develop a robust, statistically defensible farmer segmentation model. It was therefore necessary to develop a survey that could be analysed statistically using appropriate techniques to allow inferences about the farmer population in question to be made with confidence. An important part of the survey design was to minimise non-response bias and measurement error. Badly designed surveys are likely to result in low response rates, and poorly worded questions can lead to misleading or inaccurate answers (Dillman, 1991). The wording of each question as well as the layout and design of the survey as a whole were therefore carefully considered. Advice on such matters was taken from the likes of Bradburn *et al.* (2004), Dillman (2007, 1991) and Oppenheim (1992). Following the advice of Dillman (2007), subordinating language and complex questions were avoided, and the survey was designed in a way that showed that the researcher considered the respondent's input to be highly valuable.

As far as possible closed questions were used in the survey, an example of which is shown below.

Please select the statement which best describes your situation			
I own my farm	<input type="checkbox"/>	Some of my farm is owned and some is rented	<input type="checkbox"/>
I rent my farm	<input type="checkbox"/>	I am the farm manager	<input type="checkbox"/>

Where necessary, open-ended questions were also used. For example:

How big is your farm?
_____ acres/hectares (please delete as appropriate)

The piloting process (described in more detail in section 4.5.2) helped to ensure that ambiguity or vagueness in the questions was avoided.

Following tried and tested approaches to the development of farmer typologies used in previous studies carried out by Urquhart (2009), Tsourgiannis (2007), and Pike (2008), a series of statements were included in the survey, all of which required a 5-point Likert scale response. This approach ensured consistency in the data, which is important for factor and cluster analysis, both of which were used to develop the farmer segmentation model.

The survey shown in Appendix 5 was well spaced on 5 A4 pages printed on both sides. A heading was included on the first page. The survey was then divided into the following six sections:

1. Information about the farm
2. Agricultural risk
3. Experience of bTB
4. Attitudes and opinions
5. Support network
6. General questions about the farmer

The structure of the survey was designed to be easy to follow and to show a clear progression from one section to the next. The first and last sections were included to gather descriptive data about the respondents in order to help determine the characteristics of any farmer groups that emerged from the segmentation model. The second section explored farmers' general attitudes towards agricultural risks such as input and output prices and weather. This was designed to provide a context for their attitudes towards bTB risk. In section 3, respondents were asked about their experience of bTB, for example, whether they had had a bTB breakdown, how many cattle they had lost, as well as their uptake of recommended biosecurity measures. The fourth section explored respondents' attitudes and opinions about various aspects of the study including bTB risk and impacts, as well as issues relating to social capital. The fifth section focused on respondents' support networks including questions about who they would seek advice about bTB from, who they trust, the level of practical and emotional support received from different contacts and the regularity of their contact with various individuals.

4.5.2 Piloting the postal survey

The survey design went through a series of iterations before it was finalised. This was done for two reasons. Firstly, it was necessary to ensure that all questions were clear and accurate to ensure the quality of the responses. Secondly, the survey was improved in terms of layout and design to increase the response rate. The draft survey was sent to three knowledgeable academics and an experienced farmer who were asked to comment on the clarity and relevance of the questions and the overall design of the survey. These comments and suggestions were incorporated into the pilot survey, which was then distributed to the 20 farmers who had been interviewed in phase 1. All of the interviewees had agreed to be involved in the second research phase. A cover letter explained the nature of the survey and asked the respondents to make comments and suggestions, but also to indicate the time that it took for them to complete the survey. Seventeen responses were received, noting a completion time of between 10 and 30 minutes, with an average time of 16 minutes, which was considered to be appropriate. Some of the respondents did not make any comments but others suggested minor

amendments to the wording of some of the questions and one question in particular was shown to lack clarity. This question related to herd type. The first question asked respondents to state their farm type (beef, dairy, mixed, etc.), and the following asked for their herd type. Respondents who had selected beef or dairy in the first question felt that the second question was simply a repeat of the first. The question was therefore re-worded as follows:

1. Which of the following best describes your farm type?			
Beef	<input type="checkbox"/>	Mixed livestock	<input type="checkbox"/>
Dairy	<input type="checkbox"/>	Mixed	<input type="checkbox"/>
			Other (please state) _____
2. If different from your answer above, which of the following best describes your cattle herd?			
Beef	<input type="checkbox"/>	Dairy	<input type="checkbox"/>
		Beef and Dairy	<input type="checkbox"/>

All of the respondents answered every question, which indicated that overall the questions were clear and the instructions provided to the farmers were appropriate. Once the survey was finalised, a covering letter was devised providing an overview of the research project and instructions for completing and returning the survey. It was then necessary to identify the sample farmers, the process for which is described in the following section.

4.5.3 Sampling strategy

As noted in section 4.4.5, the South West of England was the area chosen for this study due to the high levels of bTB incidence in the region. While phase 1 interviews were conducted in just two of the seven counties in the region, it was decided that in order to gather generalisable data for the development of the farmer segmentation model, it would be appropriate for the population of interest to be all cattle farmers in the South West. A representative sample was therefore sought. However, a number of obstacles were met at this point. Firstly, there is no complete list of cattle farmers in the South West in the public domain. It was therefore necessary to seek the information from relevant institutions and Defra, the Country Land and Business Association (CLA) and the NFU were approached to ask for their assistance. Although Defra and the CLA were unable to

provide the information, the NFU took a particular interest in the study and agreed to provide access to their farmer database. However, the contact details available were only for NFU members. The South West TB Farm Advisory Service (SWTBFAS) were therefore approached and agreed to provide access to their farmer database consisting of 800 cattle farmers in the region.

Secondly, a representative sample was sought, ideally through the use of stratified sampling techniques. However, due to data protection regulations, the NFU and SWTBFAS were unable to release the details and so agreed to randomly select farmers from the database. This prevented the use of a stratified sampling technique which would have allowed for a completely representative sample to be drawn by selecting participants based on characteristics representative of the South West farmer population. Due to the time limitations of the NFU and SWTBFAS staff members who assisted with this process, it was not possible to dictate the number of farmers that were selected from each county or the division between farm type, etc. Instead, a completely random sample was taken. However, the results were analysed for non-response bias (discussed further in Chapter Six) and, due to large sample size, this was not found to be a significant limitation.

The surveys and covering letters were printed and packed into envelopes, which were then sent to the NFU's mailing department. The mailing labels were printed and stuck onto the prepared envelopes by NFU staff and posted from their office. This process limited the researcher's control over the sampling process but was necessary to ensure that data protection regulations were adhered to.

A sample size of 1500 was chosen with the aim of receiving between three and four hundred responses (a response rate of between 20% and 27%). Following the advice of Hair *et al.* (1998), this was considered a sufficient number to reflect the potential variations in the population and to make comparisons across the sample. The researcher's financial limitations were also taken into consideration.

4.5.4 Problems with the sampling strategy

In addition to the lack of researcher control over the sampling strategy outlined above, it is also important to note the limitations of the farmer contact details provided by the NFU, namely that some of the contact details had not been recently updated. It is therefore a possibility that some of the surveys did not reach the intended respondents. This was clear from the small number of surveys that were returned to the researcher which stated that the addressee was no longer resident at the address or that the respondent was no longer farming. While this may have limited the number of responses, this was not considered a significant problem, due to the high level of completed surveys that were received.

4.5.5 Response rate

The potential survey response rate was maximised as far as possible through piloting the survey, ensuring unambiguous questions and a clear structure. Following the advice of Oppenheim (1992), pre-paid return envelopes were enclosed with the survey. As noted above, 1500 surveys were distributed to farmers in the South West. A total of 401 completed responses were received within two months of the survey being distributed. Based on the advice of Hair *et al.* (1998), this was considered a sufficient number of responses. Some time elapsed while no additional responses were received and it was therefore decided that the analysis of the surveys would begin. However, during the following six months an additional 14 responses were received which unfortunately could not be included in the analysis. With hindsight this problem could have been avoided by specifying a deadline by which responses were required to be returned. However, at the time it was thought that this could potentially reduce the response rate. Due to the high number of responses that were received, it was not necessary to send out reminders or additional surveys as has been done in other studies (Dillman, 2007). A response rate of 26.7% was achieved which was relatively high compared to other postal surveys of farmers (Britt *et al.*, 2011; Ilbery *et al.*, 2006; Pennings, Irwin and Good, 2002). While the relatively high response rate indicated that the survey was clear and well designed, it

also emphasised the emotive nature of the subject area, about which farmers are eager to voice their opinions. Of the 401 responses that were received, 374 were usable.

As the sample was drawn at random the division between the counties in terms of the surveys distributed is unknown. It is therefore not possible to calculate response rates for each county compared with population data. However, Table 4.8 provides a summary of response numbers.

Table 4.8 Number of usable survey returns by county

County	Total
Devon	124 (33.2%)
Somerset	69 (18.4%)
Cornwall	60 (16.0%)
Gloucestershire	41(11.0%)
Wiltshire	39 (10.4%)
Dorset	31 (8.3%)
No response	10 (2.7%)
Total	374

4.5.6 Data analysis

As previously noted, the primary aim of this research phase was to develop a farmer segmentation model. In order to do this, a two stage method was adopted following the approach taken in previous studies (Tsourgiannis, 2007; Pike, 2008; Urquhart, 2009). The two stages are detailed below:

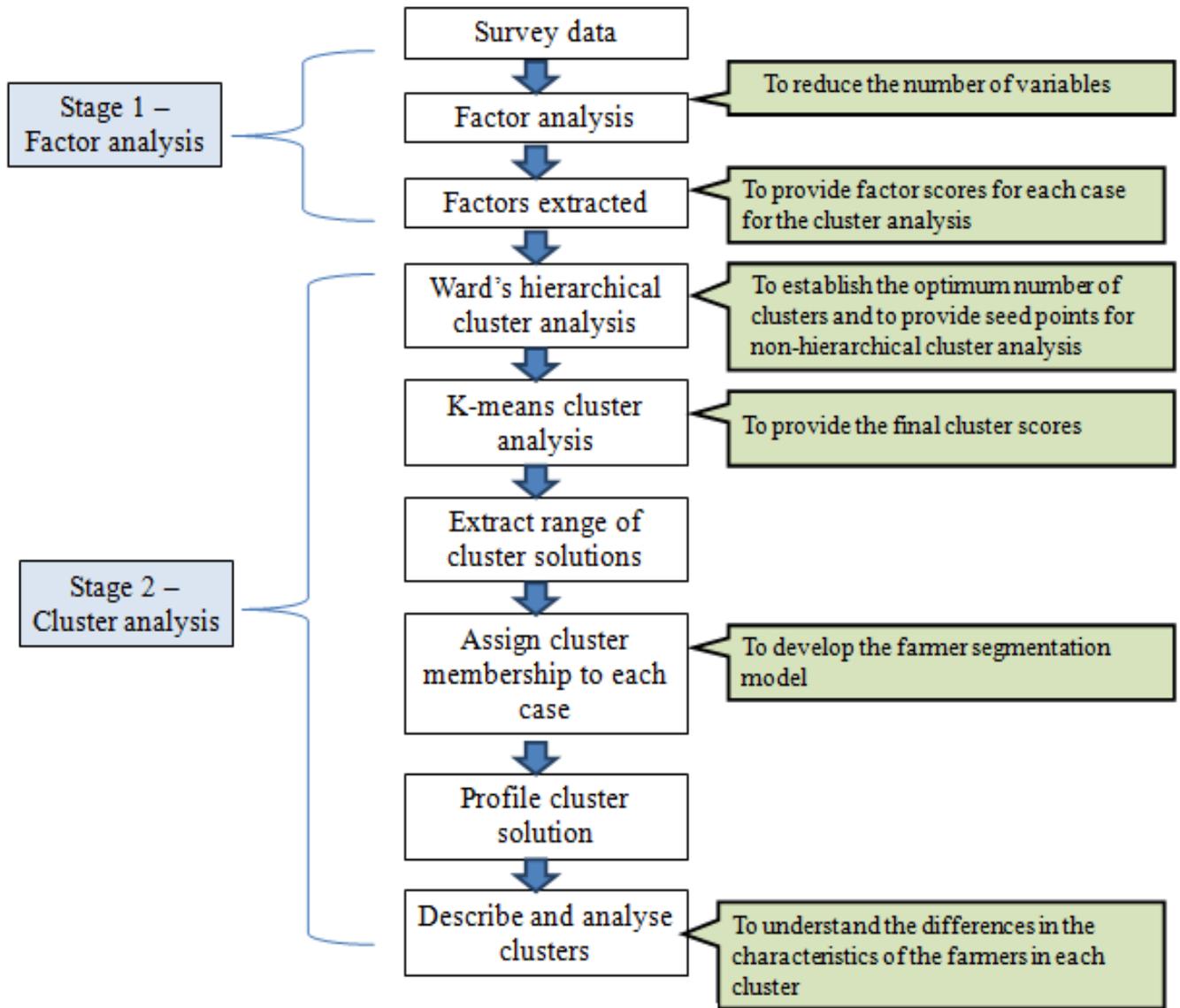
1. The data were first subjected to factor analysis to reduce the number of variables to those that provided the best explanation of the attitudes and behaviour of the respondents. This process involved a number of stages including removing outliers using the Mahalanobis D^2 measure and exploring levels of

multicollinearity. The factorability of the data was established by the Bartlett Test for Sphericity and the Kaiser-Meyer-Olkin Measure of sampling adequacy.

2. This was followed by cluster analysis which used the factor scores to cluster the respondents into groups. Again, outliers were identified using the Mahalanobis D^2 measure. After careful consideration, the Squared Euclidean distance measure and Ward's method were selected for the clustering process and it was decided that hierarchical analysis would be followed by non-hierarchical analysis to identify farmers with similar characteristics in relation to their attitudes and behaviour (Hair *et al.*, 1998). The cluster centroids provided by the hierarchical analysis were used as initial seed points in the non-hierarchical process. The choice of cluster solution was informed by careful consideration of the findings from the literature review and first research phase.

The software IBM SPSS Statistics 19 was used for the analysis. The two stages of the analysis used in phase 2 are shown in Figure 4.3 below.

Figure 4.3 Stages of data analysis in phase 2



4.6 SUMMARY

At the beginning of this chapter, five research questions were presented based on the findings of the literature review presented in the preceding chapters. In order to address these questions this chapter has described the methodological approach taken in this study. A mixed methods approach was taken in order to address the various conceptual issues that have been identified. Following a pragmatic, iterative approach, the research design was divided into two phases. The main objective of the first phase was to gather in-depth contextual data to inform the second phase. Following Ellis-Iverson *et al.*'s (2010) pathway to disease control model, a semi-structured interview schedule was designed and twenty farmers were interviewed. The data were analysed according to Kolb's (1985) learning cycles approach which involved an iterative process through which intimate familiarity with the data was achieved and a robust coding framework developed. The qualitative analysis software NVivo9 was used for the analysis. The findings derived from phase one were considered alongside Pike's (2008) theory of behaviour and the social capital components identified by Hall (2008). This process informed the development of a postal survey for the collection of quantitative data in the second research phase. The survey, distributed to 1500 cattle farmers in the South West, resulted in 374 usable responses. Following the approach taken by Tsourgiannis (2007), Urquhart (2009) and Pike (2008), the data were subjected to factor and cluster analysis in order to devise a farmer segmentation model. The results of the qualitative and quantitative phases of analyses are presented in the following two chapters.

CHAPTER 5. PHASE 1 RESEARCH FINDINGS

5.1 INTRODUCTION

The findings from the twenty face-to-face interviews conducted in the first interview phase are presented in this chapter. Firstly, an overview of the sample characteristics is provided. This is followed by a series of sections structured around the key themes that emerged from the data.

5.2 FARM AND FARMER CHARACTERISTICS

Out of the 20 interviewees, 15 were beef farmers and 5 were dairy farmers. The average herd size is just under 150, ranging between 26 and 700 cattle. Within the sample, dairy herds tended to be larger with an average of 273 cattle, compared to an average of 104 for beef herds. The average farm size is just over 100 hectares, ranging from 25 to 364 hectares. In terms of tenure, eight of the participants owned their farms and eight were tenant farmers. The remainder had mixed tenure.

All of the interview participants had experienced at least one bTB breakdown. One of the participants was under bTB restriction at the time of the interview. Experience of bTB was not a criterion for selection but exemplifies the intensity of the disease in the case study areas.

For 11 of the farms in the sample, cattle represented 100 per cent of the farm income. The remaining farms were mixed, with either additional livestock (e.g. sheep) and/or arable. The majority of farms had diversified to one extent or another. Within the sample, diversification activities included cheese making, livery, holiday lets, contract farming and direct sales. For some of the participants, the farm only represented a proportion of their household income. For example, for a number of the participants income was also generated through off-farm activities such as a family member working elsewhere. Only

two farms in the sample have not diversified. In both instances the cattle represent 100 per cent of their business and household income.

The majority of participants were from a farming family and had farmed all their lives. Of the three farmers in the sample who are new to farming, all had entered the industry following a previous career. All of these were organic farmers, selling their produce direct to customers through farmers markets or box schemes.

The average age of the participants was 53.9. This is somewhat lower than the national average of 59 (Defra, 2010a). However, the sample covered a large age range from 29 to 75. In each case the interviews were undertaken with the/one of the main decision maker(s) on the farm. In two instances, the interviews were undertaken with two interviewees. In both cases the interviewees were a husband and wife partnership who were both keen to take part in the interview. The majority of the respondents were male, although five females were interviewed individually and two were interviewed with their husbands.

Participants were asked about their reasons for farming. The majority spoke about farming being “in the blood” and suggested that they never considered doing anything else. Other reasons included family loyalty and quality of life. In terms of the participants’ educational background, seven had no agricultural training while the majority had completed day release courses at agricultural college. Two of the participants had undertaken undergraduate degrees in agriculture or a related subject. These were the two youngest respondents (aged 29 and 33).

Following the first section of the interview schedule, which focused on farm and farmer characteristics, a number of key areas were explored. These included attitudes towards agricultural risk, experience of bovine TB, social support networks and plans for the future. Within these, a number of key themes emerged, namely: trust, networks and norms. These have been identified by a number of researchers as the key components of social capital (see for example Putnam, 1995; Coleman, 1988). An additional theme which was found to be very important in relation to building social capital and dealing

with bTB, was knowledge and information acquisition. Within the literature, knowledge in the form of human capital has been noted as having an important influence on social capital (Coleman, 1988). Discussions with the farmers also identified the importance of the different forms of social capital (linking, bonding and bridging) on farmers' capacity to respond to bTB. In the following sections these, and the key themes outlined above, are explored in relation to farmers' attitudes towards bTB and its control.

5.3 RESEARCH FINDINGS

This section presents the findings of the qualitative analysis undertaken in NVivo9. A number of key themes emerged from the data:

1. The role of trust and its relationship with different forms of social tie
2. The distinction between information dissemination and knowledge transfer
3. The role of different social networks in providing different forms of support
4. The potential for exclusion brought about by overly close ties

This section is framed around these four key themes.

5.3.1 The role of trust and its relationship with different forms of social tie

Trust was a key feature of the farmer interviews and was explored in relation to the micro (personal trust) and the macro (trust in organisations/government) levels. The majority of respondents emphasised the importance of trust in running their business and more specifically, in dealing with bTB. Trust in individuals as well as in information was considered to be important. The role of trust is summed up by a Gloucestershire beef farmer as follows:

“Trust is a big part of my business. If I can't trust someone, I don't deal with them, and if that trust is betrayed I kick them into touch very quickly...Farming still runs very much on a gentleman's hand shake.” (n.2)

In the farmer interviews, trust emerged most notably in the form of distrust of government. When asked about their views of the government in the context of bTB, all

participants appeared frustrated by the lack of action taken by the government and some went further to suggest an underlying or alternative policy agenda:

“We all know there are ways to treat TB. There are vaccines, so people are wondering what the motives are. Why isn’t anything being done? Somebody somewhere is saying ‘don’t mention it’. There is a reason why they want TB out there, I don’t know what it is but it must serve a purpose.” (Devon beef farmer n.17).

A similar view was held by some participants in relation to the livestock industry more generally:

“There’s no trust in government, I think they have an alternative agenda... Everything that has happened in the livestock industry in the last 20 years has been increasing pressure. They’re always making life more difficult, almost to the extent that I feel it is an underlying policy.” (Devon beef farmer n.16)

Participants’ distrust in government was also indicated in their sceptical view of the reliability of information provided by Defra:

“I don’t think what the government tells us about TB is true. All their advice comes from a source which is questionable.” (Devon beef farmer n.17)

When asked about their relationship with government representatives, the majority of participants said they had had very little contact with specific individuals and suggested that it is often difficult to contact the same individual more than once. The distrust of government inherent among the respondents perhaps reflects the lack of long-term personal relationships between farmers and government representatives. One of the participants suggested that it is this sort of relationship that is needed:

“They should have a case worker who works in a certain area and who knows what’s going on in that area who you can speak to.” (Devon dairy farmer n.18)

Kasperson *et al.* (1992) identify the following components of trust in institutions: commitment to a goal (for example the eradication of bTB), competence, caring, and

predictability. Following Kasperson *et al.*'s trust framework, a number of key factors relating specifically to institutional trust in the context of bTB were noted. Perhaps the most prevalent is the frustration felt by farmers at the lack of action taken by the government to tackle the disease:

"I think the battle has been lost, it's too widespread. They've left it too late." (Devon beef farmer n.11)

"They all say they're going to do something but then they don't... No one's got the courage to do anything" (Devon beef farmer n.12)

"I think it's been the lack of tackling the problems which has been frustrating for farmers really. Frustration is the word I think." (Gloucestershire dairy farmer n.9)

This relates strongly to Kasperson *et al.*'s first trust component: commitment to a goal. Their second component, competence, was also noted. Many of the participants spoke about a lack of farming knowledge among government officials and policy makers:

"A lot of the people making policy and thinking up all these inspections don't have a clue. TB is crippling." (Devon beef farmer n.20)

Also relevant here are the views of participants towards the efficacy of the bTB test. The majority of respondents spoke about their doubts about the accuracy of the test. For example:

"It's not very accurate. It's the same one as they used in the 40s. I don't know why they haven't found a better test... I feel like we keep doing these tests which take up a lot of time and money and we're not achieving anything. It's like we're going backwards" (Devon beef farmer n.15)

"If you have an inconclusive and then you find out there's nothing wrong with them, that's just rubbish." (Devon beef farmer n.20)

“What we need is an accurate test. That’s the big issue. As far as I’m concerned I don’t believe that we’ve ever had TB but the government shot half of my cows.”
(Gloucestershire beef farmer n.3)

The third component, care, is strongly connected to the first. In the context of bTB, farmers appeared to assume that a lack of action shows a lack of care. A number of the participants suggested that the government will not take action to tackle bTB because it is too low a priority on their political agenda:

“They don’t do anything because the farming community is too small, they’d lose votes.”
(Devon beef farmer n.12)

“I think they’re happy to leave agriculture almost on its knees because it keeps food prices low.” (Devon dairy farmer n.18)

“Farmers are in the minority and what the minority want doesn’t generally happen.”
(Devon beef farmer n.19)

“Basically, it isn’t one of their problems is it? They ignore it.” (Gloucestershire beef farmer n.3)

The last of Kasperson *et al.*’s trust components relates to predictability. This was less prevalent among participants, although there were feelings of a lack of direction among policy makers:

“You gaily start off down one road and then the government moves the goal posts.”
(Gloucestershire beef farmer n.2)

“When they [the Coalition] first came in they were sort of dead keen to get something achieved and now they’ve actually taken a step back, so you do wonder whether they are going to be any better.” (Gloucestershire dairy farmer n.7)

Distrust in government has been shown to have important implications in relation to farmers' attitudes towards the control of bTB. For example, a study carried out by Gunn *et al.* (2008) found that farmers who feel that the government takes its commitment to tackling bTB seriously are more likely to implement recommended biosecurity measures. This implies that building trust in government through investment in linking social capital could potentially increase the level of uptake of recommended control measures and thus reduce the risk of disease transmission. The link between levels of linking social capital and farmer behaviour was also found by Hall and Pretty (2008) in their study of farmers' attitudes towards sustainable management. They suggest that farmers with higher levels of linking social capital were more likely to farm in a sustainable way, suggesting a strong association between linking social capital and management decisions.

Few participants could recall positive interactions with government officials; however, those that could appear to have a more positive view of government. This implies that positive relationships with representatives from a given organisation may have far reaching impacts on an individual's attitudes towards the organisation more generally. In order to understand more fully the role of linking social capital in building system trust and influencing farmers' attitudes towards the control of bTB, these concepts were explored further in the second phase of this research.

In terms of linking social capital and institutional trust, also of relevance here are the attitudes of farmers towards organisations such as the National Farmers' Union (NFU). There was a divide among interview participants with regards to the integrity of the NFU. For example, according to a Devon beef farmer (n.16), "*the NFU is just a mouthpiece for the government*", whereas another participant suggested that "*the NFU is very good, we're happy with how they are doing things*" (Devon beef farmer n.19). A number of interviewees noted their distrust of the upper echelons of the organisation:

"The NFU isn't on our side. Have you noticed that whoever gets to the top of the NFU soon becomes a Sir?" (Devon beef farmer n.17).

“I think there was a time when too many of the NFU were in it for themselves and probably after knighthoods.” (Devon dairy farmer n.18)

Interestingly, the second participant quoted above (n.18) explained how his opinion of the NFU changed as he increased his participation in the organisation:

“Having berated the NFU, I have to swallow it now I’ve become involved. I’m on the regional arable board so I get to see how much work it is doing.”

This example shows how investment in linking social capital, in this case becoming involved in the organisation, could potentially have far reaching influences on the attitudes of individuals. In addition to building trust, increased levels of linking social capital could help to enhance understanding of how an institution functions and the work that they do.

In the farmer interviews carried out for this study, linking social capital in the form of attendance at NFU meetings was also found to increase access to insider information. For example, a Devon beef farmer (n.19) suggests:

“You can sit and moan about it in the pub and the rugby club or you can get on and be a part of it...attending meetings gives you first-hand knowledge from people who are actually seeing the Secretary of State face to face. You can gauge their emotions and reactions. It makes you feel like something’s happening.”

Participation in NFU meetings appears to have an important effect on the attitudes of farmers towards the level of their impact on decision making. For example, the participants who attended NFU meetings tended to feel that the government listens to farmers, whereas those who do not often stated that there exist no channels through which they are able to voice their opinions. For example, one of the participants who had made the conscious decision not to become a member of the NFU suggests:

“Everybody in the farming community has a valid point of view and I don’t think there’s been any surveys, any canvassing, any collection of opinions, sharing of knowledge. You

know, why aren't there sort of TB road shows every month all over, collecting information, keeping people aware?" (Devon beef farmer n.15)

Although some of the participants spoke about the benefits of NFU membership and attending various meetings, attendance at such meetings appears to be rather low. However, most of the participants agree that it is important to have the opportunity to go to meetings even if they decide not to.

In general, levels of linking social capital appear to be low among the participants with the majority having very limited contact with government agents and feeling that the government do not listen to farmers:

"You can say what you like but no one listens. No one wants to listen so that's why I have come to the belief that it's a political decision not to address the problem." (Devon beef farmer n.16)

"We're not really given the opportunity to voice our views...as long as food's coming in they don't worry." (Devon beef farmer n.12)

The distrust in government felt by many of the interviewees starkly contrasted with the highly trusting relationship between farmers and their private vets. All of the interview participants named their private vet as an important contact. Their importance was noted on both a practical and emotional level as well as being a main source of information. Many of the participants have been with the same vet throughout their farming career and a number noted that the farm had been with the same practice for generations. The longevity of the farmer-vet relationship was considered to be very important. Repeated contact allows a vet to get to know the farm and the livestock as well as building mutual trust and respect with the farmer. The general view of private vets is summarised by a Gloucestershire beef farmer (n.2):

“I’ve known my vet for 30 odd years so I have the greatest respect for the man. He has the wellbeing of my herd and the industry at heart which I sometimes doubt if the Ministry [Animal Health] has.”

An interesting contrast emerged between the interviewees’ feelings towards their private vet and Animal Health vets. This accentuated the importance of building mutual trust and respect through long-term relationships. This view is summarised by a Devon dairy farmer (n.18), as follows:

“To me, I trust our vets. They’ve got their ethics, they’re not going to cloud their judgment by helping you out because it doesn’t do anybody any good whereas I think sometimes Ministry vets look at things through very coloured glasses and only see the view that they want to see. Whereas private vets see both sides of the coin and will do a good job for everybody.”

Other participants made similar comments:

“I have very little time for the Ministry vet because they’re talking the government line...”
(Devon beef farmer n.16)

“The advice you get from the state vet you may as well put in the bin...they’re enforcing policy. I’d never consult them over anything.” (Devon beef farmer n.17)

“We don’t like the thought of having a Ministry vet who might be too much of a jobs worth. One of the Ministry vets is terrible, can’t make a decision. That’s why they’re Ministry vets; they’d be rubbish in practice.” (Gloucestershire dairy farmer n.5)

Interviewees noted the lack of continuity in relation to Animal Health vets, with very few seeing the same vet on more than one occasion. Narratives about stressful encounters with Animal Health vets were frequently expressed and communication issues were also mentioned in relation to Animal Health using foreign vets:

“You get one or two foreign vets. Communication is everything really so I think it can be a bit difficult at times.” (Gloucestershire dairy farmer n.9)

“We had a Polish chap to do the testing and there was a slight language barrier and you felt like he wasn’t involved with you and the farm and about your general health and welfare. If you have a total stranger who’s not English, don’t get me wrong, I’ve not got a problem, it’s simply about communication.” (Devon beef farmer n.13)

Continuity is clearly important in terms of building social capital and consequently increasing levels of trust.

5.3.2 The role of knowledge

According to the participants, knowledge is an essential factor from which trust can be built. Farmers, it would appear, are less likely to trust individuals, especially those in a position of authority, if they do not consider their knowledge to be sufficient. For example, many of the participants spoke about a lack of grass roots knowledge among policy makers. For instance, according to a Devon dairy farmer (n.18):

“In Defra you’ve got a lot of people in there who are without an agricultural background or education.”

Drawing on past experience, he explains:

“When I was working as an agronomist, a couple of my farmers were involved in trial studies of the ELS and some of the daft things that were coming out of Defra at the time. Like they were going to say that you couldn’t cultivate within a metre of the edge of the hedge. It took sitting down with one of the representatives from Defra and saying, ‘When are you measuring this metre from the edge of the hedge?’ He didn’t comprehend that a hedge grows and moves over the course of a season. It’s that kind of ignorance that I think is endemic in the whole of Defra”

Another participant taking a similar view recalls the day after a TB test which identified nine reactors:

“The day after the test we had the Minister of Agriculture here with an NFU meeting to talk about TB. I said ‘I just wish you’d been here yesterday’, I was in tears, she just didn’t know, she couldn’t imagine. She’d come from transport or something.” (Gloucestershire dairy farmer n.5)

The lack of agricultural knowledge among policy makers was noted by the majority of participants. In many cases these feelings appear to be coupled with a lack of confidence in government representatives. Drawing on past experience, one participant described his feelings towards Animal Health officials during the 2001 Foot and Mouth epidemic:

“There wasn’t a farmer frightened of Foot and Mouth; they were frightened of the officials that came round. Because a lot of them didn’t know the first thing about Foot and Mouth and if there was an animal that looked like there was something wrong, they’d say ‘well, if you’re in doubt, kill ‘em.” (Gloucestershire beef farmer n.6)

In comparison to the lack of confidence that interviewees had in the knowledge of Animal Health and its representatives, participants considered their private vet to be very knowledgeable and readily asked them for advice. According to one farmer:

“There’s often things you want to ask them about. When they’re there, if it’s your usual vet they can advise you on different things. They’re useful for information. And it is important because you need to be kept on the right road.” (Gloucestershire dairy farmer n.9)

The importance of knowledge in building social capital is noted by Dwyer *et al.* (2007) who suggest that it is essential that farm advisors are familiar with farming practices to enable them to maintain a balanced and informed view of the situation. In addition, Dwyer *et al.* (2007) point out that continuity between farmer and advisor is important for building trust. Although participants appear to base their levels of trust in an individual on the extent of their knowledge or experience, it could also be argued that the knowledge of the individual may in fact be adequate but, due to a lack of social capital, and consequently a lack of trust, a farmer may be unaware of the depth of the individual’s

knowledge. The direction of causality between social capital and perceived knowledge is therefore rather unclear. It would appear that there are grounds to argue that the relationship between the concepts is instead mutually reinforcing.

5.3.3 The distinction between information dissemination and knowledge transfer

Information and knowledge were considered to be important resources among interview participants, particularly in relation to dealing with bTB. Participants detailed a number of different information sources ranging from the farming press and NFU newsletters to conversations with vets and other farmers. Past experience was also considered to be important, as was “*old knowledge*” (*beef farm, Devon n.13*) which has been passed down through generations. Participants were asked about their main sources of information relating to bTB and its control. In relation to policy developments, the farming press was the main source of information with *Farmers Weekly* and the *Farmers Guardian* most frequently cited. Information leaflets sent by Defra were also mentioned, although there was a clear divide between participants with regards to their usefulness. For example, one farmer suggested that “*nobody looks at it because it’s like telling your Grandma how to suck eggs*” (*Gloucestershire beef farmer n.6*). Whereas another argues that “*information from Defra is important, of course it is*” (*Gloucestershire dairy farmer n.9*). Whilst being kept up to date with policy developments was thought to be important by participants, the most meaningful information sources were considered to be those which could be accessed during a bTB breakdown. For example, participants recalled times when they contacted Animal Health regarding issues relating to cattle movement restrictions.

According to the interview participants, by far the most important information source in relation to bTB policy, regulations and restrictions was the private vet. The role of private vets in providing information and support to farmers has been noted by other researchers. For example, in their study of the psychological impact of foot and mouth disease on farmers, Peck *et al.* (2002) found that after family, friends and other farmers, vets were the group most likely to be approached. They suggest that this is because vets are considered to be high status professionals who are likely to have long-term relationships with farmers. In addition, the researchers suggest that, broadly speaking, vets are in the

same business as farmers and are therefore likely to experience similar feelings about the loss of livestock. The relationship between farmers and their private vet represents an important bridging tie. Vets have access to different resources to farmers and are able to offer information and knowledge to which farmers may not otherwise have access.

In the farmer interviews, it was noted that farmers are unlikely to go in search of information if they have not been affected by bTB. As one Gloucestershire beef farmer suggested: *“you become more receptive to information once you experience TB”* (n.19), and similarly: *“before we had a reactor I had very little knowledge”* (Devon beef farmer n.11). This has important implications in terms of farmers’ response capacity. Although participants appear to actively seek information about ways of coping with bTB, they seem less likely to attempt to source information about ways to avoid the disease, for example through the implementation of biosecurity measures.

The key farm-level disease prevention measure recommended by Defra is the implementation of biosecurity. However, as noted earlier, a number of studies have shown a general lack of uptake in recommended measures to reduce the risk of bTB transmission (Enticott, 2008a; Bennett and Cooke, 2005). In agreement with this, a general consensus emerged among interview participants that: *“apart from killing the badgers there’s not much we can do”* (Gloucestershire dairy farmer n.5). A number of participants spoke about the impracticalities of implementing biosecurity. For example, according to a Gloucestershire beef farmer (n.2): *“some things can be prohibitively unpractical or prohibitively expensive.”* Another farmer noted that: *“they tell us to keep badgers away from livestock but it’s impossible. There is very little you can do”* (Devon beef farmer n.15).

A lack of understanding of biosecurity was prevalent throughout the sample. A number of farmers felt that they had a high level of biosecurity in place, whereas when asked for more information, their implementation of recommended measures appeared minimal. For example, although one participant suggested that *“anything we can do we do do”*, when asked about specific measures, he explained that they maintain a closed herd and

keep the feed store shut at night and went on to say that “*short of killing all the badgers and deer on the farm there’s nothing else we can do*” (Devon beef farmer n.11). Another farmer explained that:

“We have done everything we can. We have altered the cropping and stopped grazing some of the fields” (Gloucestershire dairy farmer n.8).

Interestingly, one of the participants had been involved in research trials run by FERA looking at the effectiveness of various biosecurity measures. The farmer explained how CCTV cameras were used to monitor badger activity around the farm buildings. Being provided with proof of badger activity appeared to have had an important impact on the farmer’s behaviour. She explained:

“I didn’t believe they could get into such small spaces; that was an eye opener. We got more vigilant in shutting the gates” (Gloucestershire dairy farmer n.9).

Although the FERA study was not designed to assess the impact of providing farmers with proof of badger activity on their uptake of biosecurity measures, a discussion with a FERA representative working on the project suggested that it was a factor that certainly did not go un-noted. She suggests that providing proof helped to build trust, a key component of bridging social capital, between the farmers and the FERA personnel. This in turn helped to maintain participation in the trials and encouraged farmers to continue implementation of certain biosecurity measures.

Defra have distributed various guidance leaflets about biosecurity; however, due to the low levels of trust in government described in the previous section, it would appear that the information disseminated is often overlooked or disregarded and is therefore not transformed into usable knowledge which is then acted upon.

Many of the interviewees discounted the government in relation to knowledge transfer. Instead they again emphasised the importance of their private vet in providing reliable information and guidance. In addition, a number of interview participants spoke about

the importance of knowledge exchange between farmers, as shown by the following quotes:

“Other farmers are very important for information. You can speak to a farmer and he says something and you think ‘I better get on and do that’.” (Devon beef farmer n.20)

“I tell other folks what I do. You listen to other farmers and I do listen to my elders.” (Gloucestershire beef farmer n.6)

“You always want to chat to other farmers and ask them things and it’s amazing what you’ll find out... But you have to communicate. It is important because then you sort of share ideas. You say ‘oh yeah, we tried that and it wasn’t a lot of good’ and they might tell you something. It is important.” (Gloucestershire dairy farmer n.9)

“We just chat away, you know ‘what are you up to’, ‘well I’m ploughing mine’, ‘how have you got on with that?’, you know, trying to learn best practice and all that sort of stuff.” (Gloucestershire beef farmer n.10).

The majority of participants have regular contact with other farmers, particularly their farming neighbours. A small number of the interviewees noted the importance of more formal ways of knowledge sharing, such as through farmer discussion groups:

“A group of us used to meet on a regular basis and share experiences to do with farming and we had speakers, like to do with homeopathy and different shared interests. We could share some professional input which could benefit our farming.” (Devon beef farmer n.13)

“I go to the Hill Discussion Group, we have six meetings during the winter with a speaker. We often have someone talking about TB. It’s good for farmers to get together and discuss things. You can learn from each other and share your problems.” (Devon beef farmer n.15)

“At the discussion group they always come up with some good stuff. It may only be a small acorn but from that large oak trees can grow.” (Gloucestershire beef farmer n.2)

Based on the interview findings there appears to be high levels of social capital between farmers. However, although the majority of the participants noted the importance of knowledge sharing in a general sense, few spoke about it specifically in relation to bTB. Instead, contact with other farmers was considered important emotional support because they are *“all in the same boat” (Gloucestershire beef farmer n.3)*.

5.3.4 The role of social networks in providing different forms of support

Key to understanding farmers' bTB response capacity is exploring the various networks which provide access to different forms of support. The relationships between farmers and their private vets have been shown to be essential in terms of providing access to information and knowledge. To some extent, vets were shown to offer a certain level of emotional support. However, according to interviewees, strong ties with family members or other farmers (bonding social capital) were essential in helping them to cope with the emotional impacts of bTB. The importance of bonding social capital in providing emotional support was first noted by Granovetter (1973) in his work on strong and weak ties. He suggests that while weak ties such as with acquaintances are extremely useful for accessing information, strong ties, such as those with family and close friends, provide a more intense form of support which is likely to play a greater role in emotional wellbeing.

According to interview participants, bTB can have a huge emotional impact on farmers, both in terms of the threat of the disease and experiencing an actual breakdown:

“TB is your focus, it's something you think about all the time... It's foremost in your mind because it's a major disease.” (Gloucestershire beef farmer n.6)

“When you are struck down by a bad case it is stressful, isn't it? Very very stressful. It hits you about.” (Gloucestershire dairy farmer n.9)

Family members were considered to be most important by interview participants in terms of providing emotional support:

“Certainly the emotional stress of the whole thing about TB testing is the unknown and the grind... It’s about sharing it out within the family, you share it, you get on with it, and you make the best of a bad job.” (Devon dairy farmer n.18)

The majority of the interview participants were from family farms and work alongside other family members. This was considered to be very important, but at times could make it more difficult:

“We’re each other’s support. But sometimes it’s difficult. For example, while we’re building up to TB tests, the tension is building up and we start bickering. You can’t get away from it. We don’t have any other emotional support.” (Gloucestershire beef farmer n.1)

Another problem associated with the intensity of inter-family bonding social capital was noted by a Devon beef farmer (n.16) who worked alongside his wife:

“It’s sometimes difficult to talk to my wife about business problems, she’s too close. It’s important to have someone to talk to who’s less involved in the business.”

The problems relating to the strong ties among family members have been overcome by some farmers through ensuring that each person has their own role within the business:

“They all have their roles on the farm, one son’s a mechanic, the other helps with the livestock and my wife does the paper work.” (Devon beef farmer n.20)

“My mother runs the shop side of things. Dad tends to do the swedes and the cattle and I’m somewhere in between the arable and the shop.” (Devon dairy farmer n.18)

When asked about emotional support, the majority of participants maintained that they would be unlikely to share their problems outside of the family. However, some noted the importance of farming friends. For example:

“The day we went down with TB we went to meet some of our friends and they’d come down with TB the same day. You realise that we’re all in the same boat, you can share your problems. They sympathise.” (Gloucestershire dairy farmer n.9)

Most participants suggested that they would be more likely to speak to farming friends than non-farming friends if they were experiencing any problems. A number of farmers felt that non-farming friends would not be able to understand the situation and would therefore be unlikely to offer advice. According to one farmer:

“We don’t really have any non-farming friends. Even if you did, if you wanted to talk to them about farming they wouldn’t know what you were on about.” (Devon beef farmer n.17)

In addition to emotional support, relationships with other farmers were considered to be important in a more practical context:

“We always help each other out if we need to. It’s very nice to be able to ask for help. One particular neighbour I know I could call on anytime. It’s also good to get another person’s opinion on some things. That can be useful.” (Devon beef farmer n.15)

“Our first point of contact is other farmers, we help each other out. If we’ve got problems with a cow calving or if we don’t know what’s wrong with a sheep we’ll ring up another farmer to ask for help.” (Devon beef farmer n.19)

Although bonding social capital was considered to be important both in terms of practical and emotional support, participants also noted the importance of building relationships with those outside of the industry. Although non-farming friends may not provide direct emotional support, interests outside of farming were considered to be an important outlet. This is made very clear by one of the participants:

“Farming can become very all-consuming if you don’t get off the farm and have a social life and see people from different walks of life. It’s very closed, especially in bad periods. You can go and see other farmers if you want or otherwise you can get out and see other people and realise that there’s a big world out there. That’s very important I think. My father, 10, 15 years ago, he had got very involved and the way the business was going I think he would have strung himself and shot himself if he hadn’t gone back to playing rugby and doing things like that. He saw an outlet and it gave him a few hours a week just to get away from it, otherwise it’s all you think about, all the time and it’s a recipe for disaster that one!” (Devon dairy farmer n.18)

Bridging ties between farmers and the general public were noted by the interviewees. Most commonly, relationships with the public took the form of farmers’ ties to their customers. For the interviewees who were involved in direct sales, this was seen as particularly important:

“We have brilliant relationships with our customers. 70% of everything we sell is repeat business. We maintain relationships through our website, newsletters and social media.” (Devon beef farmer n.17)

“Our relationship with our customers is very important. Once I’ve delivered to their door, 90% will come back.” (Devon beef farmer n.19)

However, the majority of interviewees noted that although customers are essential for financial support they provide little, if any, emotional support. For example, one farmer explained how his customers are only interested in the idyllic side of farming:

“All our newsletters were all really light hearted, ‘it’s a lovely day on the farm’, and someone asked if we could tell them the other stuff so I wrote a newsletter about treating sheep for parasites and our sales plummeted and people took themselves off the newsletter list.” (Devon beef farmer n.17)

However, another farmer, also involved in direct marketing, suggested that positive feedback from customers can provide an important emotional boost:

“When you’re in the middle of a breakdown and you get a thank you letter from a customer, it makes a real difference. If it wasn’t for our customers, we wouldn’t bother.”
(Gloucestershire dairy farmer n.4)

Encouragement was also provided by village members in one case, as explained by a Gloucestershire beef farmer (n.2):

“The day we had a reactor I was too upset to go to the village meeting and our apologies were passed on to the villagers along with the reason why we weren’t there. The next day I had three letters come through the door from villagers offering their condolences. That made a real difference.” (Gloucestershire beef farmer n.2)

Relationships with the public were considered to be important by the interviewees. However, one of the main issues noted by the participants was the lack of knowledge about bTB and farming more generally among the general public. According to one participant, *“the public have no idea. They are so far removed from agriculture”* (Devon beef farmer n.11). Although there appears to be a general consensus among participants that the public lack knowledge about bTB, the majority maintained that they should still have a role in the debate. As one farmer notes, *“they have to, it’s as much their countryside as it is ours”* (Devon dairy farmer n.14). However, education is considered to be essential, with a number of participants explaining that if the public are to voice their views on bTB, it must be ensured that they are provided with the necessary information. In relation to this, some participants suggested that farmers have a role in educating the public. For example, one farmer who rents out holiday accommodation suggested:

“It’s important to educate the public about TB... We educate a lot of the visitors that come here. I enjoy telling people about it. Most people don’t know about the day to day problems that farmers have.” (Devon beef farmer n.12)

Another participant considered the education of her customers to be essential:

“I madly campaign about it in the shop all the time... If they knew more of the facts they might have a different attitude.” (Gloucestershire dairy farmer n.5)

Other participants also spoke about their involvement in farm open days and educational visits.

5.3.5 The potential for exclusion brought about by overly close ties

Although bonding social capital among farmers was shown to be important in relation to both emotional and practical support, the farmer interviews also identified some negative impacts of overly close ties. Three of the interviewees were what they described as ‘*incomers*’: the individuals were not from farming backgrounds and have come into farming in later life following a previous career. Additionally, each of the farmers was organic. Interestingly, each of them spoke about feelings of exclusion and of being different from other farmers:

“Wednesday night at the local pub is farmers’ night. I started going and I realised that it’s not farmers’ night at all, it’s a family reunion; they’re all related. Whatever you do, you’re doing it wrong. There’s an ex-pat mentality down here. It’s very much them and us.” (Devon beef farmer n.17)

“I’m not walking the same road as they are. I’m an organic retail business, it’s different... We’re different; we’ve got different backgrounds.” (Devon beef farmer n.16)

“I’m a bit of an oddity, when I came here, first of all I was a woman on my own, buying a farm at 50. I was also a Liberal Democrat county councillor. I then became organic and then I was in stewardship. Well you can imagine, they were all looking over their hedges with binoculars thinking, ‘What’s she doing now?’” (Devon beef farmer n.13)

Perhaps relating to their sense of exclusion, two of these participants spoke about their distrust of other farmers or their disagreement with conventional farming practices:

“Most people in farming I’ve met cheat when it comes to organic. They do it for financial reasons and always cut corners.” (Devon beef farmer n.17)

“I feel at risk from my neighbours, not from me and not from what we’re doing. I feel at risk because we’re completely surrounded by maize fields and dairy farmers with loads of shite and horrible looking animals.” (Devon beef farmer n.13)

This implies that exclusion brought about by strong levels of bonding social capital may impact on levels of trust among farmers, and therefore their likelihood to cooperate and share knowledge. This was an issue that was explored further in the second research phase.

5.4 SUMMARY OF PHASE 1 RESEARCH FINDINGS

Based on the data gathered in the twenty qualitative face-to-face farmer interviews, the findings presented in this chapter have identified some important links between investment in social capital and farmers’ bTB response capacity. Two key themes have emerged which appear to influence farmers’ levels of social capital: trust and knowledge.

Trust has been shown to be essential in building all forms of social capital. In terms of linking social capital, trust in government was found to be important. Levels of linking social capital among interview participants appears to be low with very few having regular contact with government agents. The majority of participants also felt that they had very little impact on decision making and felt frustrated by the government’s lack of action in relation to bTB. Many of the interviewees noted the lack of agricultural knowledge within government and felt that the majority of government agents do not have a realistic view of farming. The relationship between trust, knowledge and linking social capital has been shown to be complex, with each influencing the others.

Trust and knowledge were also found to be important in relation to bridging social capital. The most important bridging tie among participants was found to be their relationship with their private vet. The majority of participants considered this to be their main source of information and had extremely high levels of trust in and respect for their vet. This appears to have been achieved through long-term and regular contact, with many participants having dealt with the same vet or veterinary practice throughout their

career. This relationship contrasts hugely with the relationship that farmers have with Animal Health vets. With regards to this, many of the participants noted issues such as the lack of continuity, knowledge and communication. This emphasises the importance of long-term relationships in building trust and mutual respect and providing trusted information channels. Bridging social capital was also found to be important in terms of relationships with the general public, the local community and non-farmers.

Bonding social capital was shown to be important in relation to emotional support, with the majority of participants relying on their family and farming friends when faced with problems. However, participants noted the importance of forming relationships with non-farmers and developing non-farming interests to provide an emotional outlet. Knowledge sharing between farmers was considered to be an important information source among participants. This form of bonding social capital allowed farmers to share information and best practice with others in a similar situation. Many of the participants considered the knowledge and experience of other farmers to be indispensable; however, this was often spoken about in a general sense rather than specifically relating to bTB. Additionally, the negative issues associated with high levels of bonding social capital were identified with newcomers feeling excluded and exhibiting feelings of distrust of other farmers.

5.5 IMPLICATIONS FOR NEXT RESEARCH PHASE

The qualitative interviews provided some interesting findings in terms of the relationship between social capital and farmers' bTB response capacity. However, the findings of the interviews suggest that, at present, farmers' investment in certain forms of social capital is low. In order to gain a more accurate understanding of the extent of farmers' social capital investment, and the factors which either encourage or prevent investment, further research was required. While the findings from the first interview phase indicated that knowledge and trust, brought about by investment in social capital, can influence farmers' attitudes towards bTB and their ability to respond to it, it was necessary to collect quantitative data which could be subjected to statistical analysis to allow potential causal relationships to be explored further. The various themes that emerged from the

first interview phase informed the development of the postal survey used in the second phase. The findings also helped with the interpretation of the farmer segmentations identified through multivariate analysis.

The findings which resulted from the statistical analysis undertaken in the second research phase are described in detail in the following chapter.

CHAPTER 6. PHASE 2 RESEARCH FINDINGS

6.1 INTRODUCTION

The findings of 20 face-to-face, in-depth interviews with cattle farmers in Gloucestershire and Devon were reported in the previous chapter. As outlined in the methodology presented in Chapter Four, the qualitative interview phase was designed to identify key themes relating to social capital and bTB on which the quantitative phase would build. This chapter reports the findings of a quantitative survey, designed to provide representative data on cattle farmers in England in order to develop a segmentation model.

A postal survey was developed and distributed to 1500 cattle farmers in the South West, with the aim of achieving a minimum of 300 responses. A response rate of 26.7% was achieved, amounting to 401 completed surveys received between November 2011 and the end of January 2012. Of these, 27 had more than 10% missing data and were excluded from the sample, resulting in 374 usable returns (usable response rate = 24.9%).

This chapter presents the analysis of the data gathered through the survey. Initially, a descriptive analysis of the data was undertaken to provide a context for the sample. Following this, the data were subjected to factor analysis which identified five underlying dimensions of attitudes towards bTB and social capital. These factors were then subjected to cluster analysis, first using hierarchical and then non-hierarchical methods in order to identify different farmer groups. Two distinct farmer groups were identified and profiled against a variety of demographic and attitudinal variables.

This chapter firstly presents the results of the descriptive analysis of the data, reporting any differences and similarities across the sample. The analytical procedures and results of the factor and cluster analyses are then outlined. Throughout the process the data were thoroughly examined to ensure suitability for multivariate analysis. Methods for addressing issues such as multicollinearity, linearity and normality were carefully

considered throughout and are detailed below, as are the approaches taken to address missing data and outliers. Following this, a descriptive summary of the emergent farmer groups is provided.

6.2 DESCRIPTIVE RESULTS FROM THE FARMER SURVEY

The descriptive characteristics of the sample are reported in this section, providing a broad overview of the data and presenting a summary of the farmers sampled in this study. The following section begins with an overview of the sample characteristics including farm type and size, tenure, age and education. This is followed by a summary of farmers' levels of risk perception, bTB experience, and biosecurity uptake. Where appropriate, statistically significant differences between groups are reported, as well as statistically significant relationships between variables. A statistically significant result ($p < .05$) indicates that there is less than a 5% likelihood that the finding occurred by chance.

6.2.1 Respondent characteristics and non-response bias

This section provides a summary of the characteristics of the survey respondents. In order to assess the representativeness of the sample, the data were examined for non-response bias⁴. According to Brick (2001), potential non-response bias can be estimated by comparing the characteristics of the sample to the results of other surveys. Large differences may indicate potential bias; however, there are other possibilities for variations such as diverse survey contexts, time periods or dissimilarities in the wording of questions. Nonetheless, differences serve to alert the researcher to potential concerns which can then be addressed as necessary. The Farm Business Survey, conducted on behalf of Defra, was used as the main comparison, together with regional reports published by Defra. The results of the comparison are reported below.

As mentioned above, 374 usable survey responses were received from farmers in the South West which included the counties of Devon, Somerset, Cornwall, Gloucestershire,

⁴ Non-response bias refers to whether there is a difference between the characteristics of respondents and non-respondents

Wiltshire and Dorset. The survey was distributed to beef and dairy farmers as well as to farmers who had both beef and dairy herds. A breakdown of the sample is provided in Table 6.1 below.

Table 6.1 Summary of sample by county and herd type

County	Beef (%)	Dairy (%)	Beef and dairy (%)	No response (%)	Total
Devon	51.6 (n=64)	31.5 (n=39)	16.9 (n=21)	0	33.2 (n=124)
Somerset	47.8 (n=33)	33.3 (n=23)	18.8 (n=13)	0	18.4 (n=69)
Cornwall	45.0 (n=27)	33.3 (n=20)	20.0 (n=12)	1.7 (n=1)	16.0 (n=60)
Gloucestershire	56.1 (n=23)	26.8 (n=11)	14.6 (n=6)	2.4 (n=1)	11.0 (n=41)
Wiltshire	46.2 (n=18)	28.2 (n=11)	20.5 (n=8)	5.1 (n=2)	10.4 (n=39)
Dorset	35.5 (n=11)	48.8 (n=15)	16.1 (n=5)	0	8.3 (n=31)
Unknown	30.0 (n=3)	50.0 (n=5)	20.0 (n=2)	0	2.7 (n=10)
Total	47.9 (n=179)	33.2 (n=124)	17.9 (n=67)	1.1 (n=4)	n=374

To examine the extent of non-response bias, the sample was compared to data for the whole cattle farm population in each county (Defra, 2009a). Table 6.2 provides a summary of county level figures.

Table 6.2 Population data by county and herd type (Defra 2009b)

County	Beef (%)	Dairy (%)	Beef and dairy (%)	Total (%)
Devon	74.5 (n=4109)	22.1 (n=1221)	3.4 (n=188)	36.9 (n=5518)
Somerset	66.0 (n=1765)	25.8 (n=691)	8.2 (n=220)	17.9 (n=2676)
Cornwall	75.4 (n=2208)	20.5 (n=602)	4.0 (n=118)	19.6 (n=2928)
Gloucestershire	76.4 (n=916)	18.5 (n=222)	5.1 (n=61)	8.0 (n=1199)
Wiltshire	67.7 (n=822)	26.6 (n=323)	5.7 (n=69)	8.1 (n=1214)
Dorset	60.0 (n=858)	31.1 (n=445)	8.9 (n=128)	9.6 (n=1431)
Total	71.3 (n=10678)	23.4 (n=3504)	5.2 (n=784)	n=14966

A comparison between Table 6.1 and Table 6.2 shows that the division within the sample between the six counties is fairly consistent with the county level data. The highest number of responses was received from Devon farmers who make up 36.9% of the farmers in the South West. Similarly, as would be expected based on population data, the lowest number of responses was received from Dorset, which contains only 9.6% of the region's cattle farmers. The division between the number of beef and dairy farms in the South West is slightly more extreme than in the survey sample. In the South West 71.3% of cattle farms are classified as beef and 23.4% as dairy, whereas in the sample just under half were beef farmers and a third dairy. However, it is worth noting that a higher proportion of mixed herds was reported in the sample, suggesting that a majority of these may have been predominantly beef cattle. It may be the case that the question about herd type posed to farmers in the survey differed from the definition held by Defra. On further investigation, it can be seen that the distribution of herd types across the counties follows a similar pattern in both sets of results. The highest proportion of beef farms was

consistently found in Gloucestershire, and the highest proportion of dairy herds was in Dorset for both data sets. While there is a disparity in terms of the distribution between dairy and beef herds, due to the consistencies reported in relation to the distribution of farm types across the counties, the degree of non-response bias was not deemed substantial enough to warrant weighting of the data (Peck *et al.* 2010).

To further validate the sample, non-response bias was explored in relation to a number of other characteristics. There was a broad range of herd sizes within the sample ranging from only four to 2000 animals. The mean herd size was 227 head of cattle (median=180, standard deviation=211.241), although this varied significantly by farm type and area. Beef farms had the smallest herds, with an average of 141 head, while dairy herds averaged 304. This is consistent with the Farm Business Survey (2011), which also reports larger herds on dairy farms in the region. The largest herds were found in Wiltshire (average 296) and the smallest were in Gloucestershire with an average herd size of 194 cattle.

While all of the respondents were cattle farmers, some were from mixed farms with other livestock such as sheep (27.6%) or arable (17.1%). Farms ranged in size from 6.5 hectares to 2000 hectares (median=143.2, standard deviation=158.630). The majority (79.4%) of farms in the sample were less than 200 hectares and only 8 of the farms were over 500 hectares. Within the sample, mixed farms (arable and livestock) were significantly larger than those with only livestock. The average size of mixed farms was 223 hectares. Beef farms were the smallest, with an average of 85 hectares compared to dairy farms which averaged 125 hectares. Regional figures reported by the South West Farm Business Survey report (Farm Business Survey, 2011) show a similar distinction between beef (average of 85 hectares) and dairy farms (average of 147 hectares). The largest farms were found in Wiltshire where farms were significantly larger than in other areas. Farms in Wiltshire averaged 213.7 hectares, while the smallest were in Cornwall, averaging 105 hectares.

In terms of tenure, the majority of respondents owned at least some of their farm. 46% owned all of their land while 42% owned some land but also rented additional land. 10% of the sample were tenant farmers while six of the respondents were farm managers. Tenure was fairly consistent across the counties. Beef farmers were more likely to own all of their land (56% compared to 34% of dairy farmers). Although only a small proportion of the sample were tenant farmers, the majority were dairy farmers. Farm Business Survey (2011) data show a similar pattern with three quarters of beef farmers owning all or part of their farms compared to 55% of dairy farmers.

As would be expected when examining national data (Farm Business Survey, 2011c), the majority (58.6%) of respondents were aged between 46 and 65. Only 4.5% of the respondents were under 35 and 19% of the respondents were aged over 65. There were no obvious differences in age distribution between the counties. In general, beef farmers tended to be older. Almost half of the beef farmer respondents were aged over 56, compared to less than one third of dairy farmers.

A total of 35 of the respondents were from organic farms and two were in conversion at the time of the survey. This figure accounts for 11.6% of the sample, correlating with national figures which suggest that in the South West 10.7% of land is organic (Defra, 2011c). There was no significant difference between beef and dairy farms in terms of whether they were organic or not. Almost a third of the organic farmers in the sample were from Gloucestershire, while only two were from Somerset.

Respondents were asked if all or some of their herd was pedigree. Just over 40% had at least some pedigree cattle. Dairy herds were more likely to be pedigree with almost half of dairy farmers stating that all or some of their herds were pedigree, compared to 37% of beef farmers.

In order to establish levels of diversification, respondents were asked to estimate the proportion of the farm income that their cattle accounted for. For only one quarter of respondents, cattle represent all of their farm income. For 46% the cattle enterprise makes up over half of their farm income. For only 9% of respondents, cattle represent

less than one quarter of their farm income. No comparable survey data could be found for these last two points.

The comparison between the sample characteristics and the findings of other surveys reported above indicate a high level of consistency. The issue of non-response bias was therefore not deemed to be problematic. Due to the large sample size, high response rate and the consistency with other data sources, the findings reported here can be considered to be representative of the wider cattle farmer population in the South West of England.

6.2.2 Risk perception

In the qualitative interviews, discourses about risk and risk perception were frequently encountered. In order to provide a context for farmers' perception of bTB risk, the survey respondents were therefore asked to rate other risk factors they may face. As explained in chapter 2 (page p.16), risk is defined as "exposure to unfavourable consequences" that may lead to a transformation (Hardaker *et al.*, 2004, p.5). Therefore, risk refers to both the impacts of a risk once it is realised, as well as the impacts caused by the feeling of being at risk. Risk perception on the other hand refers to the level of risk an individual attributes to a potential risk factor. This is focussed mainly on the perceived importance of the potential impacts. As shown in Table 6.3, risk perception varies depending on the risk factor in question. However, supporting the interview findings, respondents perceived bTB to pose the highest degree of risk, with over 60% rating the risk as high or very high. Concerns relating to fluctuations in market prices were farmers' next highest risk factor with almost 56% of respondents rating the risk as either high or very high. Crop disease was perceived as posing the least risk. The majority (83%) of respondents were not producing crops commercially which would explain the low levels of perceived risk.

It is interesting to note the difference in perceived risk levels between bTB and other animal diseases. While the majority of farmers consider bTB to pose a high or very high risk, less than a third consider other animal diseases to pose a similar degree of risk. This emphasises the current prominence of bTB in the minds of South West cattle farmers,

despite other cattle disease scares such as Bluetongue, BSE and Foot and Mouth disease in recent years.

Farmers were asked to list other risks, which resulted in 26 additional responses. The majority of these related to the respondent's health or health issues within their family. Other risks were more policy focused such as Nitrate Vulnerable Zone regulations and loss of Higher Level Stewardship scheme payments. Termination of tenancy was stated as a risk by two respondents. Financial risks such as exchange rates and the general economy were also listed, as were food scares and the negative media exposure of farmers and the agricultural industry.

Table 6.3 Respondents' risk perceptions

	No risk (%)	A small risk (%)	A moderate risk (%)	A high risk (%)	A very high risk (%)	N/A (%)	Total (n)
Bovine TB	1.1	7.1	18.5	36.7	36.4	0.3	n=379
Fluctuations in market prices	2.1	8.9	33.3	39.8	15.9	0.0	n=384
Changes in agricultural policy	1.1	14.3	42.4	29.5	11.4	1.4	n=370
Weather	1.9	16.1	47.1	24.1	10.6	0.3	n=378
Animal disease (other than bTB)	1.3	27.1	40.0	20.8	10.8	0.0	n=380
Increasing cost of inputs	5.7	28.1	41.8	23.4	0.0	0.0	n=381
Crop disease	12.1	37.8	30.6	5.9	2.7	11.0	n=373

In terms of perceived bTB risk, there was no clear difference depending on herd or farm types, despite higher bTB losses reported among dairy farmers at the regional level (Butler, Lobley and Winter, 2010). Participants with larger herds considered bTB a higher risk: 21% of farmers with herds under 50 cattle considered bTB to pose a very high risk, compared to 43% of participants who have over 300 cattle. A similar pattern was found when looking at farm size. Only 27% of farmers with less than 50 hectares considered bTB to pose a very high risk compared to 42% of farmers with over 200 hectares. There is an implication here that more commercial farms (i.e. those with more land and higher cattle numbers) consider bTB risk to be highest. It could be argued that farmers with smaller herds and less land may have other sources of income and may therefore consider bTB risk to be lower. Indeed, the proportion of the farm income that the cattle represent had a clear influence on levels of perceived risk. In general, participants whose cattle represent less than a quarter of their farm income were less likely to consider bTB to pose a very high risk. 25% of participants who derive less than a quarter of their income from their cattle rated bTB as posing a very high risk compared to 42% of participants whose cattle represent 100% of their farm income. Farmers with pedigree herds consider bTB to pose a higher risk than farmers with no pedigree cattle. Just under 30% of non-pedigree farmers rated bTB as a very high risk compared to 44% of pedigree farmers.

Although some differences within the sample were identified in terms of levels of bTB risk perception, it is clear that, in general, farmers consider bTB to pose a substantial risk to their business. The particularly high levels of bTB risk perception compared to other risk factors raises some interesting questions relating to the ways in which farmers think about bTB, their understandings and beliefs about the disease and their wider coping strategies. These issues will be addressed more fully in the discussion chapter that follows.

6.2.3 bTB experience

Over three quarters of the sample had experienced a confirmed bTB breakdown. This is not surprising as national figures show that over half of all TB breakdowns in the UK

occur in the South West, with over one quarter of all herds in the region likely to experience a breakdown in any one year (Butler, Lobley and Winter, 2010). Of the farmers who had experienced a breakdown, 37% were under restriction at the time of the survey and an additional 44% had experienced a breakdown in the last three years. While some farmers had only lost one or two cattle to bTB, others had lost far greater numbers - up to 500 in one case - with an average loss of 27 cattle in the past ten years. Participants who had experienced a bTB breakdown perceived bTB risk to be higher than those who had not. 63% of participants who have never had a breakdown consider bTB risk to be high or very high compared to 74% of those who have, with participants who had had the largest number of breakdowns considering the risk to be the highest. Although there is a difference between farmers who have experienced a bTB breakdown and those who have not, the difference between the groups is not statistically significant ($p=.063$). This implies that attitudes between farmers who have experienced bTB and those who have not may not be widely different.

The respondents who had not experienced a bTB breakdown were asked why they thought they had avoided it. As shown in Table 6.4, luck was by far the most often stated factor. Biosecurity was considered far less important, suggesting that the majority of farmers do not consider the implementation of biosecurity measures a viable risk reduction strategy. Farmers' attitudes towards biosecurity measures are discussed in more detail in section 6.2.4.

Table 6.4 bTB avoidance factors

	Yes (%)	No (%)	Total (n)
Luck	74.4	25.6	n=82
The badgers on my farm are healthy	53.7	46.3	n=82
Maintaining a closed herd	51.2	48.8	n=82
Living in an area with low TB incidence	25.6	74.4	n=82
Implementing biosecurity measures	22.0	78.0	n=82
There are no badgers on my farm	7.3	92.7	n=82
There are no cattle in neighbouring farms	4.9	95.1	n=82

N.B: 82 respondents had not experienced a bTB breakdown

6.2.4 Biosecurity

Farmers were asked whether they had implemented any recommended biosecurity measures in order to avoid contracting bTB. Responses show a general reluctance among farmers to put various biosecurity measures in place. Raising feed and water troughs was an exception, with over half of the respondents already doing this and an additional 25% responding that they would do so if grant aided. The data were disaggregated based on whether the respondents had had bTB or not. As shown in Table 6.5, respondents who had experience of bTB appear more likely to implement biosecurity measures. However, although the results indicate a difference between the groups, it is not statistically significant.

Table 6.5 Uptake of recommended biosecurity measures

Had bTB?	No Already do (%)	Yes	No Would do if grant aided (%)	Yes	No Would never do/impractical (%)	Yes	Total (n)
Fence off badger latrines	8.6	14.3	24.1	26.3	67.2	59.5	n=324
Fence off badger setts	13.3	19.2	28.3	31.5	58.3	49.2	n=329
Badger proof farm buildings	18.6	22.1	28.8	37.0	52.5	40.8	n=328
Badger proof silage clamps	16.3	17.9	28.6	37.9	53.1	42.9	n=307
Raise feed and water troughs	47.8	54.7	19.4	26.4	32.8	18.9	n=335
Stop spreading slurry on grazing land	27.5	18.0	5.9	8.2	66.7	73.9	n=315
Double fence farm boundaries	13.1	20.5	31.1	30.8	55.7	48.7	n=392

N.B. Not accounting for N/A and non-responses

Considering farmers' low uptake of biosecurity measures and the feeling that the main factor affecting whether a herd is infected with bTB or not is luck (Table 6.4), there appears to be a feeling of a lack of control in dealing with the disease among farmers. This supports the findings of the qualitative interviews in which participants reported feelings of frustration at the uncontrollable nature of bTB.

6.2.5 Seeking advice/information

The literature review and the results of the qualitative interviews identified the importance of information and knowledge in influencing farmers' attitudes towards bTB. Therefore, respondents were asked to rate a number of potential informants. Respondents rated each informant on a scale of 0-5, with 0 indicating that they would not seek their advice, and 5 that they would be most likely to approach the informant for advice. The list of informants was developed based on those identified by participants in the in-depth

qualitative interviews. As can be seen from Table 6.6, the private vet was the most likely informant to be approached by respondents seeking advice about bTB. The NFU was the informant least likely to be approached. However, it is important to note that not all of the respondents were NFU members.

Table 6.6 Level of likelihood that respondents would approach the listed informants for advice about bTB

	Most likely to seek their advice (%)				Least likely to seek their advice (%)		Would not seek their advice (%)	Total (n)
	5	4	3	2	1	0		
Private vet	57.8	16.6	7.9	7.7	9.5	0.5	n=379	
Animal Health/Defra	20.2	21.2	22.3	14.5	15.3	6.5	n=372	
Advisory organisation	15.6	16.4	22.3	17.7	17.2	10.8	n=372	
Another farmer	14.6	19.4	22.1	16.7	20.5	6.7	n=371	
The NFU	13.2	17.0	19.9	18.1	19.9	11.9	n=371	

One of the points raised by interviewees in the in-depth interviews was the level of perceived knowledge among informants. It was suggested that advice would only be sought if the farmer had confidence in the level of knowledge held by the informant. As shown in Table 6.7, corresponding with the likelihood of seeking their advice, respondents had the highest level of confidence in the knowledge held by their private vets, with over three quarters feeling that their private vet knows a great deal about

farming. Although respondents were least likely to seek advice from the NFU about bTB, the majority had confidence in their farming knowledge. As this question asks about farming more generally, this is perhaps unsurprising. On the whole respondents had limited confidence in the knowledge of Defra staff, with the majority feeling that they have little or no knowledge of farming.

Table 6.7 Levels of perceived knowledge among informants

	They know nothing about farming (%)	They know a little about farming (%)	They know a reasonable amount about farming (%)	They know a great deal about farming (%)	Total (n)
Private vet	0	1.6	21.4	77.0	n=384
NFU staff	1.9	21.2	55.9	20.9	n=378
AHOs	5.1	27.7	55.5	11.7	n=379
Defra staff	16.3	54.2	28.2	1.3	n=382

6.2.6 Trust

Farmers were asked about the level of trust they have in various informants. As with the responses discussed in the previous sub-section, farmers rate their private vet as their most trustworthy contact, with over 90% of respondents rating them as mostly trustworthy or very trustworthy. Defra received far more negative responses, with only 40% of farmers considering the department to be mostly or very trustworthy. The figures in Table 6.8 appear to correspond with those in Table 6.7 above. The statistical significance of the relationship between these variables is discussed in more detail in section 6.2.7.

Table 6.8 Levels of perceived trustworthiness among informants

	Very untrustworthy (%)	Untrustworthy (%)	Neither trustworthy or untrustworthy (%)	Mostly trustworthy (%)	Very trustworthy (%)	Total (n)
Private vet	1.1	0.5	6.9	42.6	48.9	n=378
NFU	2.2	2.2	30.4	47.9	17.3	n=365
AHOs	1.3	3.0	32.9	48.2	14.6	n=371
Defra	3.7	8.6	47.6	34.2	5.9	n=374

6.2.7 Correlation analysis

The findings presented above suggest a possible relationship between perceived trustworthiness and the knowledge of an informant and the likelihood that a farmer will seek their advice. The findings of the qualitative interviews also suggested that regularity of contact and the longevity of a relationship with a particular contact are also likely to influence farmers' attitudes. In order to explore the potential relationships further, Pearson product-moment correlation coefficients (also known as Pearson r)⁵ were calculated to establish whether statistically significant ($p < .05$) associations exist between the variables. The results of the correlation analysis are presented in Tables 6.9 to Table 6.12.

⁵ Pearson product-moment correlation coefficient is denoted as the r value in tables 2.9-2.12. The coefficient measures the linear dependence of two variables. The r value is a number between +1 and -1, indicating the magnitude and direction of the association between two variables. The closer the correlation is to +1 or -1, the stronger the magnitude. If the r value is close to 0 there is no association between the variables. If the correlation is a negative value, the variables have a negative relationship (as one increases, the other decreases) and if the value is positive, there is a positive relationship between the variables (as one increases, the other also increases).

Table 6.9 Private vet - correlation between whether respondents are likely to seek the informant's advice, levels of perceived trustworthiness and knowledge, and regularity of contact

		Seek advice	Perceived knowledge	Perceived trustworthiness	Regularity of contact
Seek advice	(r)		.381**	.270**	.211**
	(p)		.000	.000	.000
Perceived knowledge	(r)	.381**		.655**	.391**
	(p)	.000		.000	.000
Perceived trustworthiness	(r)	.270**	.655**		.285**
	(p)	.000	.000		.000
Regularity of contact	(r)	.211**	.391**	.285**	
	(p)	.000	.000	.000	

***Correlation is significant at the 0.01 level (2-tailed)*

Table 6.10 NFU - correlation between whether respondents are likely to seek the informant's advice, levels of perceived trustworthiness and knowledge, and regularity of contact

		Seek advice	Perceived knowledge	Perceived trustworthiness	Regularity of contact
Seek advice	(r)		.192**	.153**	.061
	(p)		.000	.002	.228
Perceived knowledge	(r)	.192**		.551**	.242**
	(p)	.000		.000	.000
Perceived trustworthiness	(r)	.153**	.551**		.255**
	(p)	.002	.000		.000
Regularity of contact	(r)	.061	.242**	.225**	
	(p)	.228	.000	.000	

***Correlation is significant at the 0.01 level (2-tailed)*

Table 6.11 AHO - correlation between whether respondents are likely to seek the informant's advice, levels of perceived trustworthiness and knowledge, and regularity of contact

		Seek advice	Perceived knowledge	Perceived trustworthiness	Regularity of contact
Seek advice	(r)		.210**	.148**	.067
	(p)		.000	.003	.186
Perceived knowledge	(r)	.210**		.652**	.253**
	(p)	.000		.000	.000
Perceived trustworthiness	(r)	.148**	.652**		.294**
	(p)	.003	.000		.000
Regularity of contact	(r)	.067	.253**	.294**	
	(p)	.186	.000	.000	

***Correlation is significant at the 0.01 level (2-tailed)*

Table 6.12 Defra - correlation between whether respondents are likely to seek the informant's advice, levels of perceived trustworthiness and knowledge, and regularity of contact

		Seek advice	Perceived knowledge	Perceived trustworthiness	Regularity of contact
Seek advice	(r)		.251**	.170**	.073
	(p)		.000	.001	.150
Perceived knowledge	(r)	.251**		.657**	.309**
	(p)	.000		.000	.000
Perceived trustworthiness	(r)	.170**	.657**		.337**
	(p)	.001	.000		.000
Regularity of contact	(r)	.073	.309**	.337**	
	(p)	.150	.000	.000	

***Correlation is significant at the 0.01 level (2-tailed)*

The results of the correlation analysis show a number of statistically significant relationships between the variables. The most significant correlations are between levels of perceived trustworthiness and perceived knowledge. For all of the informants the Pearson r value for the two variables is above .50 which, according to Cohen (1992), indicates a large positive effect. Although regularity of contact has a positive effect on levels of both perceived knowledge and perceived trustworthiness for all of the informants, regularity of contact only has a significant relationship with the likelihood that a farmer will seek their vet's advice. This indicates that the more regularly a farmer sees their vet, the more likely they are to seek their advice. The importance of regular contact with vets was noted in the qualitative interviews, with participants suggesting that seeing their vet regularly was important for building trust and respect, as well as providing opportunities to seek their advice. The positive relationship between regularity of contact and seeking a vet's advice may provide some explanation for the results presented in Table 6.6 which show that, for the majority of farmers, their vet was their most favoured informant.

The quantitative results presented in Table 6.9 to Table 6.12 indicate an interesting distinction between more distant informants, with whom farmers are likely to have limited contact, and those who they see more regularly. The majority (67.7%) of farmers see their vet at least once a month. The fact that private vets stand out as farmers' most favoured informant, perceived as having by far the most farming knowledge and considered the most trustworthy, corroborates findings of other studies (see for example Peck, Grant, McArthur, *et al.*, 2002), as well as those of the qualitative interviews. It has been suggested in the literature that regularity of contact can have a positive influence on the development of social capital, and as a consequence an increase in levels of trust (Sligo and Massey, 2007; Lyon, 2000). This is an important issue in terms of understanding the role of social capital and the impact it may have on the relationships between farmers and their informants. This will be explored in more detail in the following chapter.

6.2.8 Involvement in the farming community

In addition to asking respondents for their views about various informants, they were asked about their involvement in the farming community. This had been identified in the qualitative interviews as being important in terms of access to information, but also as an emotional and practical support network. Farmers were therefore asked whether they had been involved in any farming groups in the past 3 years. Half of the respondents had. Groups included the Young Farmers Club, local buying groups, cooperatives, discussion groups and farming social clubs. Of the respondents who had been involved in a farming group, 45% had held responsibilities such as raising funds or organising events.

Correlation analysis found a statistically significant correlation between membership of farming groups and whether the respondent would seek advice from other farmers ($r=.415$; $p=.000$). Farmers who were members of farming groups were more likely to seek farmers' advice. Interestingly, a similar pattern was also found for respondents who were members of non-farming groups. Statistically significant correlations were found between membership of non-farming groups and the likelihood that the respondent would seek other farmers' advice ($r=.459$; $p=.000$). This is an interesting finding as it provides an indication that general community involvement (be it farming or otherwise) increases the likelihood that a farmer will seek advice from his or her peers. This perhaps says more about the attitudes and practices of 'more active' respondents than it does about the opportunities for farmers to share knowledge and information.

When asked whether they had done a favour for another farmer in the last six months, the vast majority had (92.2%). Slightly less (86.7%) had had another farmer do a favour for them in the same time period. These data suggest that farmers regularly undertake reciprocal action to help one another. Farmers who have done a favour for another farmer were also more likely to seek advice from other farmers ($r=.504$; $p=.000$) as were respondents who had received a favour from another farmer ($r=.906$; $p=.000$).

6.2.9 Summary of the descriptive findings

The descriptive findings presented in this section have provided an overview of the sample as well as identifying some interesting relationships between a number of variables. It is clear that farmers consider bTB risk to be high compared to other potential risk factors. However, few take active measures such as the implementation of biosecurity to reduce the risk of their herd contracting the disease. Instead, bTB is considered by many farmers to be uncontrollable, with the vast majority of those who have avoided the disease suggesting that it is simply due to luck. When asked about their sources of advice, farmers identified private vets as their most favoured informant. Levels of perceived knowledge and trustworthiness were substantially higher for vets compared to other contacts, as was the regularity of contact between farmers and their vets.

In order to more fully understand the findings of the descriptive analysis, the data were subjected to factor and cluster analysis to further explore the relationships between the variables as well as to identify any similarities between respondents. The results of the analysis are presented in the following section.

6.3 FACTOR ANALYSIS – IDENTIFICATION OF UNDERLYING STRATEGIC VARIABLES

As part of the postal survey, a series of 34 statements measured against a 5-point Likert scale were included to explore various aspects of social capital, trust and attitudes towards bTB. These were subjected to factor analysis in order to reduce the original set of variables into a smaller number of factors, with the aim of explaining correlations between the variables and in turn identifying the underlying dimensions across the set. Principal Component Analysis (PCA) was used for the factor extraction in order to identify the varying attitudes and practices of different farmers.

6.3.1 Suitability of the data

As reported in section 6.1, 401 surveys were returned. Of these, 27 had over 10% missing data so were not used for the analysis, leaving 374 cases. The data were also checked for

multivariate outliers using the Mahalanobis D^2 measure⁶. Two cases were identified as multivariate outliers. On further inspection, they both contained many particularly high and low scores inconsistent with other cases and were therefore removed from further analysis. Additionally, cases were removed if responses to any of the statements to be used for the factor analysis were missing. A total of 31 cases were missing one or more responses to the 34 statements so were therefore removed, leaving 341 cases for the factor analysis⁷.

Once unsuitable cases had been removed, the first step in the factor analysis was to undertake a correlation analysis of the variables to establish if there was a sufficient level of multicollinearity⁸. Correlation between variables in the factor analysis is essential as the aim of the process is to identify interrelated sets of variables based on levels of correlation. Correlations of less than ± 0.3 are considered to be small (Cohen, 1988). On examination, 14 variables had no correlations with other variables of more than ± 0.3 and were therefore removed⁹. Excess multicollinearity is also undesirable as it would suggest that the variables in question are addressing the same issue rather than exploring distinct aspects of the subject matter. The correlation matrix was therefore explored for

⁶ Mahalanobis D^2 measures the distance of a case from the multidimensional mean centre of all the cases and assigns each case a Mahalanobis score. Higher scores indicate cases that are positioned further from the general distribution. The Mahalanobis score divided by the number of variables (representing the degrees of freedom – df) is approximately distributed as a t -value (D^2/df). According to Hair et al. (1998) in large samples, with a level of significance of .001, D^2/df values above 3 are potential outliers.

⁷ According to Hair et al. (1998), in order for data to be suitable for factor analysis, it is necessary to have at least 5 cases per variable. The 34 variables would therefore require 170 cases. This study consisted of 341 cases making it suitable for factor analysis.

⁸ Multicollinearity indicates the level of correlation between variables. A value of 0 would indicate no correlation, while +1 indicates complete positive correlation (as one variable increases, the other also increases) and -1 indicates complete negative correlation (as one variable increases, the other decreases and vice versa).

⁹ The following variables were removed from the analysis: v1. 'Taking a risk is an essential part of running a successful farming business'; v2. 'I feel that I have full control of the future of my business'; v3. 'I often cooperate with other farmers'; v4. 'It is important to have interests outside of farming'; v15. 'It is likely that I will fail the next bTB test'; v20. 'bTB makes me want to give up farming'; v23. 'I have made changes to my farm in order to overcome problems associated with bTB'; v25. 'Implementing biosecurity measures on my farm is not practical'; v26. 'The skin test is an acceptable way of establishing whether a cow has bTB'; v27. 'I have a good knowledge of bTB, its spread and its control'; v28. 'The farming press is a reliable source of information about bTB'; v.32. 'I would be keen to attend information events about bTB'; v33. 'There are plenty of people that I can talk to when I am feeling stressed or upset'; and v34. 'Farmers have a responsibility to educate the public about the impact of bTB and farming more generally'.

correlations over ± 0.9 . No variables with excessive multicollinearity were found. This process left 20 variables for the analysis.

The analysis was re-run on the remaining 20 variables and further statistical tests were undertaken to check for factorability. The Bartlett Test for Sphericity was used to check suitability for factor analysis by ensuring that a sufficient number of correlations between the variables was statistically significant. The test calculated a chi-squared value of 2160.448, which was highly statistically significant ($p=.000$), further justifying the use of factor analysis (Pallant, 2001).

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was also used to confirm the factorability of the data. The KMO index ranges from 0 to 1, with values over 0.5 considered suitable for factor analysis (Hair *et al.*, 1998). The overall KMO value for this sample was 0.726, which was acceptable¹⁰.

The next step was to explore partial correlations between variables. Partial correlation analysis allows for the identification of correlations between variables while controlling for possible effects of another confounding variable. Principal Component Analysis required that the Kaiser-Meyer-Olkin Measure of Sampling Adequacy be greater than 0.50 for each individual variable as well as the set of variables (as calculated above). The anti-image matrix provided by SPSS calculates values for each variable representing the part of the variable that cannot be predicted. In other words, it is a matrix of the negatives of the partial correlations among variables. The matrix confirmed suitability of the sample for factor analysis. Communalities were calculated to indicate the amount of variance in each variable that is accounted for in the final factor solution. Small values indicate variables that do not fit well with the factor solution. A further two variables, with particularly small communality values (.246 and .154) were removed¹¹.

¹⁰ Hair *et al.* (1998) provide the following summary of KMO values: 0.80, meritorious; 0.70 or above, middling; 0.60 or above, mediocre; 0.50 or above, miserable; and below 0.50, unacceptable.

¹¹ The factors that were removed based on small communality values were: v21. 'There is plenty of support available to farmers who are worried about bTB'; and v22. 'There is nothing that farmers can do to reduce the risk of their herd going down with bTB'. This process left 18 variables remaining for the factor analysis.

The factors were then extracted from the correlation matrix based on three criteria. The first criterion was the eigenvalue rule, also known as Kaiser's criterion (Kaiser, 1959). Based on this rule, only factors with an eigenvalue of 1.0 or more were retained¹². In the final solution, 5 factors had eigenvalues over 1. The second criterion for establishing the number of factors to be extracted was the scree test (Cattell, 1966). This test plots the eigenvalues against the number of factors and the shape of the curve provides an indication of the number of factors that should be extracted. The point at which the curve begins to flatten indicates the total number of factors to extract (Hair *et al.*, 1998). The scree plot for this sample was not explicit, suggesting either a 5 or 6 factor solution. As only 5 factors met the first criterion (eigenvalue rule), no further factors could be extracted. The final criterion for factor extraction was the calculation of cumulative percentage of total variance explained by the extracted factors. According to Hair *et al.* (1998), in the social sciences, at least 60% of the total variance should be explained by the extracted factors. For this sample, the 5 extracted factors accounted for 60.727% of the variance. The extraction of any fewer factors would not have satisfied this final criterion.

In the final factor solution, the Bartlett Test of Sphericity chi-squared value of 2080.766 was highly significant ($p=.000$), the overall KMO measure of sampling adequacy was 0.718 and the communality for each variable was greater than 0.30, all of which confirmed that the final solution was suitable for factor analysis. The final factor solution was based on 18 variables and presented 5 factors explaining 60.727% of the variance, as shown in Table 6.13.

¹² The eigenvalue of a factor represents the total variance explained by the factor.

Table 6.13 Total variance explained for the extracted factors

Component	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.400	18.891	18.891	3.400	18.891	18.891
2	2.940	16.336	35.227	2.940	16.336	35.227
3	2.047	11.370	46.597	2.047	11.370	46.597
4	1.422	7.899	54.495	1.422	7.899	54.495
5	1.122	6.232	60.727	1.122	6.232	60.727

Extraction method: Principal Component Analysis; Bartlett's Test for Sphericity chi-squared = 2080.766 (p = .000); KMO = .718.

Once the factors had been extracted, the final step to aid interpretation was factor rotation. This does not change the underlying solution, but presents the pattern of factor loadings in a way that is easier to interpret. Un-rotated factor solutions extract factors in order of importance, with the factor representing the largest amount of variance appearing first, followed by factors accounting for successively smaller portions of variance. When the factors are rotated, the reference axes of the factors are turned until another position is reached allowing the variance from earlier factors to be redistributed to later ones, providing a more meaningful factor solution (Hair *et al.*, 1998). Rotation can be either orthogonal or oblique. In orthogonal rotation, the axes are maintained at 90°, while for oblique rotations, the axes are not constrained to 90°. No specific rules exist to guide researchers in terms of the most appropriate rotation to use. However, according to Hair *et al.* (1998), in general orthogonal rotation is used when the factor scores will be used for subsequent regression analysis (e.g. cluster analysis). There are a number of

orthogonal approaches to choose from but the most widely used is Varimax. In general, the Varimax approach provides a simpler solution than other orthogonal rotations, with a clearer separation of factors. The factor solution for this study was therefore rotated using the Varimax method and interpreted as follows.

6.3.2 Interpretation

Interpretation of the factor solution involves locating all of the variables that have large loadings on the same factor. There is some disagreement among statisticians as to what constitutes a ‘large loading’. According to Tabachnik and Fidell (2007), loadings above 0.55 are good, 0.60 are very good and those over 0.71 are excellent. Factor scores of ± 0.55 were therefore considered to be significant. The variables loading on each factor were carefully considered in order to name each factor. Factor scores were saved as new variables and later used for the cluster analysis reported in section 6.4.

A summary of the factor loading scores is presented in Table 6.14.

Table 6.14 Results of principal component analysis of variables

Variable	Factor loading
Concerned with the negative impacts of bTB	
v.18 Going down with bTB is/would be very stressful	.913
v.19 Going down with bTB is/would be very upsetting	.882
v.17 Going down with bTB has/would have a major financial impact on my business	.802
v.16 BTB creates a lot of extra work	.550

Strong bonds with farming community		
v.7	Most farmers in the local area look out for each other	.819
v.6	I trust most of the farmers in my local area	.812
v.12	I do not feel excluded by other farmers	.671
v.5	I know most of the farmers in my local area	.619
Good relationships with authority		
v.9	The government is interested in what farmers think about bTB	.782
v.8	The government is doing a good job in relation to bTB	.773
v.10	The NFU is doing a good job in relation to bTB	.677
v.11	By working together farmers can influence decisions that are made relating to bTB	.581
Seeking and acting on internal influences		
v.14	I often follow the advice of others farmers in relation to bTB	.760
v.13	I often speak to other farmers about bTB	.758
Seeking and acting on external influences		
v.29	I follow advice from Defra relating to bTB	.781
v.31	I follow the vet's advice relating to bTB	.718
v.30	I follow advice from the NFU relating to bTB	.672
v.24	I am happy to try new things to reduce the risk of bTB	.596

Extraction method: Principal Component Analysis; Rotation method: Varimax with Kaiser Normalization

The five distinct factors are summarised as follows:

Concerned with negative impacts: This factor, accounting for 18.891% of the variance, emphasises farmers' concerns for their personal wellbeing and that of their business. High factor loadings were associated with statements relating to stress and being upset, as well as the financial and practical problems associated with a bTB breakdown.

Strong bonds with the farming community: Farmers who score highly on this factor were likely to have positive and close relationships with other farmers, emphasising trust, inclusion and cooperation. The factor accounted for 16.336% of the variance.

Good relationships with authority: Variables that loaded heavily on this factor emphasised positive feelings towards the government and the NFU. Farmers who scored highly on this factor were more likely to feel that both the government and the NFU were doing a good job in relation to bTB and that their views are taken into consideration by the government. Farmers also felt that cooperation with other farmers can increase levels of empowerment. The factor accounted for 11.370% of the variance.

Seeking and acting on internal influences: This factor is associated with influences within the farming community. The factor, which accounts for 6.232% of the variance emphasises communication between farmers. Farmers scoring highly on this factor are likely to follow the advice of other farmers in relation to bTB.

Seeking and acting on external influences: Conversely, this factor, accounting for 7.899% of the variance, is focused on advice and information from external sources (i.e. outside of the farming community). Farmers who scored highly on this factor follow information provided by Defra, the NFU and their vet, and are happy to try new things to reduce the risk of bTB, suggesting that they are likely to act on the information they are provided with by external sources.

6.4 CLUSTER ANALYSIS

The primary purpose of cluster analysis is to group respondents based on their underlying characteristics. Clusters therefore represent groups of respondents who are very similar to each other according to specified criteria. Within the resulting clusters there will be a high degree of internal similarity, at the same time exhibiting a high degree of external heterogeneity (Hair *et al.*, 1998). According to Gorman and Primavera (1983), cluster analysis can provide a useful complement to factor analysis allowing for enhanced interpretation of results. By itself, factor analysis provides a useful summary of the correlation between variables but it does not establish the association between cases in relation to the correlated variables. Therefore, in order to build on the findings of the factor analysis presented in the last section, and to further interpret the data, cluster analysis was used. By providing homogenous groupings of cases, cluster analysis allows for the allocation of group membership of cases based on the underlying commonalities among variables as identified by the factor analysis. In short, factor analysis groups variables, while cluster analysis groups objects (in this case, respondents). A key advantage of cluster analysis is its ability to identify distinct groups (or segments) within a population. The data for the whole population can be profiled into a number of groups, allowing the researcher to gain a more concise and understandable description of the sample. This function of cluster analysis fulfils the main objective of this phase of the research which relates to the segmentation of farmers based on their attitudes towards BTB and levels of social capital.

The factor analysis described in the previous section provided each case in the sample with a score for each factor. These scores were then used as variables for the cluster analysis. It was important that the variables selected for the cluster analysis related clearly to the objectives of the process. According to Lorr (1983), factor scores are more appropriate to use in cluster analysis than single variables as they are based on distinct, independent factors, thereby removing the potential interdependencies between variables.

While there are many advantages of cluster analysis, it is important to note that it is primarily an exploratory technique, which relies very much on the judgments made by

the researcher such as the choice of variables used and the interpretation of the elements that make up the resulting solution (Hair *et al.*, 1998). It is therefore essential that the researcher approaches the process with careful consideration at each stage, as well as making clear how decisions were taken. The decision making process and the resulting cluster solution are described in the following sections.

6.4.1 Preparation and analysis of the data

The first stage of the process was to check the factor scores for outliers, as cluster analysis is particularly sensitive to them. The Mahalanobis D^{13} method, used to identify outliers, identified 5 extreme cases with values exceeding the critical value suggested by Pearson and Hartley (1958) and supported by Tabachnick and Fidell (2007). These cases were therefore removed from the analysis. This left 334 cases to be clustered.

The second stage of the cluster analysis was to select the similarity measure to be used for the clustering process. The concept of similarity is fundamental to cluster analysis as it is the process by which cases are compared to one another and consequently grouped into clusters. There are a variety of ways to measure similarity, but those which are most commonly used in cluster analysis are correlational measures, distance measures, and association measures. The first two measures require metric data whereas the latter is used for nonmetric data (Hair *et al.*, 1998). In this case, as the study is concerned with metric data, association measures were rejected. A decision was then made regarding the use of the remaining two. According to Lorr (1983) and Hair *et al.* (1998), distance measures are the most appropriate measure for cluster analysis. Distance measures represent similarity in terms of the proximity of cases to each other across the variables. There are a variety of distance measures available, but the most commonly used is the

¹³ Mahalanobis distance is the distance of a particular case from the centroid of the other cases, where the centroid represents the means of all the variables (Tabachnick and Fidell 2007).

Squared Euclidean distance measure, which is the sum of squared differences in values for each variable¹⁴ (Hair *et al.*, 1998).

The third stage in the cluster analysis was to select a partitioning procedure, which is the process by which clusters are formed and the number of clusters established. Decisions relating to these points must be carefully considered as they both have substantial implications for the results obtained from the analysis, and the way that the results are interpreted. The first decisions are related to the choice of clustering algorithm. The most commonly used algorithms can be classified as either hierarchical or non-hierarchical. Hierarchical procedures combine cases into a tree-like structure and can be either agglomerative or divisive. In the agglomerative methods, each case starts in its own cluster and is subsequently combined with the next closest cluster. This is repeated until all the cases are grouped into one large cluster. In comparison, division methods start with one large cluster containing all cases, which is then continually split into clusters until each case is in an individual cluster (Hair *et al.*, 1998; Lorr, 1983). Within statistical computer packages, agglomerative methods are the most widely used. There are a number of popular agglomerative algorithms including single linkage, complete linkage, average linkage, Ward's method and centroid linkage¹⁵. Each method has its merits, but following Hair *et al.*'s (1998) advice, Ward's method was selected in this case as it is not a single measure of similarity, instead, it measures the sum of squares between clusters, summed over all the variables. At each stage, the within-cluster sum of squares is minimised across the whole set of clusters. Ward's method also avoids problems with the 'chaining' of cases found in the single linkage method.

¹⁴ Other distance measures are available including the city-block approach, the Chebychev distance measure, and the Mahalanobis distance measure. These alternatives were considered, but following the advice in the literature the Squared Euclidean distance measure was considered most appropriate.

¹⁵ The single linkage method is based on the shortest distance from any object in one cluster to any object in another cluster. The complete linkage method is similar but is based on the maximum distance between cases in each cluster. The average linkage method is based on the average similarity of all cases in one cluster with all the cases in another, whereas the centroid method uses the distance between cluster centroids. Ward's method is based on the sum of squares within the clusters summed over all variables. (Hair *et al.* 1998).

While hierarchical methods continue clustering cases until each case is in its own cluster, or all cases are combined into one large cluster (depending on the method used), non-hierarchical methods assign cases into a pre-determined number of clusters. In order to overcome any of the shortcomings associated with either hierarchical or non-hierarchical methods, Hair *et al.* (1998) and Milligan (1980) suggest using the methods in combination. Firstly, a hierarchical method is used to identify the optimal number of cluster solutions and to identify the starting point (or seed point) for each cluster. It can also be used to identify any outliers. A non-hierarchical method can then be employed to produce the final cluster solution. This approach was followed and is outlined in the following sections.

6.4.2 Step 1. Hierarchical method

As explained above, Ward's method and the Squared Euclidean distance measure were employed. The clustering process produced cluster coefficients and a dendrogram plot which were examined to establish the optimal number of clusters. The partition process was confined to ten clusters. It was anticipated that the final cluster solution would not exceed seven, to ensure a manageable number of final clusters. However, it was useful to examine several cluster solutions beyond seven in order to understand how the clusters combined to result in the optimal number of clusters. The 'stopping rule' was employed, whereby percentage increases of the cluster coefficient to the next stage were examined. Small percentage changes in the coefficients indicate that fairly homogenous clusters are being merged whereas larger percentage changes indicate the merging of two very different clusters. For each cluster an agglomeration coefficient was calculated, which indicates the level of difference between clusters. The percentage changes in the coefficient for 10 down to 2 clusters were then calculated in order to establish the homogeneity or difference between clusters being joined at each stage. The results of this exercise are shown in Table 6.15.

Table 6.15 Analysis of agglomeration coefficient for hierarchical cluster analysis

Number of clusters	Agglomeration coefficient	Percentage change in coefficient to the next level
10	752.6	5.6%
9	794.8	5.4%
8	837.5	5.7%
7	884.9	6.8%
6	945.1	9.8%
5	1037.9	10.1%
4	1142.7	10.0%
3	1257.0	9.2%
2	1372.7	13.3%
1	1555.3	

The largest percentage changes were for solutions of five, four, three and two clusters. There is a noticeable change in the percentage increase when combining six clusters into five (9.8%). Similar percentage changes were found for combining five clusters into four (10.1%), four into three (10.0%) and three into two (9.2%). (The percentage increase in the final stage, combining two clusters into one (13.3%) will always be large, but this does not indicate a meaningful representation of the data (Hair *et al.*, 1998)). In addition to the data presented in Table 6.15, the dendrogram, produced by SPSS, was examined to establish the best solution. Based on the percentage changes between the clusters and the distance measures presented by the dendrogram, a two cluster solution was considered optimal as it provided the clearest division between the cluster groups. As shown in the following section, the suitability of the two cluster solution was confirmed after the non-

hierarchical analysis, when statistically significant differences between the two cluster groups were found for all but one of the factors.

6.4.3 Step 2. Non-hierarchical method

The second step in the clustering process used non-hierarchical cluster analysis to ‘fine-tune’ the results of the initial hierarchical analysis, in which a two cluster solution was initially suggested. The hierarchical cluster analysis undertaken in the previous step provided cluster centroids for each of the clustering variables. As suggested by Hair *et al.* (1998), these were used as initial seed points in a K-means non-hierarchical analysis. As with the hierarchical clustering, factor scores were used as the clustering variables. In order to maximise within-cluster homogeneity, an optimising algorithm was used for the clustering process. This allowed for cases to be reallocated to a different cluster as the analysis proceeded. This iterative analysis also pointed towards a two cluster solution as being the most robust. In addition to statistical validity, it was also important to ensure that the resulting cluster solution had a firm theoretical grounding, and that there was a fairly even spread of cases across the clusters (Hair *et al.*, 1998). On further examination, the two cluster solution was found to be theoretically consistent with the findings from the in-depth interviews. For example, as shown in Table 6.16 there is a clear distinction between the clusters in relation to attitudes towards authority and sources of information. The qualitative findings reported in the preceding chapter emphasised these points as being important influences in relation to farmers’ attitudes towards bTB and its control. From a pragmatic perspective, the two cluster solution also provided an even spread across the sample, forming clusters of similar sizes (176 and 158 cases). The statistical profile of the selected two cluster solution is shown in Table 6.16.

Table 6.16 Clustering variable profile for the two cluster solution from hierarchical cluster analysis

	<i>X₁</i>	<i>X₂</i>	<i>X₃</i>	<i>X₄</i>	<i>X₅</i>	<i>Cluster size</i>
	<i>Seeking and acting upon external influences</i>	<i>Seeking and acting upon internal influences</i>	<i>Good relationships with authority</i>	<i>Strong bonds with farming community</i>	<i>Concerned with the negative impacts of bTB</i>	
TWO CLUSTER SOLUTION						
1	.1865426	-.0372524	.6161378	-.1129197	-.4376091	176
2	-.1465745	.0958773	-.6819199	.1620054	.5194507	158
<i>F value</i>	10.267	1.636	246.793	6.916	108.789	
<i>Significance</i>	.000*	.000*	.000*	.202	.001*	

*statistically significant at the .001 level

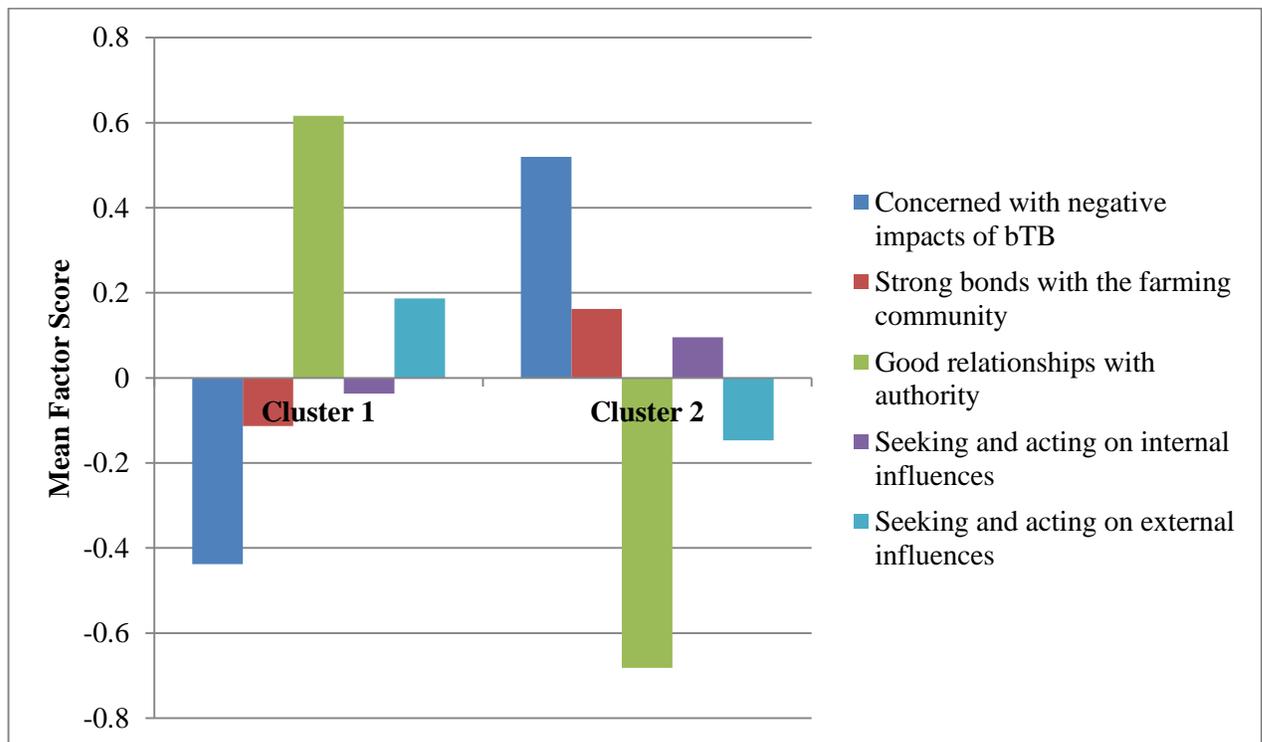
The scores presented in the above table represent the average score for each cluster on each factor. A positive value denotes a higher than average importance of a particular factor and for a negative value the opposite is true. For example, it can be seen that cluster one places the most importance on ‘good relationships with authority’, while the least important factor is ‘concerned with the negative impacts of bTB’. The second cluster is almost a mirror image of the first with a lower than average importance put on ‘good relationships with authority’, and much more importance put on ‘concerned with the negative impacts of bTB’.

6.4.4 Profiling the final cluster solution

The two clusters were named according to the farmer types that they appear to present. This was achieved by examining the mean factor scores for each cluster. High mean scores indicate that the given factor is particularly important (if the mean score is a positive number) or particularly unimportant (if the mean score is a negative number) to

the farmers in that cluster. The cluster profiles are shown in Figure 6.1, followed by a description summary of the farmer types that form the two groups.

Figure 6.1 Final cluster profiles



Cluster 1 - Resilient and externally focused farmers: The first cluster accounts for 52.7% of the sample (n=176). Farmers in cluster 1 are less likely to be concerned about the negative implications of bTB, including the practical, financial and emotional impacts. They are less concerned with having strong bonds with other local farmers, and are also less likely to seek and follow the advice of other farmers. Instead, they are more focused on external influences such as the NFU, Defra and their private vet. Farmers in this group believe that the government listens to farmers, which indicates a level of empowerment. They also feel that the government and the NFU are doing a good job in relation to bTB.

Cluster 2 - Vulnerable and internally focused farmers: In comparison to those in cluster 1, cluster 2 farmers are more concerned with the practical, financial and emotional impacts of bTB. They have strong bonds with, and trust other farmers, but have far less

positive relationships with authority. They are less likely to feel a sense of empowerment or to consider the NFU or the government to be doing a good job in relation to bTB. They rarely seek and follow advice from external sources such as the NFU, but instead seek and follow the advice of other farmers. This cluster accounts for 47.3% of the sample (n=158).

6.5 PROFILING OF THE FARMER GROUPS

The two clusters that emerged from the factor and cluster analyses were profiled further by examining a variety of variables to identify any differences between the clusters. Chi-square tests of independence were used for nominal variables and a one way Analysis of Variance (ANOVA)¹⁶ was conducted on the remaining variables. This allowed information from the survey, which had not been used in the factor or cluster analyses, to further characterise the clusters. The data used for this consisted of descriptive variables, such as farm and farmer characteristics, as well as farmer attitudes, management activities, sources of information, and levels of trust. The main aim of this was to establish the differences between the farmers in the two clusters. Significant differences between the cluster groups were found for a number of the variables, supporting the external validity of the clusters. The following subsections report the findings of the analysis and indicate where differences between the groups exist. It is useful to reiterate at this point that the presence of a significant difference ($p < .05$) indicates that it is 95% likely that the difference between the groups did not occur by chance, and that it is therefore highly probable that a difference would be present if the survey was repeated.

6.5.1 Farm and farmer characteristics

A variety of farm and farmer characteristics were explored to establish whether any statistically significant ($p < .05$) differences were present between the farmer groups. The results are shown in Table 6.17. There was a statistically significant difference between cluster groups according to herd size. *Resilient and externally focused* farmers tended to have smaller herds than those who are *vulnerable and internally focused*. There were no

¹⁶ When calculated in SPSS, the ANOVA provides an F value. This value is calculated by dividing the variance of group means by the mean of the within group variances.

significant differences between farm types, with a fairly even distribution across the two farmer groups. Similarly, no differences were found between groups based on tenure, income derived from cattle, gender or level of education. However, a significant difference was found between groups based on age. Farmers in the *resilient and externally focused* group tended to be slightly older, with a higher proportion falling into the 56-65, 66-75 and >75 categories.

Table 6.17 Farmer group profiles based on farm and farmer characteristics

	1.Resilient and externally focused	2.Vulnerable and internally focused
Average number of cattle (F=5.071, p=.025*)		
	208	260
Farm type (%) (F=.013, p=.910)		
Beef	25.0 (n=44)	22.8 (n=36)
Dairy	29.5 (n=54)	34.8 (n=55)
Mixed livestock	27.8 (n=49)	24.7 (n=39)
Mixed	17.0 (n=30)	17.7 (n=38)
Tenure (%) (F=.142, p=.707)		
Owner occupier	44.9 (n=79)	45.2 (n=71)
Tenant	8.5 (n=15)	12.1 (n=19)
Mixed tenure	44.9 (n=79)	40.8 (n=64)
Farm manager	1.7 (n=3)	1.9 (n=3)

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<i>Proportion of farm income derived from cattle (%) (F=3.835, p=0.51)</i>		
1-25%	10.9 (n=19)	5.7 (n=9)
26-50%	22.4 (n=39)	18.4 (n=29)
51-75%	14.9 (n=26)	17.7 (n=28)
76-99%	29.9 (n=52)	29.7 (n=47)
100%	21.8 (n=38)	28.5 (n=45)
<i>Farm size (%) (F=.16, p=.900)</i>		
1- 50 hectares	17.6 (n=31)	17.2 (n=27)
51-100 hectares	31.8 (n=56)	31.8 (n=50)
101-200 hectares	31.3 (n=55)	28.0 (n=44)
201-500 hectares	17.0 (n=30)	21.6 (n=34)
501+ hectares	2.3 (n=4)	1.3 (n=2)
<i>Age (%) (F=6.450, p=.012*)</i>		
<25	1.7 (n=3)	0.6 (n=1)
26-35	2.9 (n=5)	5.8 (n=9)
36-45	13.7 (n=24)	21.4 (n=33)
46-55	32.0 (n=56)	33.8 (n=52)
56-65	29.1 (n=51)	26.6 (n=41)
66-75	16.0 (n=28)	9.7 (n=15)
>75	4.6 (n=8)	1.9 (n=3)
<i>Gender (%) (F=.65, p=.800)</i>		
Male	91.4 (n=159)	92.2 (n=141)
Female	8.6 (n=15)	7.8 (n=12)

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Highest level of education (%) (F=.092, p=.761)		
No formal education	0.6 (n=1)	1.3 (n=2)
Primary school	0.6 (n=1)	.0
Secondary school	37.7 (n=66)	35.3 (n=54)
College	46.9 (n=82)	43.8 (n=67)
Undergraduate degree	9.7 (n=17)	19.0 (n=29)
Postgraduate degree	4.6 (n=8)	0.7 (n=1)

**statistically significant at the .05 level.*

In response to being asked whether they felt in full control of their business, a statistically significant difference was found between the farmer groups. Farmers in the *vulnerable and internally focused* group felt in less control of their business (Table 6.18).

Table 6.18 Farmer group profiles based on the level of control the respondent feels they have over their business

	Level of agreement (mean)	
	1.Resilient and externally focused	2.Vulnerable and internally focused
I feel that I have full control of my business (F=7.933, p=.005)	2.9023	2.5949

N.B responses to this question were given on a five point Likert scale ranging from 1 = Strongly disagree to 5= Strongly agree.

6.5.2 Risk perception

In order to provide some context for exploring farmers' understanding of bTB risk, respondents were asked to rate certain risks based on the extent to which they pose a threat to their business. The results are shown in Table 6.19. Some significant differences between the two groups were found, namely, perception of crop disease risk, animal disease (other than bTB) risk, and bTB risk. Interestingly, all of these relate to disease risk, whereas the other risk sources relate to broader economic and political threats. The

data suggest that farmers in the *vulnerable and internally focused* group tend to perceive crop and livestock disease risk to be higher than those in the *resilient and externally focused* group. As there are no significant differences between the groups in terms of farm type and size, tenure and the proportion of income derived from cattle, it is likely that the *actual* risk posed by each of the suggested factors does not differ significantly between the groups. However, the findings presented in Table 6.19 suggest that farmers in the *vulnerable and internally focused* group *perceive* the risk to be higher than those in the *resilient and externally focused* group. While the resilient farmers may have developed practical strategies to avoid the risks, these findings may also provide an insight into how risk is understood by different individuals, and what measures they have in place to cope with the risk should it be realised. These questions will be revisited in the following chapter.

Table 6.19 Farmer group profiles based on risk perception

Risk	Risk perception (mean)	
	1.Resilient and externally focused	2.Vulnerable and internally focused
Fluctuations in market prices (F=.228, p=.633)	2.691	2.6026
Increasing cost of inputs (F=1.166, p=.281)	2.7907	2.8924
Changes in agricultural policy (F=2.284, p=.132)	2.3416	2.3922
Weather (F=2.284, p=.132)	2.1607	2.3141
Crop disease (F=6.746, p=.010*)	1.3158	1.5926
Animal disease (other than bTB) (F=4.659, p=.028*)	2.0296	2.2692
bTB (F=9.111, p=.003*)	2.8606	3.1731

*Significant to the .05 level. N.B responses to this question were given on a five point Likert scale ranging from 0 = No risk to 4= A very high risk.

6.5.3 bTB experience

Farmers were asked about their experience of bTB, for example whether they had had a breakdown, the number of breakdowns they had experienced and the number of cattle that they had lost due to the disease. There was a statistically significant difference ($p < .05$) between the two groups in terms of whether the farmers had experienced a bTB breakdown (Table 6.20). A slightly higher proportion of farmers in the *vulnerable and internally focused* group had experienced a breakdown. Although the data also suggest

that farmers in the *vulnerable and internally focused* group have on average experienced a higher number of breakdowns, the difference is not statistically significant. No differences between the groups were found in terms of the average number of cattle lost or the time since the farmer's last breakdown. It is interesting that the differences between the two groups in relation to bTB experience are not great. Although there is a statistically significant difference between whether the respondent had or had not had a breakdown, the difference was not significant at the 99% level ($p < .01$). This supports the other findings reported here which suggest that factors other than bTB experience better explain the differences between the groups. This is important in terms of understanding the role of social capital in influencing farmers' attitudes towards bTB, which is explored further in the subsections that follow.

Table 6.20 Farmer group profiles based on bTB experience

	1.Resilient and externally focused (%)	2.Vulnerable and internally focused (%)
Ever had a bTB breakdown (F= 6.523, p=.011*)		
No	26.6 (n=46)	15.2 (n=24)
Yes	73.4 (n=127)	84.8 (n=134)
Number of bTB breakdowns in the last 10 years (F=2.391, p=.123)		
1	23.8 (n=31)	26.9 (n=36)
2-5	55.4 (n=72)	53.3 (n=58)
6-10	10.8 (n=14)	14.2 (n=19)
More than 10	8.5 (n=11)	15.7 (n=21)
Average number of cattle lost to bTB in the last 10 years (F=.151, p=.698)		
	37.72	39.75
Time of last bTB breakdown (F=3.083, p=.080)		
The farm is currently under restriction	34.6 (n=45)	39.6 (n=53)
Within the last 3 months	0.8 (n=1)	6.7 (n=9)
Within the last year	22.3 (n=29)	21.6 (n=29)
Within the last 3 years	20.0 (n=26)	17.2 (n=23)
Over 3 years ago	22.3 (n=29)	14.9 (n=20)

*Statistically significant at the .05 level

6.5.4 Attitudes towards bTB control

Respondents were asked to rate a number of statements relating to their attitudes towards bTB and its control, and some statistically significant differences between the groups were found. Farmers in the *vulnerable and internally focused* group appear to be more fatalistic towards bTB. A higher number felt that it was likely that their herd would fail their next bTB test compared to those in the *resilient and externally focused* group. They were also more likely to feel that there is nothing that farmers can do to reduce the risk of their herd going down with bTB. Respondents were asked about their confidence in the skin test used on cattle to establish whether or not they have bTB. As shown in Table 6.21, farmers in the *resilient and externally focused* group have a higher level of confidence in the skin test compared to those in the *vulnerable and internally focused* group.

Table 6.21 Farmer group profiles based on their attitudes towards bTB

	Level of agreement (mean)	
	1.Resilient and externally focused	2.Vulnerable and internally focused
It is likely that my herd will fail the next bTB test (F=11.230, $p=.001^{**}$)	2.9602	3.3248
There is nothing that farmers can do to reduce the risk of their herd going down with bTB (F=4.542, $p=.034^{*}$)	2.6875	2.9216
The skin test is an acceptable way of establishing whether a cow has bTB (F=18.944, $p=.000^{**}$)	2.7955	2.3097

**Statistically significant at the .05 level, **Statistically significant at the .01 level*
N.B responses to this question were given on a five point Likert scale ranging from 1 = Strongly disagree to 5= Strongly agree

6.5.5 Uptake of biosecurity measures

Farmers were asked a series of questions about their uptake of recommended biosecurity measures. As shown in Table 6.22, uptake was fairly low across the sample. Although uptake, or willingness to uptake, appears to be slightly higher among *resilient and externally focused* farmers, no statistically significant differences were found between the groups. This suggests that across the sample farmers lack confidence in the effectiveness of biosecurity measures to reduce the risk of their herd going down with bTB, further reiterating the uncontrollable nature of the disease. This provides an insight into farmers' understanding of bTB, which is likely to influence the decisions they make in terms of avoiding or coping with the disease. The existence of widely held understandings (or beliefs) among farmers will be discussed in the following chapter. It is essential that these are understood by policy makers to ensure uptake and cooperation from farmers.

Table 6.22 Farmer group profiles based on their uptake of recommended biosecurity measures

Biosecurity measure	Level of uptake (mean)	
	1. Resilient and externally focused	2. Vulnerable and internally focused
Fence off badger latrines (F=.236, p=.627)	1.5797	1.5368
Fence off badger setts (F=.530, p=.467)	1.7518	1.6838
Badger proof farm buildings (F=.034, p=.854)	1.7956	1.7786
Badger proof silage clamps (F=1.130, p=.289)	1.6341	1.5385
Raise feed and water troughs (F=.049, p=.825)	2.3562	2.3768
Stop spreading slurry on grazing land (F=.670, p=.414)	1.5115	1.4297
Double fence farm boundaries (F=2.109, p=.148)	1.7778	1.6423

N.B responses to this question were given on a three point Likert scale as follows: 1 = Would never do/impractical, 2=Would do if grant aided, 3=Already do

6.5.6 Farmer networks

In order to understand more fully the role of social capital in influencing the attitudes and behaviour of farmers in relation to bTB, a number of questions aimed at exploring farmers' support and knowledge networks were included in the survey. Both internal (within the farming community) and external (outside the farming community) networks

were explored and some statistically significant differences were found between the two groups. The results are reported in the following subsections.

6.5.6.1 Internal networks

As expected, farmers in the *vulnerable and internally focused* group were more likely to have an internally focused support network, made up mainly of family and other farmers. For example, a higher number of farmers in this group had done a favour for another farmer than those in the *resilient and externally focused* group ($F=7.198$, $p=.008$). Farmers in the vulnerable group were also less likely to feel excluded by other farmers. However, *resilient and externally focused* farmers were more likely to feel that there is plenty of support available to farmers who are worried about bTB compared to those in the *vulnerable and internally focused* group. However, there is no statistically significant difference between the groups in terms of whether the respondents felt that there are plenty of people that they can talk to if they are stressed or upset. There therefore appears to be a distinction between general support available to farmers from external sources and the emotional support that they may access within their close, internal networks. This suggests that although farmers in the resilient group are more externally focused, they do not appear to lack emotional support. The results are shown in Table 6.23.

Table 6.23 Farmer group profiles based on internal support network

	Level of agreement (mean)	
	1. Resilient and externally focused	2. Vulnerable and internally focused
I do not feel excluded by other farmers (F=6.184, p=.013*)	3.5398	3.7848
There is plenty of support available to farmers who are worried about bTB (F=16.801, p=.000**)	3.0578	2.6815
There are plenty of people that I can talk to when I'm feeling stressed or upset (F=.403, p=.526)	3.2759	3.2115

*Statistically significant at the .05 level, **Statistically significant at the .01 level
N.B responses to this question were given on a five point Likert scale ranging from 1 = Strongly disagree to 5= Strongly agree

6.5.6.2 External networks

Respondents were asked about their wider support networks and their attitudes towards the government and bodies such as the NFU. A highly significant difference was found between the groups in terms of NFU membership (Table 6.24). A substantially higher proportion of resilient farmers were NFU members. Resilient farmers were also more likely to have attended an NFU meeting in the past three years. Farmers were asked about the regularity of their contact with NFU representatives. Farmers in the *vulnerable and internally focused* group have less contact with the NFU than *resilient and externally focused* farmers. These findings identify a number of interesting questions about the role of NFU membership which will be addressed further in the discussion chapter that follows.

Table 6.24 Farmer group profiles based on attitudes towards the NFU

	1.Resilient and externally focused (%)	2.Vulnerable and internally focused (%)
Member of the NFU (F=23.002, p=.000**)		
Yes	86.1 (n=149)	64.1 (n=100)
No	13.9 (n=24)	35.9 (n=56)
Have you attended any NFU meetings in the past 3 years (F=9.163, p=.003**)		
Yes	63.2 (n=110)	46.8 (n=72)
No	36.8 (n=64)	53.2 (n=82)
How often do you see or speak to an NFU representative? (F=13.840, p=.000**)		
At least once a week	2.3 (n=4)	.0
At least once a month	5.8 (n=10)	4.0 (n=6)
A few times a year	64.7 (n=112)	50.3 (n=76)
Not at all in the last 12 months	27.2 (n=47)	45.7 (n=69)

**Statistically significant at the .01 level

A difference between the groups was also found in terms of the importance of regularly seeing the same vet (Table 6.25). Although the majority of farmers in the sample felt that it was either very or quite important, more of the resilient farmers felt that it was not at all important compared to those in the vulnerable group. As reported in the descriptive findings above, the private vet was noted as the preferred advisor by the majority of farmers. It is therefore interesting that a significant difference was found between the

groups in terms of their attitudes towards private vets. The findings indicate that *vulnerable and internally focused* farmers are perhaps more reliant on their vet, and therefore consider always seeing the same vet as more important. *Resilient and externally focused* farmers on the other hand are more able to ‘cope’ with seeing different vets, and may indeed see advantages in doing so.

Table 6.25 Farmer group profiles based on contact with their private vet

	1.Resilient and externally focused (%)	2.Vulnerable and internally focused (%)
How important is it to regularly see the same vet (F=5.331, p=.022*)		
Very important	21.0 (n=37)	29.0 (n=45)
Quite important	60.2 (n=106)	60.0 (n=93)
Not at all important	18.8 (n=33)	11.0 (n=17)

**Statistically significant at the .05 level*

As discussed in the literature review, a key component of social capital is trust; respondents were therefore asked about their levels of trust in various institutions, groups and individuals. As shown in Table 6.26, levels of trust were fairly high across the sample. However, farmers in the *resilient and externally focused* group appear to be slightly more trusting of external groups (Defra, NFU, private vet and AHOs), whereas those in the *vulnerable and internally focused* group appear to be slightly more trusting of other farmers. However, differences between the groups are negligible, and ANOVA analysis identified no statistically significant differences.

Table 6.26 Farmer group profiles based on levels of trust

	Level of trust (mean)	
	1.Resilient and externally focused	2.Vulnerable and internally focused
Defra (F=3.286, $p=.071$)	3.400	3.2318
The NFU (F=2.265, $p=.133$)	3.8503	3.7143
Private vet (F=.138, $p=.711$)	4.4070	4.3775
AHOs (F=.212, $p=.646$)	3.7619	3.7219
Other farmers (F=2.790, $p=.096$)	3.8488	3.9669

N.B responses to this question were given on a five point Likert scale ranging from 1 = Very untrustworthy to 5= Very trustworthy

The consistency across the groups in relation to levels of trust is interesting as earlier results have identified statistically significant differences between the groups in terms of their attitudes towards the various groups and individuals. For example, the highly significant difference in levels of NFU membership between the groups would perhaps suggest that levels of trust in the NFU may be higher among its members. However, this does not appear to be the case. Instead, trust levels are relatively high across the sample. This raises some interesting questions in relation to the role of trust in affecting farmers' attitudes towards potential influencers.

To explore further the relative importance of trust in relation to other factors which may influence farmers' attitudes towards their informants, respondents were asked about their confidence in the same institutions, groups and individuals in terms of their knowledge of farming. As shown in Table 6.27, respondents in the *resilient and externally focused*

group tend to have slightly more confidence than those in the *vulnerable and internally focused* group. However, as with the findings presented in table Table 6.26, the differences between the groups are negligible and no statistically significant differences between the groups were found.

Table 6.27 Farmer group profiles based on levels of confidence in the knowledge of institutions, groups and individuals

	Level of knowledge (mean)	
	1.Resilient and externally focused	2.Vulnerable and internally focused
Defra (F=2.065, p=.152)	2.2176	2.1111
NFU (F=.329, p=.567)	2.9940	2.9504
Private vet (F=.207, p=.649)	3.7746	3.7516
AHO (F=3.530 p=.061)	2.8563	2.7105

N.B responses to this question were given on a five point Likert scale ranging from 1 = They know nothing about farming to 5= They know a great deal about farming

The lack of statistically significant differences between the groups in relation to levels of trust and perceived knowledge raises some interesting questions about the factors that do influence the differences between the attitudes of the farmers in the *resilient and externally focused* group and those in the *vulnerable and internally focused* group towards potential influencers. This question will be addressed further in the following chapter. Firstly, however, it is useful to summarise the profiles of the farmer groups. This is done in Table 6.28.

Table 6.28 Summary of farmer group profiles

	Cluster 1 - Resilient and externally focused farmers	Cluster 2 - Vulnerable and internally focused farmers
Farm and farmer characteristics	On average farmers in this group have slightly smaller herd sizes and tend to be slightly older. Farmers in this group are also more likely to feel in control of their business.	Farmers in this group tend to have larger herds and are likely to be slightly younger. A lack of control of their business was felt by farmers in this group.
Risk perception	For all factors, risk perception among members of this group was lower. Perceptions of crop and animal disease risk, as well as bTB risk, were significantly lower in this group.	Members of this group perceive all risks to be higher, particularly crop and animal disease and specifically bTB.
bTB experience	Although across the sample the majority of farmers had experience of bTB, a slightly higher proportion of this group had not experienced a bTB breakdown.	Farmers in this group were slightly more likely to have experienced a bTB breakdown. No differences between the groups were found in relation to the numbers of cattle lost or the timing of the most recent breakdown.
Attitudes towards bTB	Farmers in this group felt more in control of the disease.	Members of this group were more fatalistic towards the disease with many feeling a lack of control and lack of confidence in the bTB skin test.
Biosecurity uptake	Levels of uptake of recommended biosecurity measures were low across the sample. No statistically significant differences were found between the groups.	
Internal networks	Farmers in this group were more likely to feel that there was plenty of support available to them, but they were more likely to feel excluded by other farmers.	Members of this group were more likely to feel included in the farming community; however, fewer felt that there was plenty of support available to farmers who are worried about bTB.

External networks	Farmers in this group were more likely to be NFU members, to attend NFU meetings and to see or speak to an NFU representative more regularly. They were less likely to consider regularly seeing the same vet as important.	NFU membership in this group was lower, with fewer farmers going to NFU meetings or having regular contact with NFU representatives. Farmers in this group considered regularly seeing the same vet as very important.
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6.6 SUMMARY OF PHASE 2 RESEARCH FINDINGS

This chapter has reported the findings of the quantitative survey distributed to cattle farmers in the South West. Descriptive analysis showed that farmers consider bTB to be a significant risk and three quarters of the sample have had first-hand experience of the disease. However, supporting the findings of other studies (Enticott, 2008a; see, for example, Bennett and Cooke, 2005), in general farmers appear reluctant to adopt recommended biosecurity measures. There was a clear distinction in attitudes towards various advisors and informants, with many farmers demonstrating particularly low levels of confidence and trust in Defra. Levels of trust, as well as regularity of contact, were found to be statistically significant in terms of whether farmers seek information from a particular source.

Following the descriptive analysis, the data were subjected to factor and cluster analyses to further explore potential relationships between variables and cases and, in turn, develop a segmentation of farmers based on their attitudes towards bTB and levels of social capital. The factor analysis identified five distinct factors which were interpreted and named as follows: concerned about negative impacts; strong bonds with the farming community; good relationships with authority; seeking and acting on external influences; and seeking and acting on internal influences. The factor scores were then used for the cluster analysis which identified two farmer segments. The first group was labelled *resilient and externally focused*, and the second, *vulnerable and internally focused*. The first group was less concerned about the negative impacts of bTB, including the practical, emotional and financial impacts, and was therefore considered to be more resilient in the

face of the disease. The farmers in this group had positive relationships with authority such as the NFU and Defra and felt a sense of empowerment. Furthermore, *resilient and externally focused* farmers were more likely to seek information from actors outside the farming community such as vets, the NFU or Defra. The second group was almost a mirror image of the first. Farmers in the *vulnerable and internally focused* group were far more concerned with the negative impacts of bTB. In comparison to the first group, they had more negative views of authority and instead sought information from contacts within their farming network. Farmers in this group had strong bonds with other farmers, which was not the case for farmers in the first group.

The two farmer groups were profiled against a number of demographic and attitudinal variables and some statistically significant differences were identified. For example, farmers in the *vulnerable and internally focused* group appear to be more fatalistic towards the control of bTB. They were more likely to feel that there was nothing that they could do to reduce the risk of bTB and were more likely to feel that their herd would fail its next bTB test. There was a particularly high statistically significant difference in levels of NFU membership between the two groups with a higher level of membership among *resilient and externally focused* farmers.

Although descriptive analyses identified a statistically significant association between levels of trust and regularity of contact in relation to the likelihood that farmers would seek information from a particular actor, negligible differences between the farmer groups were found in relation to levels of trust and confidence.

The results reported in this chapter highlight a number of issues in relation to the role of social capital in increasing the response capacity of farmers towards bTB. Networks, trust and values, and other aspects of social capital, have been shown to influence attitudes towards bTB and its control. The significance and implications of these findings will be considered further in the discussion chapter that follows.

CHAPTER 7. DISCUSSION

7.1 INTRODUCTION

This chapter brings together the findings presented in the previous two chapters. The findings are considered in relation to relevant academic and policy debates discussed in earlier chapters and in relation to the research questions posed by this study.

Throughout this thesis, the ways in which individuals respond to bTB risk have been shown to be firmly rooted in wider social contexts. The construct of social capital has therefore been used to explore the various social mechanisms that influence farmers' bTB response capacity. A mixed methods approach was adopted for this study resulting in a farmer segmentation model which demonstrates a clear relationship between certain types of social capital and farmers' capacity to respond to bTB. The model is discussed in the following section and is contextualised throughout this chapter by drawing on findings from both the qualitative and quantitative research phases, as well as the wider academic literature.

The chapter firstly discusses the farmer segmentation model derived from the self-completion postal survey and provides an overview of farmers' current bTB response capacity. This is followed by three sections which discuss the role of the different forms of social capital: bonding, bridging and linking. While bridging and linking social capital are shown to have a positive impact on farmers' ability to cope, this chapter goes on to argue that, currently, it is only farmers' *attitudes* that are being influenced, not their *behaviour*. In general, farmers are not following government advice by being either proactive or reactive in terms of increasing their resilience to bTB. A disconnection between attitudes and behaviour is therefore identified. Finally, a number of theoretical considerations for the research findings is discussed.

7.2 FARMER SEGMENTATION MODEL

A farmer segmentation model was developed using a mixed methods approach. Qualitative in-depth interviews were used to inform the development of a quantitative postal survey. Through multivariate analysis of the survey findings, two farmer types were identified: *resilient and externally focused*; and *vulnerable and internally focused*. The two farmer types reflect diversity in attitudes towards bTB and its impacts, and also in behaviour with regard to levels and types of social capital.

Resilient and externally focused farmers are more able to cope with the impacts of bTB and are less likely to express concern about the financial, practical or emotional impacts associated with the disease. They are also more likely to consider trying new things to reduce the risk of bTB. The farmers in this group have higher levels of linking social capital, demonstrating positive attitudes toward authority, including the government and the NFU. They believe that the government is interested in what farmers think about bTB and feel that, by working together, farmers can influence decisions. *Resilient and externally focused* farmers seek information and advice from contacts outside of their immediate farming network such as their vet, the NFU or Defra.

In comparison, farmers in the *vulnerable and internally focused* group are far more concerned about the impacts of bTB, noting the stress, upset, and the financial and practical implications associated with a bTB breakdown. Farmers in this group have lower levels of linking social capital, demonstrating negative attitudes towards authority. Conversely, *vulnerable and internally focused* farmers have higher levels of bonding social capital, with strong ties with, and high levels of trust in, other farmers. These farmers are more likely to seek advice and information from other farmers rather than external contacts.

The farmer segmentation model derived from the study findings implies an important role for social capital in increasing farmers' bTB response capacity. *Resilient and externally focused* farmers have higher levels of linking and bridging social capital and are better able to cope with the impacts of bTB, while *vulnerable and internally focused* farmers

have higher levels of bonding social capital and are more concerned about the negative impacts. It is important to note, however, that those farmers that were categorised as *resilient and externally focused* were not all completely redundant of bonding social capital or completely unconcerned with the negative impacts of bTB. Instead, the segmentation model shows that farmers in this group were less likely to focus heavily on bonding relationships but were instead more inclined to seek advice and support outside of the farming community. Similarly, farmers in this group were less concerned with the negative impacts of bTB when compared with farmers in the *vulnerable and internally focused* groups. As with other work carried out on farmer segmentation (see, for example, Collier *et al.*, 2010), the boundaries between the two groups are likely to be ‘fuzzy’. Nonetheless, the segmentations provide a very useful vehicle through which to explore the various issues raised by this thesis.

Before discussing the benefits of the various forms of social capital, it is first useful to address the issue of response capacity. A clear distinction was found between the response strategies promoted by Defra and those adopted by farmers. This is discussed in the following section.

7.3 FARMERS’ RESPONSE TO bTB

This study has shown that bTB is considered to be a substantial risk by the majority of south west cattle farmers, with many considering it to be the most pressing risk that they currently face. Risk perception does not appear to differ substantially between different farmer groups (for example, in relation to farm size or type), but instead bTB is considered to be a constant and often uncontrollable risk by the majority of farmers. Drawing on academic literature and the findings of both research phases, this study identified three distinct responses to bTB. These were: avoidance, coping and adaptation. Avoidance strategies focus on taking proactive measures to reduce the risk of contracting bTB such as the implementation of biosecurity measures. Coping strategies are more reactive and focus on ways to cope with bTB risk once it is realised (i.e. when bTB is found in the herd), such as dealing with the financial or emotional impacts. Adaptation strategies are also implemented reactively, as farmers find ways to ‘farm around’ the

disease by changing their management practices to work in accordance with movement restrictions, for example.

While the government's current bTB policy (Defra, 2011a) focuses on avoidance strategies, emphasising farmers' responsibilities for farm-level disease control, farmers' response strategies tend to be far more focused on coping. The disjuncture between farmers' and the government's focus is an important one. The relationship between the two groups is already strained and, as this study has shown, levels of trust and confidence in the government are low. However, for disease control strategies to be successful, cooperation and communication is essential.

Petric's (2008) model of risk management behaviour discussed in Chapter Two provides a useful framework to consider farmers' responses to bTB risk. Petric's (2008) puts forward three categories of behaviour: controlled, precautionary and responsive. In the model, farmers who demonstrated controlled behaviour responded proactively to risk and were convinced that avoidance strategies would be effective. This study has shown that, in the face of bTB risk, very few farmers were convinced of the efficacy of avoidance strategies. The low levels of biosecurity uptake found in the postal survey confirmed the findings of other studies which note the lack of confidence that farmers have in such measures (Enticott, 2008a; Bennett and Cooke, 2005). As shown in Chapter Six, very few farmers already implement biosecurity measures (generally less than 20% for each measure). Slightly more farmers would implement the measures if they were grant aided, while the largest proportion would never implement the measures and felt that they were impractical. Instead, farmers tend to be fatalistic towards the disease and consider luck to be the main reason for avoiding bTB.

In relation to Petric's (2008) model of risk management behaviour, the majority of farmers can be categorised as responsive, only facing the consequences of bTB when forced to do so. For example, survey respondents were asked whether they had made changes to their farms in order to overcome problems associated with bTB. A statistically significant difference was found between responses to this question from farmers who

had experienced a breakdown and from farmers who had not ($p=.037$). Of those who had had a bTB breakdown 42.7% had made changes, compared with 22% of those who had not. It is therefore apparent that changes are generally made in response to a breakdown rather than as an avoidance strategy. Additionally, the findings show that over half of farmers who had experienced a breakdown had not made any changes, signifying a general lack of proactive or reactive response from the majority of farmers.

The findings of this study therefore suggest that the response strategies adopted by the majority of farmers are focused on coping with the impacts of the bTB rather than taking action to avoid or adapt to the disease. Figure 7.1 provides a summary of farmers' response strategies.

Figure 7.1 Farmer bTB response strategy

Avoidance Strategies	Coping Strategies	Adaptation Strategies
Farmers act proactively to prevent their herd contracting bTB, for example through the implementation of biosecurity measures.	Farmers focus on coping with the impacts of bTB. They are unlikely to take proactive or reactive measures to avoid bTB. Instead, they simply cope with the impacts of the disease. It is likely to represent a mind-set rather than a clear action.	Farmers act reactively to reduce the impacts of a bTB breakdown. These actions are adopted to allow farmers to 'farm-around' the disease. For example, this may constitute selling cattle straight to slaughter when under movement restriction.

In order to explore levels of coping, farmers were asked about the various impacts that a bTB breakdown had/would have on them. Based on the findings of the first research phase and the literature review, the postal survey required farmers to score a number of statements relating to the practical, emotional and financial impacts of bTB. Responses to these statements were included in the factor and cluster analysis, which was used to

develop the farmer segmentation model. This was undertaken to gain a deeper understanding of the mechanisms that allow farmers to cope better with the impacts of the disease. These mechanisms included the different components of social capital, and are discussed further in the following section.

It is interesting to note a potential disparity in the research findings between farmers' attitudes towards their own response to bTB and the strategies that they actually adopt. Despite the limited uptake of biosecurity measures and the lack of changes being made to respond to the impacts of bTB noted above, three quarters of survey respondents said that they were happy to try new things to reduce the risk of bTB. A disjuncture between the farmers' philosophy and their practice is therefore evident. Understanding the reasons for this disjuncture is important. For some, it may be financial; an average of 22.5% of postal survey respondents said that they would implement biosecurity measures if grant aided. For others, it could be a lack of information. According to a number of phase one interviewees, farmers are unlikely to seek information about bTB until they have experienced a breakdown. For the remainder, the constraints are likely to be more complex, firmly rooted in their wider social contexts. The research findings suggest that deep-seated norms of behaviour among farmers, as well as their beliefs about the disease and its control, have a significant influence on the response strategies that they adopt. As explained in the following section, it is here where social capital plays an important role.

7.4 THE ROLE OF SOCIAL CAPITAL

Studies carried out elsewhere which explore farmers' attitudes towards other livestock diseases have identified social networks as essential to understanding farmers' responses to disease risk. For example, in a study of Swedish pig farmers' disease awareness, Nöremark *et al.* (2009) found that farmers' social networks play an important role in influencing their response to disease. Larger farmers, who they labelled professional farmers, had well established networks including their vet and slaughterhouse contacts and were more likely to be members of farmers' organisations. In comparison, smaller farmers did not necessarily consider themselves to be part of the farming community and

were less likely to consider information provided to them as being applicable to their farm. Heffernan *et al.* (2008) have also discussed the importance of farmers' social networks in terms of the responses to disease. They suggest that community level social networks could provide a useful resource for information dissemination and encouraging collective action. While these and other studies (see, for example, Enticott, 2008c; Hennessy, 2008) note the importance of the social networks in which farmers are positioned in influencing their disease behaviour, they do not explore the importance of the structure of these networks or the different types of social tie that are most productive.

Drawing on the present findings, this section provides an in-depth discussion of the role of social capital in influencing the capacity of farmers to respond to bTB. The different forms of social capital identified in the literature, bonding, bridging and linking, were each explored with three aims in mind. The study aimed firstly to assess current levels of social capital investment; secondly to explore the relationship between social capital and farmers' bTB response capacity; and thirdly to identify potential roles for social capital in increasing farmers' bTB response capacity in the future. The farmer segmentation model found an important link between farmers' ability to cope with the (potential) impacts of the disease (i.e. their level of vulnerability or resilience), and their levels of linking, bridging and bonding social capital. Each form of social capital is discussed below, detailing its role in farmers' capacity to respond to bTB.

7.4.1 Bonding social capital

Many of the farmers who participated in this study had close ties with their families and with other farmers. Over half of the postal survey respondents worked alongside their spouse, and over 80% of the sample worked alongside at least one family member. Half of the respondents see or speak to relatives (other than those that they live with) at least once a week. When questioned about who they could ask for assistance on the farm if they were ill, 65% of farmers responded that they could ask their spouse. The contact that farmers were most likely to ask for help after their spouse was another farmer. A similar pattern was found when farmers were asked who they would seek assistance from if they required help with a bTB test. Very few farmers (<5%) said that they had no one that they

could ask for assistance. Additionally, just under half of the respondents were a member of a farming group such as the local Young Farmers Club or social group and three quarters of the sample knew most of the farmers in their local area. These findings demonstrate the high levels of bonding social capital present among farmers. Levels of trust, a core component of social capital, were also high, with 71.3% of postal survey respondents agreeing or strongly agreeing with the statement “*I trust most of the farmers in my local area*”.

While levels of bonding social capital appear to be high, few farmers would choose another farmer as their first point of contact if they had a query about bTB. While other farmers and family members are essential in terms of practical support, information dissemination between farmers in relation to bTB is relatively low. This was emphasised by the findings of the phase one interviews in which participants noted the importance of learning from other farmers in a general sense but few spoke about social learning specifically in relation to bTB. Instead, when discussing bTB with other farmers, the majority of interviewees spoke about mutual support and feeling that they were ‘*all in the same boat*’, rather than actively seeking each other’s advice in relation to responding to the disease.

Although levels of bonding social capital within families and between farmers were relatively high among survey respondents, 10% of the sample felt excluded by other farmers. This implies that in some cases high levels of social capital between the majority of farmers may lead to the development of exclusive networks to which some farmers do not have access. This is a problem that has been noted in the literature (Curry and Fisher, 2012; Browning, Dietz and Feinberg, 2000; Levi, 1996), and was identified in both the qualitative and quantitative data collected in this study. The issue was explored in depth in the qualitative interviews undertaken in the first research phase, in which three farmers discussed feelings of exclusion. These farmers were ‘incomers’ who farmed organically and were not from a farming background. The quantitative data were used to further address this and a statistically significant relationship was found showing that farmers

who were not from a traditional farming background were more likely to feel excluded ($p=.008$).

Another problem associated with excessive bonding social capital identified by this study was the overly close ties between family members which were shown to be potentially destructive at times of crisis. This was an issue which was most prevalent in the phase 1 interviews where participants spoke about the importance of having outside support. Farmers explained that at difficult times they were unable to speak to family members, particularly those involved with the farm, as stress levels were likely to be intensified.

These findings support the conclusions made by others about the existence of a darker side of social capital among farmers (Ingram and Morris, 2007; Reed *et al.*, 2002). While farmers appear to have plenty of practical support from family and other farmers in relation to bTB, fewer felt that they had adequate emotional support. Less than half of the postal survey respondents (44%) agreed that there were plenty of people that they could lean on when they were stressed or upset.

The farmer segmentation model provides an interesting perspective on the role of bonding social capital in relation to farmers' capacity to respond to bTB. One of the factors which were explored in the multivariate analysis related to the bonding social capital present within the farming community. Farmers who responded positively to this factor agreed with statements relating to high levels of trust in other farmers, feelings of inclusion in the farming community, and regular contact with local farmers. Although other studies have shown that strong ties such as these play an important role in encouraging social learning, ensuring group commitment and developing effective sanctions (Mills *et al.*, 2011; Pelling *et al.*, 2008; Coleman, 1994), such ties have been shown to be less productive in the context of bTB.

The segmentation model showed that resilient farmers tended to be less focused on their social ties with other farmers and their inclusion in the local farming community. In

comparison, vulnerable farmers had higher levels of bonding social capital, both in terms of their levels of trust and inclusion and their likelihood to seek and follow the advice of other farmers. The role of bonding social capital in this context is therefore complex. While farmers specify family members as being important for both practical and emotional support, farmers with lower levels of bonding social capital were less concerned about the negative impacts of bTB, indicating that they were better able to cope with the impacts of the disease. The findings of the qualitative interviews provide some illumination on this issue. The concerns voiced by a number of the interviewees suggest that particularly close ties could accentuate the stress or upset felt by the farmer when faced with a bTB breakdown. Farmers spoke about being able to confide in one another about the bTB situation, with one farmer explaining how bTB horror stories would be met with even more extreme tales from his peers. While such relationships can be seen as supportive or even necessary by farmers, they are unlikely to provide an environment where innovation or proactive behaviour can flourish. Instead, the situation may bear more relation to Portes' (1998) theory of "*downward levelling norms*", whereby collective negativity is continually accentuated, creating an environment where fatalism and opposition become the norm. Strong bonding ties may also engender the development of certain beliefs, or even myths. For example, when explaining low levels of biosecurity uptake, Enticott (2008a) discusses the development of lay understandings of disease control among farmers, which can often contravene government recommendations. This is an area that warrants further exploration and is discussed in the final chapter where a number of areas for further research are suggested.

The findings of this study support the argument put forward by Dasgupta (2003) who suggests that strong, closed networks can impede proactive adaptation to cope with change. The potential for negative externalities to arise from high levels of bonding social capital are clearly apparent. While the findings do not suggest that all bonding ties are unproductive, they have shown that in certain contexts bonding ties can hinder farmers' capacity to respond to bTB. The limitations associated with bonding social capital noted

in this section emphasise the necessity for other ties which encourage the development of bridging and linking social capital. These are explored further below.

7.4.2 Bridging social capital

The farmer segmentation model distinguishes between internally and externally focused farmers. While vulnerable farmers are internally focused, seeking advice from contacts within their immediate farming network, more resilient farmers focus on external contacts when seeking information and advice about bTB. Such external ties represent high levels of bridging social capital, whereby farmers extend their own networks to include contacts who are from outside the farming community, or who have access to alternative resources. Although bridging social capital can increase access to a variety of resources, in this study it has been shown to be most significant in relation to increasing access to information and enabling knowledge transfer. While knowledge transfer between farmers through strong bonding ties appears to be low, the bridging social ties between farmers and external contacts, specifically private vets, has been shown to be essential.

Throughout the qualitative interviews conducted in the first research phase, private vets were noted as an essential informant by farmers. Farmers trust their private vets and frequently seek and act on the information that they provide. The longevity of farmer-vet relationships has led to trusting relationships, generating mutual respect. Communication was shown to be key, with some interviewees criticising Animal Health's use of foreign vets due to not being able to understand them. Building on the findings of the qualitative interviews, the role of private vets was explored in the postal survey. Over 80% of the sample selected their private vet as their first choice when seeking advice in relation to bTB. Respondents also demonstrated high levels of confidence in their vet's knowledge.

The strong relationships between farmers and their private vets enable valuable knowledge transfer to take place, with the key intervening factor being trust. Trust builds confidence in the communicator, which in turn increases the likelihood that the

information provided will be transformed into usable knowledge. Peters *et al.* (1997) maintain that knowledge and expertise is a key determinant of trust and credibility and therefore essential for building social capital. The connection between trust and access to information has also been noted in the risk literature. For example, according to Siegrist and Cvetkovich (2000), when an individual has limited personal knowledge of a hazard, trust becomes important when assessing the possible personal risks or benefits resulting from it. In contrast, they found no relationship between trust and assessing the level of risk relating to a hazard of which an individual is knowledgeable. This suggests that the level of trust within a farmer's network is likely to have important implications in relation to the information which they act on, and consequently their ability to respond effectively to disease in their herd.

The relationship between trust and knowledge transfer was addressed in the postal survey. The results of a correlation analysis were presented in section 6.2.7 in Chapter Six. The analysis explored the likelihood that a farmer would seek advice from a particular informant. Farmers were asked about how knowledgeable and trustworthy they perceived the informant to be, as well as the regularity of their contact with the informant. The results show a clear relationship between farmers' perceptions of their contacts' knowledge, trustworthiness and how regularly they see them, indicating an important role for social capital in knowledge transfer. Farmers who do not perceive a contact to be knowledgeable or trustworthy will not seek their advice. Regular contact was shown to increase levels of perceived knowledge and trustworthiness, and in turn farmers were more likely to seek the advice of the informant. At present, farmers have the highest level of confidence in their vets' knowledge and many see them on a regular basis. In comparison, government representatives, including AHOs, were considered to lack knowledge and were less trusted by farmers. Additionally, they were shown to have less regular contact with farmers. Corroborating these findings, a number of writers have emphasised the role of social capital in successful information and knowledge transfer (see, for example, Hall and Pretty, 2008a; Slee, Gibbon and Taylor, 2006; Mathijs, 2002)

and others have noted the importance of knowledge transfer in increasing response capacity (Maye, Ilbery and Mukherjee, 2008).

The results of the quantitative analysis can be further explained by the findings of the qualitative interviews. Throughout the research, the relationships between farmers and their private vets were shown to be in stark contrast to their relationships with vets employed by Animal Health. A lack of social capital between farmers and AH vets was evident in the farmer interviews in which negative discourses were regularly encountered. The lack of continuity was noted as an important problem, as was their perceived lack of knowledge. The findings of the postal survey show that very few farmers were able to see or speak to the same AH vet on more than one occasion and were therefore unlikely to build trusting and productive relationships. Many of the interview participants lacked confidence in AH vets' bTB knowledge and their practical abilities. Additionally, a number of interviewees suggested that AH vets were simply '*communicating government policy*'. In comparison, interviewees felt that private vets were '*on their side*' and were far more likely to act in the interest of farmers and the industry in general. This supports the findings of other studies such as the work undertaken by Peck *et al.* (2002) on the psychological impacts of foot and mouth disease on farmers. The researchers identified private vets as being an essential contact for farmers, both in terms of emotional support and a source of information. As well as noting the importance of the long-term relationships between farmers and their vets, they suggested that vets were considered by farmers to be '*in the same business*' and therefore likely to experience similar feelings towards the situation.

The comparison between farmers' relationships with their private vets and their relationships with AH vets provides a useful lens through which to consider the role of bridging social capital. There was a clear distinction in terms of who farmers would trust and whose advice they would be most likely to seek and follow. While both types of vet are likely to have undertaken the same type of training and to have obtained the same level of qualification, it is the level of social capital, brought about by regular contact,

confidence and trust, that is present in the relationship which influences farmers' attitudes towards them.

In addition to knowledge transfer, bridging social capital was also found to be important in terms of farmers' capacity to cope with the emotional impacts of bTB. In the qualitative interviews, the importance of having interests outside of farming was emphasised in order to enable farmers to escape the '*all consuming*' nature of the job. Relationships with outside contacts may address problems associated with the downward levelling norms brought about by strong bonding social capital noted in the previous section.

While bridging social capital was found to be important, the most significant form of social capital in terms of increasing levels of bTB response capacity was found to be linking social capital, which is discussed in the following section.

7.4.3 Linking social capital

As demonstrated by the farmer segmentation model, there exists a significant relationship between farmers' bTB resilience or vulnerability and their levels of linking social capital. Resilient farmers felt that the government and the NFU were doing a good job in relation to bTB and were more likely to demonstrate feelings of empowerment. Additionally, such farmers were more likely to seek and follow advice from the government and the NFU. In this study, relationships with the NFU are considered to represent a linking tie due to the level of authority that it is considered to have by the industry. The organisation dominates the representation of agricultural interests (Halpin and Jordan, 2009), and as noted by Winters (1987, p.295), the NFU "*has a privileged position in British policy discussions*". Cox *et al.* (1987) also explain that the NFU has been fully incorporated into British policy making. Accordingly, in their investigation of linking social capital and sustainable management practices, Hall and Pretty (2008) also classify relationships between farmers and the NFU as a linking tie.

NFU membership was shown to be highly significant in relation to the farmer segmentation model. The model showed that farmers in the *resilient and externally focused* group were more likely to be NFU members, attend NFU meetings and have more regular contact with NFU representatives. This is a significant finding in relation to the role of linking social capital in increasing farmers' bTB response capacity. Membership to trade unions has been used as a proxy for social capital in a number of studies (for example, Putnam, 1995). There is an assumption that such membership can have a number of benefits such as enhancing empowerment, increasing access to information and providing opportunities to meet new contacts. The NFU provides a route through which farmers can voice their concerns about bTB at both local and national levels, as well as providing information events and opportunities to get involved in the organisation, for example through chairing a local NFU group. Such opportunities are therefore likely to enhance farmers' feelings of empowerment, as well as increasing information access.

Participation in NFU meetings appears to have an important impact on farmers' attitudes towards the level of influence that they have on decision making. For example, the findings of the qualitative interviews suggest that participants who attended NFU meetings tended to feel that the government listens to farmers, whereas those who did not often stated that there exist no channels through which they are able to voice their opinions. According to one NFU member:

“They [the NFU] have livestock meetings once a month. We discuss things and try to find solutions which get passed down the line to higher up. It's definitely important to have meetings like that so farmers can air their views. The people making the decisions need to know what's going on.” (Devon beef farmer n.12)

This was further explored in the postal survey. Analysis of the survey data found a statistically significant relationship between NFU membership and whether a respondent felt that the government is interested in what farmers think about bTB, with NFU members more likely to respond positively to the question.

In addition to the farmer segmentation model, empowerment was also explored in the postal survey using a question adapted from the World Bank's SoCAT. Respondents were asked if they had undertaken a variety of actions in the last three years to voice their views about bTB. For example, they were asked whether they had contacted their local MP or attended a protest. Levels of empowerment were generally low across the sample. Less than a quarter of survey respondents had spoken to a local councillor or MP and very few had written to a farming journal or newspaper. Around a quarter of respondents had attended a protest or joined an action group to voice their views and slightly more (27%) had contacted Defra. The most popular route for voicing views and concerns was by contacting the NFU (34% of respondents had done so). These questions relate to *active* empowerment, whereby farmers are taking purposeful action to voice their views. While levels of active empowerment were generally low across the sample, levels of *perceived* empowerment were slightly higher. For example, just over half of the survey respondents agreed or strongly agreed that by working together farmers can influence decisions that are made relating to bTB.

While no statistically significant differences were found between the groups in the farmer segmentation model in terms of active empowerment, a difference in levels of perceived empowerment was evident. Farmers who were categorised as *resilient and externally focused* were shown to have higher levels of perceived empowerment than those in the *vulnerable and internally focused* group. A highly statistically significant difference was found between the farmer groups in relation to their perceptions about their ability to influence the government. Farmers in the *resilient and externally focused* groups were significantly more likely to feel that the government is interested in what farmers think about bTB compared to the *vulnerable and internally focused* farmers. This finding indicates that, while farmers may not take action to voice their views about bTB, feeling that they could if they felt inclined to do so is important. Feelings of disempowerment may emphasise fatalistic tendencies, for example, or add to the collective negativity among certain farmers.

The importance of empowerment among individuals was noted by Hall and Pretty (2008) who suggest that farmers with high levels of linking social capital are more likely to engage with policy consultations. This helps to prepare them emotionally, financially and practically for the challenges of policy change. In their study of sustainable management, they found that farmers who had engaged in reciprocal exchanges with government staff, such as through trialling agri-environment scheme options, had benefited from '*insider information*'. The role of insider information was also found to be important in this study. The findings of the qualitative interviews suggest that becoming involved in an organisation such as the NFU not only improves farmers' attitudes towards the organisation, but also increases farmers' understanding of the political situation and the particular measures being promoted by the government. Therefore, following the findings of Hall and Pretty (2008), this study has shown that such membership can help to prepare farmers for the impacts of bTB and provide access to the information that can help them to cope better with the disease.

A number of studies have noted the importance of linking social capital in influencing farmers' attitudes and changing their management practices (see, for example, Hall and Pretty, 2008a). However, such studies have also noted a general lack of linking social capital among farmers, and others have found low levels of trust in the government. For example, research carried out by Enticott *et al.* (2011) found low levels of trust and confidence in the government in relation to bTB policy and their capacity to tackle the spread of the disease. Similar findings were prevalent in this study. In the qualitative interviews carried out in the first research phase, trust emerged as a key factor influencing farmers' feelings towards the government. As shown in Chapter Five, each of Kasperson *et al.*'s (1992) trust components (commitment to a goal, competence, caring, and predictability) was lacking. Many of the farmers felt that the government was not committed to tackling bTB and, even if they were, they lacked the competence to do so. Interviewees spoke about the lack of farming knowledge among Defra staff and the consequential lack of understanding of the impact that the disease has on farmers. Closely related to this were farmers' feelings that the government does not care about the farming

industry or the bTB situation. An absence of predictability was also noted, with farmers speaking about a lack of direction in government policy. Distrust in government has been shown to have important implications in relation to farmers' attitudes towards the control of bTB. For example, a study carried out by Gunn *et al.* (2008) found that farmers who feel that the government takes its commitments to tackling bTB seriously are more likely to implement recommended biosecurity measures.

A link between levels of linking social capital and farmer behaviour was also found by Hall and Pretty (2008) in their study of farmers' attitudes towards sustainable management. They found that farmers with higher levels of linking social capital were more likely to farm in a sustainable way, suggesting a strong association between linking social capital and management decisions. This was further explored through the farmer segmentation model to assess whether farmers with higher levels of linking social capital were more likely to implement biosecurity measures. However, no statistically significant difference in levels of implementation was found between the two farmer groups. This suggests that higher levels of linking social capital do not necessarily have a positive influence on farmers' actions in terms of their response to bTB. However, the farmer segmentation model shows that farmers who have higher levels of linking social capital *feel* more resilient than those who have lower levels. That is to say that they are less concerned about the financial, practical and emotional impacts. Coupled with the observation reported above relating to active and perceived empowerment, the study findings suggest that in the context of bTB, linking social capital may influence farmers' attitudes rather than their behaviour. In other words, linking social capital does not make farmers more able to avoid bTB, but instead changes their attitudes towards the impacts of the disease. This is discussed further in the following section.

7.5 FROM INFLUENCING ATTITUDES TO INFLUENCING BEHAVIOUR

The findings of this study have identified an important relationship between farmers' bTB response capacity and their levels of bonding, bridging and linking social capital. However, it has been shown that while social capital has been found to influence farmers' ability to *cope* with the disease, it does not necessarily influence their behaviour with respect to undertaking positive actions to avoid the disease. While in other contexts coping may be considered to be a particular behaviour, in this study it is seen as an attitude or world view.

There is therefore an important distinction between the role of social capital in influencing farmers' attitudes and its role in influencing their behaviour. While this study has identified that some farmers are better able to cope with the disease (i.e. *resilient and externally focused* farmers), such farmers are characterised by their attitudes rather than their actions. For example, no differences between the groups in the farmer segmentation model were found in relation to the uptake of biosecurity measures or levels of *active* empowerment. Instead, more resilient farmers held more positive attitudes towards the government, were less fatalistic about the disease and had higher levels of *perceived* empowerment.

While the role of social capital in changing attitudes is often noted, it is generally discussed within the context of changing behaviour. For example, while Oerlemans and Assouline (2004) found that social capital had a strong influence on farmers' attitudes towards change, such attitudes were translated into positive diversification behaviour. However, in this study, there appears to be a disconnection between farmers' attitudes and their behaviour. Farmers who are less fatalistic towards bTB or have more positive attitudes towards the government do not necessarily exhibit any different behaviour to other farmers. While more positive attitudes have been shown to help farmers cope, they have not been shown to increase the implementation of avoidance or adaptation strategies that would further increase their levels of bTB resilience.

The literature often assumes a direct causal relationship between attitudes and behaviour. For example, Loudon and Della Bitta (1993, p.422) claim that: “*Behavioural change is a function of change in behavioural intentions...Changes in behavioural intentions are related to changes in attitudes.*” However, others have shown that the relationship between the two is less clear. Little attention has been paid to this within the disease control literature, or even in the literature that is specifically focused on farmer decision making and behaviour. To understand the disjuncture between attitudes and behaviour revealed by this study it is therefore useful to draw on literature from a variety of disciplines. For example, within the health literature, a connection between perceptions of risk and behaviour has been explored.

Research has shown that in some cases individuals who feel more vulnerable to a disease are less likely to take action to avoid it. For example, a study which explored individuals’ attitudes towards lung cancer found that those who were at most risk were less likely to take preventative action due to their tendency to judge recommendations to be ineffective (Niles, 1964). Those who were most vulnerable were found to have low levels of self-esteem, considering themselves less able to cope. Another study, conducted by Laventhal *et al.* (1965), explored the relationship between people’s attitudes towards having a tetanus inoculation and actually taking action to be inoculated. The study found that increasing participants’ fear in the potential effects of not being inoculated was insufficient to influence their actions. Instead, to ensure inoculation occurred, study participants required specific recommendations relating to the action required, for example in the form of an action plan. However, the researchers also noted that an individual’s emotional state must be pre-disposed to support the recommendations put forward. They found that fearful participants who received the action plan were more likely to be inoculated than those who received the action plan but who were not previously fearful of the effects of not being inoculated.

In order to understand more thoroughly the complexities associated with the relationship between attitudes and behaviour, a number of models have been put forward, recognising that there are multiple attributes that influence behaviour, of which attitudes are only one.

For example, within the field of business studies the Fishbein Behavioural Intentions Model has been widely used (Mullen and Johnson, 1990). In addition to attitudes, the Fishbein Model includes beliefs about the consequences of a specific behaviour as well as normative beliefs and subjective norms. Pike's (2008) theory of farmer behaviour (Figure 2.3), which was used to inform the postal survey for this study, also recognises the complex relationship between attitudes and behaviour. Pike (2008) argues that while the intention to adopt a particular behaviour is a function of attitudes, other social factors such as the views of others and past behaviour are also important, as well as the extent to which the behaviour is believed to be possible. Pike (2008) also suggests that intention to act is facilitated by external measures and incentives (such as those put in place by the government). Pike's model brings together a psychological based approach to behaviour, the role of government intervention and a consideration of behavioural economics. Various external interventions are shown in the top right of the model (engagement, encouragement, enabling and exemplifying). Farmer engagement, as well as leading by example (exemplifying), are shown to influence the internal factors such as social norms and the views of others. Interventions that encourage farmers and enable them are shown to remove potential barriers to behavioural change, for example by providing financial incentives. The benefits resulting from a particular behaviour are also shown to influence future behaviour.

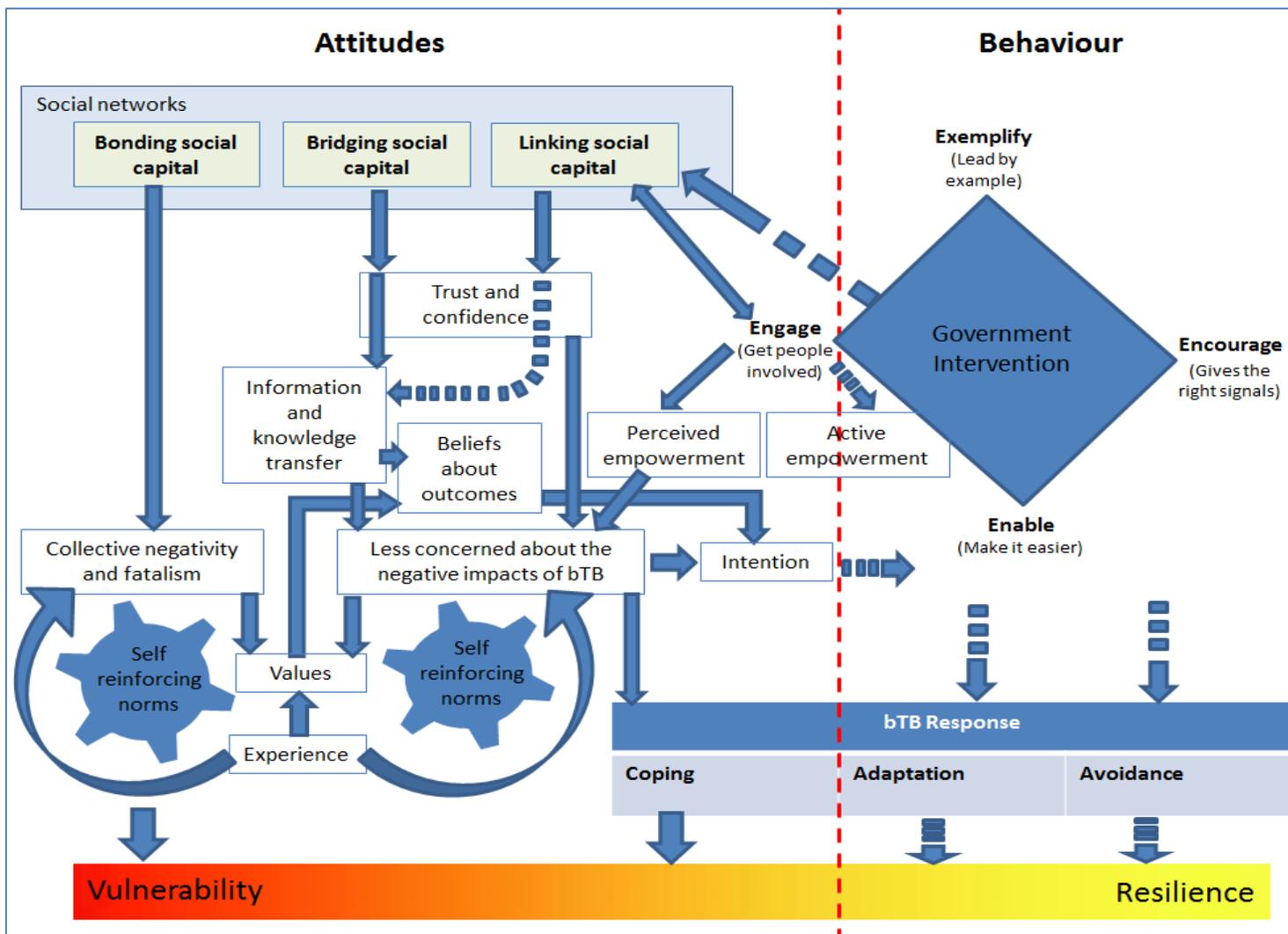
This model is informative in understanding the potential constraints or barriers which prevent certain attitudes about bTB resulting in positive behaviour change. These are discussed in the following section.

7.5.1 Constraints to behaviour change

The findings of this study were used to further develop the theory devised by Pike (2008) and put forward in the model shown in Figure 2.4 (see page 35). Figure 7.2 provides an adaptation and refinement of Pike's integrated farmer behaviour model within the context of the study findings. The unbroken arrows in the model indicate the relationships that are currently present between social capital and bTB response capacity, whereas the broken arrows indicate potential opportunities for enhancing bTB response capacity, specifically

to increase farmers' uptake of adaptation or avoidance strategies. The model is divided by a line marking the distinction between attitudes and behaviour. This is currently not being successfully crossed, resulting in responses to bTB which focus on coping rather than adaptation or avoidance. Although farmers with higher levels of bridging and linking social capital are better able to cope with the impacts of bTB and are more resilient (those classed as *resilient and externally focused* in the segmentation model), the model shows that all farmers have the capacity to become more resilient by adopting more active response strategies.

Figure 7.2 From influencing attitudes to influencing behaviour



In order to increase levels of uptake of adaptation and avoidance strategies, government intervention is important. Pike (2008) puts forward a number of strategies which can influence farmer behaviour: interventions that enable, encourage and engage with farmers as well as those which lead by example. The implications of the study findings in relation to policy are discussed in more detail in the following chapter, so will not be explored further here; instead, a number of important theoretical considerations arising from the research findings are discussed in the following section.

7.6 THEORETICAL CONSIDERATIONS FOR THE STUDY FINDINGS

The literature review presented in Chapters Two and Three outlined a number of theoretical debates which are worth revisiting in relation to the findings of this study.

One of the key debates present in the social capital literature is the productive nature of social capital in terms of the externalities that result from its investment. As discussed in Chapter Two, some social capital theorists (such as Putnam) have focused on the positive aspects of social capital, suggesting that it *always* provides benefits to *all*. However, this approach neglects the arguments put forward by others (such as Bourdieu and Lin), who suggest that by its nature, social capital investment will always exclude certain individuals or particular factions of society who are unable to obtain access to the resources held by others. The social inequality perspective therefore notes the possibility of the development of negative social capital and the potentially damaging externalities that may result. In agreement with the social inequality theorists, this study has shown that high levels of bonding social capital can impinge on farmers' capacity to respond to bTB. The farmer segmentation model, together with the qualitative findings, has shown that excessively strong ties can lead to the development of fatalistic norms and collective negativity. Such ties can also exclude certain farmers, such as those who are not from farming families or those who are less conventional in terms of their management approaches.

Another theoretical debate present in the social capital literature relates to investment. While Coleman (1994) suggests that social capital investment is largely unintentional,

Bourdieu (1986a) argues that investment in social capital is a purposeful action. It is impossible to measure specifically the extent to which social capital is purposefully invested in. However, the study findings indicate that individuals are aware of the benefits that certain social ties provide and spend time and energy ensuring that such ties remain productive. The relationship between farmers and private vets provides a good example of purposive social capital investment. Farmers emphasise the importance of regular and consistent contact with their vet, with many ensuring that they always see the same vet. Farmers realise the significance of having trust and confidence in their vet, which cannot be achieved without consistent contact. As a result of the positive relationships that develop, farmers seek advice and support from their vet, in whom they have high levels of trust and respect.

Attending NFU meetings also represents a purposive action taken by farmers to voice their views and concerns and also to access information or share knowledge with others. Many of the research respondents recognised the benefits of such membership, with some participants in the qualitative interviews noting the importance of '*insider knowledge*'. Some interviews also discussed instances where they have sought escape from the all-consuming nature of farming by joining a social club, for example. All of these actions represent instances where farmers have sought access to particular resources (e.g. information) or support and made a conscious decision to invest in a specific social tie or wider network to achieve the required outcome. Although such investment may not be entirely related to a farmer's response to bTB, it is purposeful nonetheless, with farmers investing time and effort into the relationship knowing that it is likely to provide valuable returns. For example, a farmer's relationship with his or her vet is important to maintain all aspects of animal health, not just bTB.

Other social capital investment is likely to be less purposeful or conscious. The strong bonding social capital present between farmers and within farming families develops over time and can often be inherited from previous generations. This type of social tie rarely provides farmers with access to specific resources and so purposeful investment in such ties to enhance bTB response capacity is unlikely.

7.6.1 The importance of social capital

While social capital has been shown to play an important role in increasing farmers' bTB response capacity, it is important to consider the importance of social capital in relation to the other capital assets which other writers have found to be essential. It is therefore useful to explore the role of social capital in comparison with other assets which may be important for bTB response capacity, such as financial or physical capital.

The link between social capital and other assets including human, natural, physical and financial capital has been made by various researchers (Serrat, 2008; Pretty, 2002; Chambers and Conway, 1992). The availability of each of the different resources has been shown to be important in enabling individuals to respond to risk. However, constraints have been noted which hinder response capacity despite having access to the necessary resources. For example, an individual may have the financial resources necessary to invest in physical assets which would allow them to implement a response strategy. However, if the individual lacks the information required to understand how to implement the strategy, the other assets become redundant. This emphasises the inextricable linkages between the various assets.

This thesis has shown that while social capital can increase access to certain resources, essentially, social capital builds trust, improves communication and enhances information and knowledge transfer. Without the presence of social capital and consequently, the presence of trust, the transfer of other capitals is likely to be limited at best. Social capital therefore plays an essential role in the mobilisation of other resources. Within this study, the circumstance in which this has been shown most clearly is the relationship between human and social capital. Human capital is defined by Coleman (1988, p.100) as "*the skills and knowledge acquired by an individual*". The research findings have shown that information dissemination does not directly equate to the development of human capital. For example, while Defra regularly disseminates information and guidance, many farmers are reluctant to act on it due to its perceived irrelevance or their lack of trust in Defra.

7.7 SUMMARY

The findings of this study support the assertions made by Lin (1999) and Bourdieu (1986a) that linking and bridging social capital are essential in increasing access to resources. In comparison, strong bonding social capital has been shown to encourage the development of collective negativity and fatalism among some farmers, supporting the finding of certain social capital theorists (such as Reed *et al.*, 2002; Browning, Dietz and Feinberg, 2000) that such ties can bring about negative forms of social capital.

Three forms of bTB response have been identified: coping, adaptation and avoidance. Despite the government's focus on avoidance strategies, farmers' own response focuses on coping. Farmers with high levels of bridging and linking social capital have been shown to be better able to cope with the impacts of bTB. However they do not necessarily take any additional action to adapt to or avoid the disease than other farmers. A clear distinction between attitudes and behaviour has therefore been identified coupled with various constraints that impede farmers' attitudes from being turned into positive response behaviour.

In order to influence farmers' behaviour, government intervention is important. Further investment in linking social capital is essential, particularly among farmers categorised as *vulnerable and internally focused*. Increased farmer engagement, interventions that enable and encourage farmers, as well as leading by example can increase levels of social capital as well as being facilitated by it. Within this context, the following chapter provides a more detailed consideration of the policy implications of the study findings, as well as discussing the limitations of the study and suggesting areas for further research.

CHAPTER 8. CONCLUSION

8.1 INTRODUCTION

The final chapter of this thesis summarises the key findings that have emerged from this study. In light of the research findings, a number of considerations for bTB policy are then put forward. The chapter also explores some of the methodological considerations and limitations of the study, including the usefulness of the mixed methods approach in studying response capacity and social capital. Possible directions for future research are also presented.

8.2 KEY FINDINGS

This study has explored the role of social capital in influencing the response capacity of farmers to bTB. After positioning the study within the wider literature, the following five research questions were developed in order to guide the data collection and analysis:

- 1) How is bTB risk perceived by farmers, and to what extent does risk perception differ between farmers?
- 2) What is the current response capacity of farmers and to what extent can this be improved through investment in social capital?
- 3) To what extent are farmers currently investing in social capital and what form does this investment take?
- 4) What are the differences between the various forms of social capital (bonding, bridging and linking) in terms of influencing the ability of farmers to respond to bTB?

- 5) Based on the findings of the study, what are the policy recommendations for increasing the bTB response capacity of farmers?

Based on the research questions, a number of key findings have been identified. In relation to the first research question, bTB was found to be perceived as a significant risk by the majority of farmers, with many considering it to be the most substantial risk that they currently face. Various impacts associated with bTB were noted including practical, financial and emotional impacts. Risk perception did not differ significantly between different types of farmers based on farm type or size; instead it was generally rated as high or very high across the sample.

In response to the second research question, in relation to bTB response capacity, farmers have generally been shown to favour coping rather than adaptation or avoidance strategies. This has important implications in relation to disease control as government policy currently emphasises avoidance strategies, such as the implementation of biosecurity measures. However, supporting the findings of others (Enticott, 2008a; Bennett and Cooke, 2005), this study has shown that uptake of biosecurity is low and farmers lack confidence in the efficacy of such measures. Instead, if action is taken by farmers it is more likely to be reactive rather than proactive.

In answer to the third and fourth research questions, this study has shown that relations between farmers and the government are already strained, with many farmers lacking confidence in the ability of the government to tackle the disease. Levels of trust in the government and its representatives has been shown to be low, with many farmers feeling frustrated by the lack of action being taken. These findings demonstrate limited linking social capital between farmers and the government with many study participants lacking confidence in the knowledge of government representatives, particularly Animal Health vets. The lack of linking social capital has restricted government-farmer knowledge transfer; instead, information disseminated by the government is often ignored. The

relationships between farmers and the government can be viewed in stark contrast to the high levels of bridging social capital present between farmers and their private vets.

Long-term, trusting relationships engender mutual respect. As a result, farmers have high levels of confidence in their vets' knowledge and often seek and follow their advice. Bonding social capital has been shown to be less productive within the context of this study. Although close ties within families and with other farmers can be important for emotional support, in terms of bTB response capacity such strong ties have been shown to have the potential to intensify feelings of fatalism and norms of behaviour that often contravene government policy.

These findings were confirmed by the farmer segmentation model derived from the postal survey. The model identified two farmer types: *resilient and externally focused* farmers and *vulnerable and internally focused* farmers. The model found a clear relationship between a farmer's ability to cope with the impacts of bTB and their levels and type of social capital. More resilient farmers were found to have higher levels of linking and bridging social capital, while vulnerable farmers had higher levels of bonding social capital, lacking both linking and bridging social capital. Although the findings of this study have shown that social capital has a strong influence on farmers' attitudes, at present it is not being successfully utilised to influence farmers' behaviour. Whilst farmers with higher levels of bridging and linking social capital (those in the *resilient and externally focused* group) have been shown to have more positive attitudes towards the disease (i.e. they are less fatalistic and are less concerned about the impacts), they do not demonstrate significantly different behaviour to those farmers categorised as *vulnerable and internally focused*.

In relation to the final research question, a number of considerations for policy have been identified based on the research findings. These are discussed in the following section.

8.3 CONSIDERATIONS FOR POLICY

A model showing the current relationships between the different forms of social capital and farmers' bTB response capacity was presented in Figure 7.2. The model shows a disjuncture between farmers' attitudes and their behaviour and puts forward a series of possible government interventions, all of which can both enhance levels of linking social capital and be facilitated by it. While a lack of disease avoidance behaviour was prevalent across the sample, it is instructive to consider the differences between the two farmer segments identified by this study in relation to potential policy interventions. Previous research has shown that policies targeted at particular farmer groups are likely to be more effective due to their consideration of the underlying motivations and attitudes that drive farmers to behave in a particular way (Wilson *et al.*, 2012). However, while farmer segmentation can allow for a targeted approach, it is important to reiterate that the boundaries between the groups can be blurred and some farmers are likely to move between the groups as their personal and business circumstances change. The following sections therefore outline a number of policy considerations which focus foremost on encouraging positive disease behaviour change among all farmers, but also take into consideration the diversity among farmers identified by this study. Additionally, with reference to the segmentation model, it is useful to note that farmers with higher levels of linking social capital (i.e. those categorised as *resilient and externally focused*) are likely to engage with, and respond to policy intervention most effectively. In contrast, farmers with limited linking social capital (i.e. those categorised as *vulnerable and internally focused*) may be less accessible and potentially less cooperative. In order for any of the interventions suggested below to be meaningful it is essential that efforts to increase levels of linking social capital are a priority. As levels of linking social capital increase, it is likely that farmers' responses to the proposed interventions would be enhanced. The interventions focus on strategies to engage farmers, to encourage and enable them, and to lead by example.

8.3.1 Engagement

As this thesis has shown, simply to provide information to farmers and expect their behaviour to change as a result is unrealistic. Instead, their decision making processes and behaviour are shaped by a wide range of external factors. Vanclay (2004) argues that farmers cannot be considered to be passive adopters, acting on scientific information. Instead, adoption is a social process and rarely occurs in isolation from an individual's wider social network. Engagement with individual farmers and with contacts within their network is essential in order to develop trusting and productive relationships as well as enhancing feelings of empowerment.

One of the most significant differences between the resilient and vulnerable farmers in the segmentation model was levels of NFU membership, with membership among resilient farmers being substantially higher. Farmers in this group were more likely to attend NFU meetings regularly and have contact with NFU representatives. The findings of the study show that NFU membership and involvement in the organisation is likely to increase feelings of empowerment and access to insider knowledge. This suggests that farmers involved in the NFU are more likely to feel that the government is interested in their views. While such relationships do not necessarily provide access to a wide range of resources, such as physical or financial capital, they do help to change farmers' attitudes, providing a move away from the fatalistic norms and collective negativity that may be present among certain farmers.

Due to the lower levels of NFU membership among farmers in the *vulnerable and internally focused* group, there is an indication that such farmers may feel they have no outlet through which to voice their views about bTB. Farmers were asked about whether they had voiced their views through other routes such as contact with their local MP, writing to a newspaper or farming journal, or contacting Defra. However, very few farmers had undertaken any of these activities.

The findings indicate that farmer engagement is essential for changing attitudes and potentially changing behaviour. In order to increase levels of farmer engagement, moves

could be made to provide additional opportunities for farmers to voice their views, particularly those who are not members of the NFU. The creation of a farmer panel could be beneficial, whereby representatives from the farming industry could provide advice and feedback to the government on disease control policy. The farmers chosen to sit on this panel could be elected locally by their peers and act as mediators through which farmers could voice their views. It would be beneficial for the government to make clear how the views of the panel had been addressed and what implications they would have for policy.

Vanclay (2004) argues that in order to influence behaviour, policy makers must focus on farmers' wider networks. He suggests that the most effective way of influencing the behaviour of individual farmers is by gaining the support of farmers' closest informants. In parallel to a farmer policy panel, a similar measure could therefore be put in place to provide opportunities for vets to become more involved in the development of bTB control policy and to voice their ideas and concerns about bTB. This study found high levels of bridging social capital between farmers and their private vets among both farmer segments. Farmers trust and respect their vets' knowledge and often seek and follow their advice. Many private vets undertake statutory work on behalf of the government, including bTB testing. This could provide an opportunity for increased information dissemination. Vets could therefore act as a bridge between the government and farmers by communicating information necessary for disease control. This could be particularly useful in increasing farmers' uptake of biosecurity measures. In order to achieve this, linking social capital between private vets and the government is essential. It is important that vets have confidence in the measures suggested by the government to ensure that they in turn promote the measures to farmers. In order to engender such relationships, cooperation is essential. Similar to the issues mentioned above, it is important that vets feel empowered to voice their own views and feel that they are being listened to by the government. Providing additional opportunities for vets to voice their views could therefore be beneficial.

8.3.2 Encouragement

As this study has shown, while social capital may have the capacity to influence farmers' attitudes or mind-sets in relation to the impacts of bTB, it does not necessarily encourage them to take active measures to avoid or adapt to it. Across both farmer segments the uptake of biosecurity measures was found to be low. However, current government policy emphasises farmers' responsibilities for farm-level disease control (Defra, 2011a). Increasing the uptake of biosecurity measures requires efforts to change farmers' current attitudes, specifically their lack of confidence in the efficacy of such measures. Some moves have been made to do this, for example through the development of information videos for farmers that provide CCTV evidence of badgers entering farm buildings and having direct contact with cattle. The videos, partly funded by Defra, discuss the practicalities associated with various biosecurity measures and show farmers how to implement the measures on their own farms. The videos are displayed on Defra's website, as well as being shown at information events such as those run by the South West TB Farm Advisory Service. However, as previously noted, farmers, particularly those categorised as *vulnerable and internally focused*, lack confidence in the government and often disregard the information that they provide. It is here where private vets could provide mediation. Instead of focusing on changing farmers' attitudes, it may first be more productive to influence vets. If vets are convinced of the benefits of biosecurity and the practicality of such measures, they may then be more likely to promote them to their farming clients.

Building trust and respect between farmers and the government is also important in making farmers more likely to follow the advice provided to them. The positive relationship between farmers and their private vets could provide a useful model on which to base the relationship between farmers and AH representatives. Regular and consistent contact is important. At present, farmers often find it difficult to contact the same representative more than once. Having AH case workers designated to particular areas could therefore be helpful. This could provide them with an overview of the bTB situation in that area, as well as becoming familiar with particular farms. Farmers could

then be provided with contact details for their case worker, and encouraged to contact them to ask for advice about disease control, as well as when they experience a bTB breakdown.

8.3.3 Enable

While the various social mechanisms discussed above are important, other resources are also necessary to respond successfully to bTB. Financial incentives have been discussed and some farmers suggested that they would be more likely to implement biosecurity measures if they were grant aided. The provision of financial incentives for biosecurity implementation has been addressed by Enticott and Law (2012), who argue that the current policy of paying farmers compensation for animals lost due to bTB does not provide a strong incentive for the implementation of biosecurity. Enticott and Law (2012) suggest that the provision of compensation ‘buys’ intervention rights, whereby the government can encourage farmers to behave in certain ways. Compensation therefore acts as a mechanism to influence behaviour. Although compensation is generally successful in ‘buying’ farmers’ cooperation with the government’s test and slaughter policy, it has not been successful in encouraging the uptake of recommended biosecurity measures. However, with recent changes in the government’s bTB control programme, intervention to increase biosecurity implementation has been introduced as part of the requirements for a badger culling licence (Natural England, 2011). According to a Natural England guidance document (2011, p2), *“it is a condition of the licence that reasonable biosecurity measures are being, and for the duration of any licence will continue to be, implemented by participants on their land.”* The extent to which these requirements will be enforced is unknown. However, it will be interesting to explore the long-term impact of such interventions on farmers’ behaviour.

While levels of compensation provided to farmers who suffer a disease breakdown remain relatively high, incentives to take proactive action to avoid the disease are less likely. It may therefore be possible to increase biosecurity uptake through the reduction of compensation for slaughtered cattle. However, measures such as this are unlikely to be

widely supported by the farming industry, which could have potentially damaging impacts on existing levels of social capital.

The provision of information is also essential in order to ensure that farmers have the knowledge required to implement necessary measures. The bridging ties present between farmers and their private vets have been shown to be essential in terms of knowledge transfer; however vets are not necessarily promoting specific government policies or encouraging the uptake of particular control measures. Current levels of communication between the government and farmers are low and many farmers do not follow the information that the government provides. Measures to improve this are essential in order to influence farmers' values and their beliefs about the outcome of particular actions, and subsequently to influence their behaviour. While information dissemination is important, it should be accompanied by other measures as discussed below.

8.3.4 Lead by example

The dissemination of information alone is seldom sufficient to change attitudes or actions towards a specific issue (Cohen, 1957). Rather than merely requiring instruction, individuals need motivation to change their behaviour. Interventions that lead by example are therefore key.

The research has shown that strongly engrained beliefs and norms of behaviour are present among many farmers, which potentially limit the uptake of proactive disease response strategies. Many of the farmers categorised as *vulnerable and internally focused* have been shown to share collective feelings of fatalism leading to norms of behaviour which may contravene government recommendations. Influencing norms or creating new norms is not simple. However, new norms have been shown to emerge over time. For example, within the past twenty to thirty years there has been a clear shift within the farming industry from strongly engrained post-war productionism to a more conservationist and environmentally focused farming culture. This shift has been achieved through a range of incentives (e.g. agri-environment schemes) and government regulations (e.g. Cross Compliance). It is important to note that change is a long-term

process, unlikely to occur immediately. Instead, a range of interventions implemented at various times are more likely to influence farmer behaviour slowly but sustainably.

Farmers in the *resilient and externally focused* segment are less likely to demonstrate fatalistic tendencies. Encouraging such farmers to influence their peers could help to shape the values and norms currently held by more vulnerable farmers. In other areas, demonstration farms and farmer role models have been found to be successful, for example in the context of changing farmers' conservation behaviour (Morris and Potter, 1995). Such approaches may also be beneficial in influencing farmers' response to bTB.

This research has also shown that levels of farmer confidence in the government are partly shaped by the action they take to tackle the disease. The qualitative interviews undertaken in this study identified 'commitment to a goal' and 'predictability' as key components of trust. Farmers voiced frustrations about the lack of action taken by the government and were consequently reluctant to act themselves. Other studies support this finding, such as the work carried out by Gunn *et al.* (2008) which found that farmers who felt that the government was committed to dealing with bTB were more likely to implement biosecurity measures. Appropriate government action is therefore essential. It is important that farmers are kept well informed about current policy and the future proposals for disease control. Again, vets could provide mediation for this information, emphasising the importance of investment in both farmer-government and farmer-vet relationships.

8.4 METHODOLOGICAL CONSIDERATIONS AND LIMITATIONS

The use of complementary data collection methods in the form of in-depth qualitative interviews followed by a quantitative postal survey has demonstrated the benefits of adopting a mixed methods approach. While the phase 1 interviews were designed to inform the development of the survey conducted in the second phase, they were likewise used to contextualise and explain the findings of the farmer segmentation model developed in the second phase. Following the advice of a number of social capital theorists (for example, Grootaert and van Bastelaer, 2001), the qualitative research phase

was used to gain an in-depth understanding of the particular context of the study and the particular elements of social capital that were relevant. Without this phase, it would have been impossible to develop a contextually relevant quantitative survey. The mixed methodology approach adopted for this study proved successful, allowing for the research questions put forward by this thesis to be fully addressed. The study participants engaged well with both the interviews and the survey, providing a good set of data. The data gathered by the different methods were mutually reinforcing, allowing for triangulation of the findings.

The small sample size of the qualitative research phase is perhaps the most limiting factor of this study. With only 20 qualitative interviews conducted, it is not possible to ascertain the relevance of the interview findings to the wider population, or to explore particular variations between different farmer types. However, while additional qualitative interviews may have added further contextual detail to the study, the quantitative research phase was designed to compensate for the limitations of the previous stage. The survey provided representative data which could be considered in relation to the wider farming population. It is also important to note that the qualitative phase was exploratory and 20 interviews were therefore considered to be adequate to meet the aims of the study.

A main limitation relating to the postal survey was the lack of control that the researcher had over the sample selection. Due to data protection regulations, it was not possible to select a completely representative sample. Instead, NFU and SWTBFAS staff were asked to select a random sample of farmers from their databases. There is therefore a potential that more NFU members may have been sampled than there are in the wider farmer population. The study could therefore have been improved had a full and detailed database of all South West farmers been available to the researcher. While this limitation should be taken into account when considering the research findings it is not considered to be overly problematic as both NFU and non-NFU members were included in the sample, and the sample size was relatively large.

Another issue relates to the inaccessibility of disengaged farmers. It could be argued that farmers who are particularly isolated or vulnerable may have been less likely to participate in the interviews or respond to the postal survey. Nonetheless, the findings of the postal survey showed that a small number of respondents felt isolated and excluded with generally low levels of all types of social capital. Although this may not provide a representative sample of disengaged farmers, they have been incorporated into the study. Additionally, a thorough analysis of the survey data, which explored issues of non-response bias, did not find any particular areas of concern, but instead concluded that the sample could be considered to be representative of the wider population.

While the farmer segmentation model provided some interesting insights into the relationship between social capital and bTB response capacity, it is important to note that the development of the model was an exploratory process, requiring subjective decisions about the data to be made by the researcher. However, guided by Hair *et al.* (1998) the decisions relating to issues such as the number of farmer groups to be included in the final cluster solution were carefully considered and informed by the literature and the findings of the qualitative research. Limitations of the approach were addressed as far as possible to increase the reliability of the segmentation model, for example by using factor and cluster analysis sequentially and using both hierarchical and non-hierarchical clustering techniques.

8.5 AREAS FOR FURTHER RESEARCH

While this study has provided a number of interesting findings with regard to the relationship between social capital and farmers' bTB response capacity, a number of areas for further research have been identified which are worthy of further consideration. These are outlined below.

Farmers' deeply engrained values

As this thesis has shown, farmers have deeply held values in relation to bTB. The presence of generalised fatalism and collective negativity amongst *vulnerable and internally focused* farmers may constrain proactive disease management and encourage

norms of behaviour that contravene government recommendations. The findings of this study have identified strong bonding social capital as a mechanism through which negative attitudes are bred. However, within other contexts strong bonding ties have been shown to provide important benefits, such as the knowledge transfer between farmers found by Mills *et al.* (2008). It is therefore not advisable to attempt to restrict the development of bonding social capital. Instead, further work is required to gain a more thorough understanding of the reasons why such attitudes are so strongly held by farmers. Research is currently being undertaken by researchers at the University of Gloucestershire to explore farmers' beliefs about nature and disease to understand further their decision making in relation to bTB control. How and why these beliefs are formed is important, as well as the mechanisms through which such beliefs may be influenced in the future. This work will contribute to a current gap in our understandings of disease control.

Through gaining a more thorough understanding of farmers' attitudes and beliefs, it will be possible to explore ways in which current bonding social capital can be utilised productively. The subject would therefore benefit from further research into the nature of bonding social capital, specifically in relation to the mechanisms that allow negative externalities to develop. For example, the dynamics which lead to the exclusion of certain individuals should be explored further, together with the factors which could prevent the development of exclusive networks.

Information and knowledge transfer

This study has shown that information and knowledge transfer is important in relation to farmers' ability to respond to bTB. However, knowledge transfer, particularly between the government and *vulnerable and internally focused* farmers is currently very limited. While some farmers (particularly those classified at *resilient and externally focused*) seek advice and information once they have experienced a bTB breakdown, very few farmers proactively seek information to help them to avoid the disease. Although there is a wide literature on farmer information and knowledge transfer, further research within the

specific context of bTB would be beneficial. For example, this study has suggested that private vets may be able play a productive role in being mediators between the government and farmers. It would therefore be useful to explore the opinions of vets and farmers in relation to this. For example, if vets were given a specific role by the government, would farmers' attitudes towards them change, potentially damaging the trusting relationships that are currently present?

From influencing attitudes to influencing behaviour

Further research into the relationship between farmers' attitudes and their behaviour would extend and enhance the findings of this thesis. While this study has identified an important distinction between attitudes and behaviour, and has shown that a straightforward relationship does not necessarily exist between the two, further research would be beneficial into the mechanisms which transfer attitudes into action. A number of ways in which the government might intervene have been suggested by this study in order to influence farmers' behaviour in relation to their bTB response strategies. It would be beneficial to explore the potential impact of such interventions within the study context. For example, a study exploring farmers' likelihood to implement biosecurity measures if provided with financial incentives would be informative. The farmer segmentation model put forward by this study could be used to explore further how different farmer types may respond to particular policy intervention. This would help to develop a more targeted policy approach and enhance government communication with the industry.

8.6 FINAL CONCLUDING REMARKS

Currently, bTB remains a substantial risk for farmers in the South West of England. The disease continues to spread unabated costing both the country and the farming industry millions of pounds each year. Although the path to disease control and eradication is long, moves are currently being made within government to take drastic action to tackle the disease both in cattle and in wildlife. However, this study has shown that major disparities exist between current government rhetoric, which emphasises disease

avoidance, shared responsibility and cooperation, and the strongly held attitudes of farmers. In order to assess the practicalities of the government's approach, it is essential that the views and behaviour of farmers are understood. This study therefore makes an important contribution to the limited social science literature directly associated with bTB. While the majority of bTB research is focused on ecology and epidemiology, this research has emphasised the importance of the various social mechanisms which make disease control possible. By using social capital as a lens through which to explore farmers' response to bTB, it has been shown that only certain social ties are productive and others, specifically the strong bonding ties between farmers, can be detrimental. By understanding the nature of such ties, appropriate government intervention can be put in place to successfully utilise existing social networks and invest in areas in which social capital is lacking. Through doing so, progress can be made to enhance cooperative action across the agricultural industry and the government to tackle and eventually eradicate what is currently one of farming's most pressing issues.

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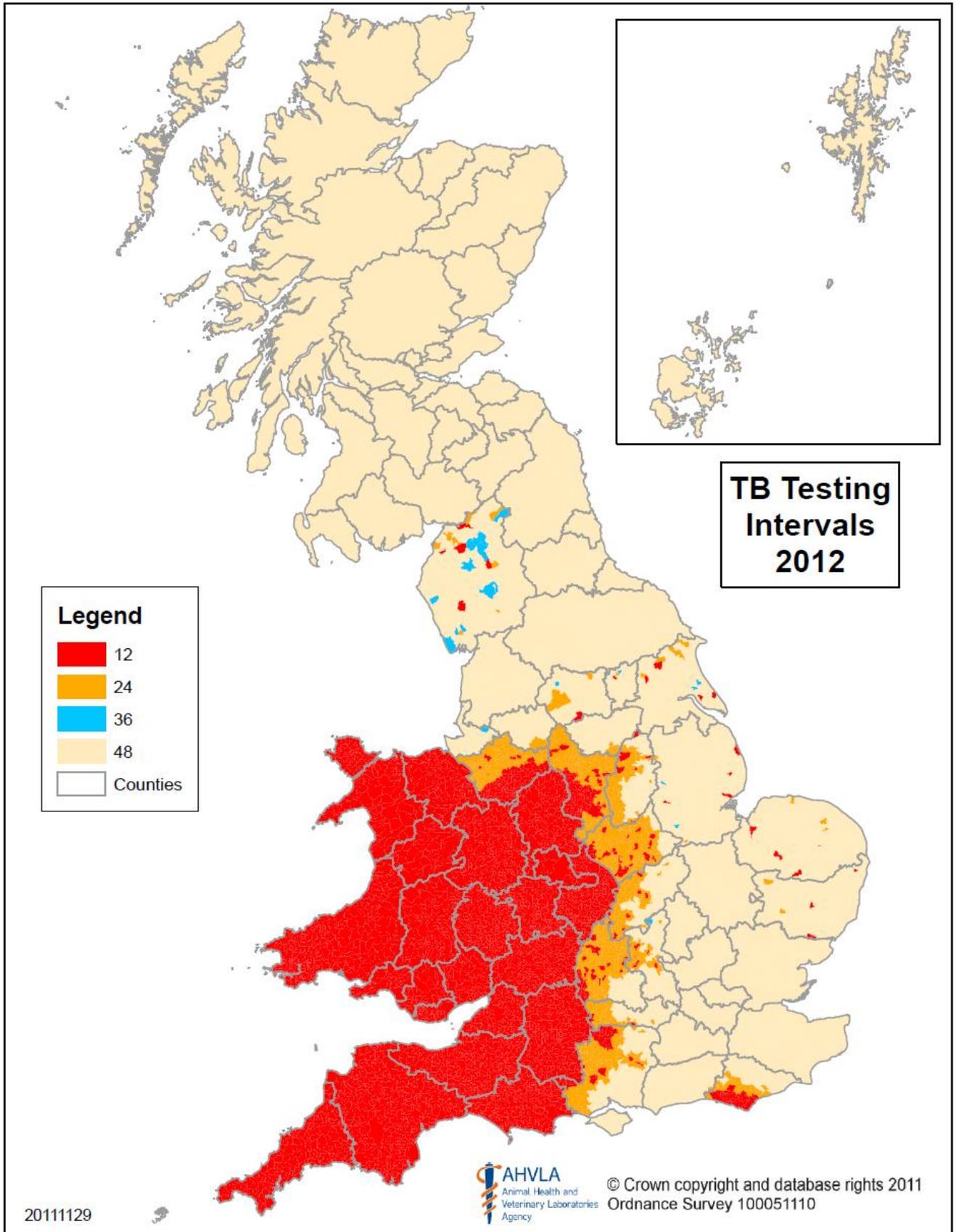
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APPENDICES

Appendix 1: bTB testing intervals determined by the AHVLA



Appendix 2: A framework for the first research phase based on the Ellis-Iverson et al.'s (2010) social ecology model and the findings of the literature review

	Issues to explore	Focus on risk and risk perception	Focus on social capital	Points to explore in face-to-face interviews
Intrinsic Factors				
Behavioural Beliefs	<ul style="list-style-type: none"> • Past experience of bTB. • Past experience of animal disease. • Own and others' experiences. 	<p>Past experience has been shown to impact on farmer decision making. For example, a farmer who has been affected by animal disease in the past is likely to have different attitudes towards the disease than others (Santarossa <i>et al.</i>, 2005; Peck, Grant, McArthur, <i>et al.</i>, 2002).</p>	<p>Trust is developed over time. Past experience is therefore likely to affect levels of trust, a key component of social capital (Putnam, 1995; Coleman, 1988).</p>	<ul style="list-style-type: none"> • Past experience of bovine TB on farm and locally (3.1). • Past experience of other animal disease (2.2). • Trust in government (3.3, 3.5, 4.7b).
Normative Beliefs	<ul style="list-style-type: none"> • Actions supported by other farmers. • Actions promoted by vet or industry. 	<p>The attitudes of others towards disease control may influence a farmer's own attitudes. Vets have been identified as playing an important role in offering advice and support to farmers in relation to animal disease (Nusbaum, Wenzel and Everly, 2007; Peck, 2005).</p>	<p>Shared beliefs and shared norms are key components of social capital (Lyon, 2000). The existence of social norms is likely to influence a farmer's behaviour.</p>	<ul style="list-style-type: none"> • Relationship with family, co-workers and local farmers and the influence that their actions may have on the actions of the farmer (1.6, 3.3, 4.1, 4.5, 4.7a). • Relationship with vets and government officials (3.3, 3.4, 4.7b, 3.7). • Whether the farmer shares the same attitudes as other farmers, the public and government in relation to bovine TB and its control (3.3,

APPENDICES

				3.6).
Belief in self-efficacy	<ul style="list-style-type: none"> • Farmers' interpretation of the available bTB response options. • Farmers' belief in their ability to implement a response strategy. 	The ability to implement response strategies is significantly influenced by the availability of various resources, including financial and physical as well as non-tangible assets such as knowledge (Dwyer and Findeis, 2008). Parkinson <i>et al.</i> (2006) maintain that individuals with limited resources are more likely to take longer to recover from a shock than those who have access to these resources.	Social capital is often considered in the context of other capital assets (physical, financial, human, and natural). It is often suggested that social capital is necessary to access other capital assets, particularly human capital (e.g. knowledge and skills) (Coleman, 1988). For example, Mills <i>et al.</i> (2008) suggest that formal group participation increases opportunities for knowledge transfer.	<ul style="list-style-type: none"> • A farmer's access to the resources required to implement disease control measures (3.2). • A farmer's knowledge of various control measures (3.2, 3.7). • A farmer's access to information/knowledge networks (4.6, 3.7). • A farmer's access to the resources required to overcome the inconvenience or financial implications associated with implementing disease control measures (3.2).
Extrinsic Factors				
Community and Industry	<ul style="list-style-type: none"> • Cooperation within industry. • Financial gain from influencing response strategy. • Cooperation/ collaboration between farmers. 	The importance of cooperation and collective action against animal disease is identified by Heffernan <i>et al.</i> (2008) who provide an analysis of perceptions of biosecurity amongst farmers. They find that barriers to biosecurity were a lack of collective support, belief in the government's responsibility, and poor	Social capital is essential for encouraging and maintaining cooperative action (Pelling <i>et al.</i> , 2008; Davies, Blackstock and Brown, 2004). Cooperation is also likely to build trust, a key component of social capital. Trust has been shown to have an important influence on farmers' behaviour and decision making	<ul style="list-style-type: none"> • Relationships with various industry representatives, e.g. Defra, NFU (3.4, 4.7b.c.d). • Cooperation with other farmers (4.1, 4.2). • Reasons for adopting present farming style/management practices (1.8, 1.11, 1.12). • Participation in agri-

APPENDICES

		understandings of farming amongst government.	(Enticott, 2010; Pellizzoni, 2001)	environment schemes (1.9).
Culture and Society	<ul style="list-style-type: none"> • Support from the public. • Support from the government. • Realistic expectations from the government and the public. 	Public attitudes towards the government and farmers as well as farmers' attitudes towards government are all likely to influence farmers' responses to bTB risk. BTB is an extremely controversial issue. The opinion of the public in relation to the appropriateness of disease control measures may influence farmers' uptake of certain measures (e.g. culling vs. badger vaccination).	This point is closely related to the idea of social norms in that levels of support are likely to influence what is considered 'acceptable' practice. Social norms are established through communication, trust and cooperation, all of which are important aspects of social capital (Lyon, 2000).	<ul style="list-style-type: none"> • Relationship with the non-farming community e.g. membership to community groups/relationships with neighbours (3.6, 3.7, 4.3, 4.4). • Level of agreement with government bTB control policy (3.5). • Level of uptake of disease control strategies recommended by the government (e.g. biosecurity measures) (3.2).
Knowledge, skills and ability	<ul style="list-style-type: none"> • Knowledge of control measures. • Access to information. • Consistency/reliability of information/advice. 	<p>Knowledge and understanding are essential for implementing appropriate bTB control strategies and have been shown to be important in influencing disease risk perception (Maye, Ilbery and Mukherjee, 2008; Sligo and Massey, 2007).</p> <p>Within the bTB debate scientific evidence and its reliability is important. Wilkinson (2010) and Cassidy (2010) suggest that the inconsistency of research and associated evidence may lead to</p>	Social capital has been shown to be key in developing successful knowledge and information networks (Inkpen and Tsang, 2005; Reagans and McEvily, 2003; Burgess, Clark and Harrison, 2000).	<ul style="list-style-type: none"> • Level of education (1.7). • Methods of accessing information (3.2, 3.7). • Trust in various information sources (4.7). • Training undertaken (1.7, 4.2). • Adoption of new practices/diversification (1.11).

APPENDICES

		poor relations and a lack of trust between farmers and the government.		
Farm(er) Characteristics				
Farm Type	<ul style="list-style-type: none"> • Main enterprise. • Herd type. • Mixed enterprise? • Level of diversification. 	Different enterprises will be subject to different levels of price variability. For example, Coble and Barnett (2008) suggest that livestock production poses the highest degree of risk. Mixed farmers therefore may consider bTB risk to be lower than dairy farmers for example.	<p>The relationships within the business are likely to be influenced by the ‘type’ of farm. For example, the relationships within a business where all the family work on the farm, including a potential successor may differ from relationships on a farm where a tenant farmer works with an employed work hand to whom he is unrelated. Gasson <i>et al.</i> (1998) note the importance of inter-family relationships, and particularly the relationship between a farmer and successor.</p> <p>Burton <i>et al.</i> (2005) suggest that trust and social networks are built up over generations, which may have implications in relation to the ‘history’ of the business.</p>	<ul style="list-style-type: none"> • Farm type – characterised by the farmer (1.3). • Farm size (1.4). • Membership to agri-environment schemes (AES); presence or absence of AES may identify areas of linking social capital (Hall, 2008a) (1.9). • Marketing methods (1.10). • Price variability (input and output) (2.1). • Yield variability (2.1). • Farm/business history (1.7). • Plans for the future (5.1).
Farmer age		Lobley <i>et al.</i> (2002) suggest that younger farmers are likely to diversify and take on new opportunities. This may have implications in relation to their perception of risk.	Age may affect peer groups and norms of socialisation (i.e. who they socialise with). Younger farmers for example may be in touch with non-farming school friends.	<ul style="list-style-type: none"> • Farmer’s age (1.5). • Number of years farming (1.7). • Planned age of retirement (5.1). • Plans for farm succession (5.1).

Appendix 3: Letter sent to potential interviewees

14th March 2011

Dear ,

Re: Bovine TB Research

I am writing to you concerning research that I am currently undertaking looking at bovine TB. I am undertaking a PhD concerned with the support available to farmers in terms of preventing and coping with bovine TB.

I am a farmer's daughter and have first hand experience of the impact that bTB can have, both in terms of the financial and emotional implications. I am therefore aiming to gain an understanding of farmers' attitudes towards current bTB policy and the support that is available to them, in the hope of influencing future policy. As Devon is an area of high bTB incidence, I will be speaking to a number of farmers in the area. I would therefore be very keen to speak to you about your experiences of bTB and the support (or lack of support) that is available to you. I am hoping to speak to farmers who have experienced bTB breakdowns as well as those who have not.

If you would be able to spare the time, I would very much like to visit you to ask some questions about your attitudes towards bTB policy, your experience of the disease, the ways in which you deal with it etc. The interview would last approximately one hour and all your answers would be completely confidential and anonymous. I hope you are interested in taking part in the research and will take the opportunity to voice your views on what is such an important issue within the industry. If you could spare the time, perhaps we could arrange a time for me to visit you at your convenience (daytime or evening). Many thanks for your time, and I look forward to hearing from you.

Yours sincerely,

Rhiannon Fisher

Countryside and Community Research Institute
Oxstalls Campus
Longlevens
GL2 9HW

Tel: 01242 715398

Email: rfisher@glos.ac.uk

*Appendix 4: Phase 1 interview schedule***Section 1. The farm**

1.1) Name of participant

1.2) Address

1.3 Farm type

- Economic significance of the cattle/farm to the household income

1.4) Farm size

1.5) Age of respondent

1.6) Who works on the farm?

- Business/family relationships
- The role of any potential successor
- Individuals' role in decision making
- Inter-family relationships

1.7) Farming history:

- How long have you been farming?
- How long have you been farming this farm?
- Are you from a farming background?
- Did you go to agricultural college (probe for educational background)?

1.8) What are your main reasons for farming? (e.g. lifestyle, financial etc.)

1.9) Are you part of the environmental stewardship scheme?

- Reasons for joining (financial/environmental concern etc.)

1.10) What are your main marketing methods?

- relationships with buyers/consumers

1.11) Have you diversified any of the farm business?

- nature of diversification, reasons for (not) diversifying, success of diversification, increased resilience

1.12) To what extent does your location dictate your management decisions?

Section 2 – Attitudes towards risk

2.1) What issues do you feel pose the most risk to your business? (e.g. disease, price fluctuation, flooding, succession etc.)

- Which are the most important risks?
- What do you do to protect the farm from the risks?

2.2) Have you experienced any events that have had a major impact on the business or the way that you farm? (For example plant disease, flooding, financial losses etc.

- Changes to management practices in response to the event, do they consider themselves to still be at risk?)

Section 3 – bovine TB risk

3.1) What is your experience of bovine TB

- Have you had a breakdown, have people you know had breakdowns?
- Do you feel at risk of bovine TB?

3.2) Do you think there is anything you can do to lower the risk of bovine TB?

- Attitudes towards biosecurity
- Following the advice of vets/other farmers
- Reasons for/against implementing control strategies (financial/practical)
- What are your sources of information/knowledge about control measures?
- Do you have the necessary resources for implementing control measures?

3.3) What do you think about the relationships between farmers and government/ vets/ NFU/Defra/other farmers in relation to bovine TB

- What are the points of agreement/conflict?
- Is trust important?
- What about communication?

3.4) How much contact do you have with vets and government officials in relation to bTB?

3.5) How do you feel the government is dealing with bovine TB

- Trust
- Past experience
- Attitudes towards government in general

3.6) What do you think about the relationship between farmers and the general public in general, and in relation to bovine TB

- Do the public have a realistic view of farming and the role of farmers?
- Understanding, communication, cooperation

3.7) How good do you consider your knowledge/understanding of bovine TB to be?

- In relation to the disease itself
- In relation to its control
- What are your information sources

3.8) Where or who do you go to for help and advice in relation to bTB risk?

- Importance of different contacts.

Section 4 – Social Networks

4.1) Do you cooperate with any other farmers in any aspects of your business? (e.g. sharing machinery, marketing methods etc.)

4.2) Are you involved in any farming groups (e.g. social club, discussion groups, shooting, producer groups)?

- Types of group
- Role in group (member/leader)
- Purpose of group (social/educational)
- Benefits of participation in the group
- Conflicts

4.3) Are you involved in any non-farming groups (e.g. parish council, church, walking club)?

- Types of group
- Role in group (member/leader)
- Purpose of group (social/educational)
- Benefits of participation in the group
- Conflicts

4.4) Are you involved in any other social activities? If so, what?

4.5) Are you involved in your local community?

- Relationship with neighbours
- Status in the community
- How supportive is the local community of the farm?

4.6) Who are the most important individuals/groups for your business? (e.g. family, co-workers, buyers, accountant, vets, other farmers)

- What sort of relationship do you have with them (i.e. formal/informal)?
- Regularity of contact

4.7) What are your opinions of the following? (Quality/usefulness of information, trustworthiness, regularity of contact etc.)

- a. Other farmers
- b. The government
- c. Defra
- d. NFU
- e. Buyers (e.g. grain merchants)
- f. The general public
- g. People living in your community

Section 5 – Plans for the future

5.1) What are your plans for the future in terms of your business?

- Retirement
- Succession
- Diversification etc.

Appendix 5: Postal Survey Cover Letter

Dear Sir/Madam,

Re: PhD study of Bovine TB

I am writing to you to ask for your assistance with a study on the impact of Bovine Tuberculosis (bTB) that I am conducting as part of my PhD programme at the University of Gloucestershire. The study is part of an effort to understand the wide range of impacts that bTB can have and the level of support available to farmers in terms of preventing and coping with the disease. It is my intention that the results will help to inform and influence future policy.

As a farmer's daughter I have first-hand experience of the impact that bTB can have, both in financial and emotional terms and feel that it is essential that farmers are given the opportunity to voice their views on the issue. I am very interested in the views of all cattle farmers, including those who have experienced bTB breakdowns as well as those who have not.

In order for the findings of this study to be influential, it is essential that as many farmers as possible complete the survey. Therefore, although the survey is of course voluntary, your participation is very important and would be much appreciated. The survey should take no longer than 10 or 15 minutes to complete and please be assured that your answers are entirely **confidential** and **anonymous**. I have enclosed a pre-paid envelope for you to use to return the survey. I hope you are able to take the time complete this survey, thereby voicing your views on what is such an important issue for the farming industry.

If you would like any further information about the study, please feel free to contact me.

Yours sincerely,



Rhiannon Fisher

Countryside and Community Research Institute
University of Gloucestershire
Oxstalls Campus
GLOUCESTER
GL2 9HW

Tel: 01242 715398

Email: rfisher@glos.ac.uk

Appendix 6: Postal Survey



BOVINE TUBERCULOSIS FARMER SURVEY

Countryside and Community Research Institute
University of Gloucestershire

YOUR FARM

1. Which of the following best describes your farm type?

Beef Mixed livestock
 Dairy Mixed Other (please state) _____

2. If different from your answer above, which of the following best describes your cattle herd?

Beef Dairy Beef and Dairy

3. How big is your farm?

_____ acres/hectares (please delete as appropriate)

4. Please select the statement which best describes your situation

I own my farm Some of my farm is owned and some is rented
 I rent my farm I am the farm manager

5. Is all or some of your farm organic?

Yes Currently in conversion
 No

6. Who works on the farm? (tick all that apply)

	How many	
	Full time	Part time
Me		
My spouse/partner		
Child		
Parent		
Other relative		
Other farm employee		

7. What proportion of your farm income do the cattle represent?

0% 26-50% 76-99%
 1-25% 51-75% 100%

8. How many cattle do you have (including followers)? _____

9. Is all or some of your herd pedigree?

Yes No

AGRICULTURAL RISK

10. Thinking about your whole farm, including non-cattle enterprises, please rate the various factors in the table below based on the amount of risk that you perceive they pose to your business (please tick).

	No risk	A small risk	A moderate risk	A high risk	A very high risk	Not applicable
Fluctuations in market prices						
Increasing cost of inputs						
Changes in agricultural policy						
Weather						
Crop disease						
Animal disease (other than TB)						
Bovine TB						
Other (please state and rate)						

EXPERIENCE OF BTB

11. Have you ever had a bTB breakdown?

Yes No

If yes, please go to question 13

12. What factors do you think have helped your herd to avoid contracting bovine TB (tick all relevant factors)

- | | | | |
|---|--------------------------|---------------------------------|--------------------------|
| Implementation of biosecurity measures | <input type="checkbox"/> | Maintaining a closed herd | <input type="checkbox"/> |
| There are no cattle on neighbouring farms | <input type="checkbox"/> | There are no badgers on my farm | <input type="checkbox"/> |
| Living in an area with low bovine TB incidence | <input type="checkbox"/> | Luck | <input type="checkbox"/> |
| I believe that the badgers on my farm are healthy | <input type="checkbox"/> | | |

Please go to question 16

13. Approximately how many bTB breakdowns have you had in the last 10 years?

- 1 2-5 6-10 More than 10

14. Approximately how many cattle have you lost because of bTB in the last 10 years? (all reactors including those that have not been found to have lesions)

If you are unsure, please give a rough estimate.

_____cattle

15. When was your most recent bTB breakdown?

- | | | | |
|---|--------------------------|-------------------------|--------------------------|
| The farm is currently under restriction | <input type="checkbox"/> | Within the last 3 years | <input type="checkbox"/> |
| Within the last 3 months | <input type="checkbox"/> | Over 3 years ago | <input type="checkbox"/> |
| Within the last year | <input type="checkbox"/> | | |

16. Thinking about your most recent breakdown, how long were you under restriction?

_____years _____months

17. Do you do any of the following specifically to reduce the risk of your herd contracting TB? (please tick all that apply)

	Already do	Would do if grant aided	Would never do/impractical
Fence off badger latrines			
Fence of badger setts			
Badger proof building			
Badger proof silage clamps			
Raise feed and water troughs			
Stop spreading slurry on grazing land			
Double fence farm boundaries			

18. In the past 3 years have you taken any of the following actions in an attempt to voice your views about bTB? (please tick all that apply)

- Contacted a local councillor or MP
- Written to a newspaper or farming journal
- Attended a protest meeting or joined an action group
- Contacted Defra
- Contacted the NFU
- Other (please state) _____

19. Are you a member of the National Farmers Union (NFU)?

Yes No

ATTITUDES AND OPINIONS

20. To what extent do you agree or disagree with the following statements?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Taking risk is an essential part of running a successful farming business					
I feel that I have full control of the future of my farm business					
I often cooperate with other farmers (e.g. sharing machinery etc.)					
It is important to have interests outside of farming					
I know most of the farmers in my local area					
I trust most of the farmers in my local area					
Most farmers in the local area look out for each other					
The government is doing a good job in relation to bTB					
The government is interested in what farmers think about bTB					
The NFU is doing a good job in relation to bTB					
By working together farmers can influence decisions that are made relating to bTB					
I sometimes feel excluded by other farmers					
I often speak to other farmers about bTB					
I often follow the advice of other farmers in relation to bTB					
It is likely that my herd will fail the next bTB test					
BTB creates a lot of extra work (e.g. testing/paperwork)					
Going down with bTB has/would have a major financial impact on my business					

Going down with bTB is/would be very stressful					
Going down with bTB is/would be very upsetting					
BTB makes me want to give up farming					
There is plenty of support available to farmers who are worried about bTB					
There is nothing that farmers can do to reduce the risk of their herd going down with bTB					
I have made changes to my farm in order to overcome problems related to bTB (e.g. diversified away from cattle, sell straight to slaughter, keep cattle inside etc.)					
I am happy to try new things to reduce the risk of bTB					
Implementing biosecurity measures on my farm is not practical					
The skin test for cattle is an acceptable way of establishing whether a cow has bTB					
I have a good knowledge of bTB, its spread and its control					
The farming press (e.g. Farmers Weekly/Farmers Guardian) is a reliable source of information about bovine TB					
I follow advice from Defra relating to bTB					
I follow advice from the NFU relating to bTB					
I follow the vet's advice relating to bTB					
I would be keen to attend information events about bTB, its spread and control					
There are plenty of people that I can talk to when I am feeling stressed or upset					

Farmers have a responsibility to educate the public about the impact of bTB and farming more generally					
--	--	--	--	--	--

21. If you had a question about bTB, who would you be most likely to ask? Please rate the following individuals and organisations with 1 being the most likely and 5 being least likely. (If you would not seek their advice please rate 0)

Individual/organization	Rating
Another farmer	
The NFU	
Animal Health/Defra	
Private Vet	
Advisory organisation (e.g. South West TB Advisory Farm Advisory Service)	

SUPPORT NETWORK

22. Have you been involved in any farming groups (e.g. Young Farmers, Local Farming group, NFU etc.) over the past 3 years

Yes No

If yes, which one(s)?

23. In the past 3 years have you had any responsibilities in this (these) group(s), such as being a committee member, raising funds, organising events or admin work?

Yes No

24. In the past 6 months, have you done a favour for another farmer?

Yes No

25. In the past 6 months, has another farmer done a favour for you?

Yes No

26. Do you attend any non-farming groups or clubs (e.g. photography club, darts club, rugby club)

Yes No

27. In your experience, how trustworthy are the following individuals and organisations?

	Very untrustworthy	Mostly untrustworthy	Neither trustworthy nor untrustworthy	Mostly trustworthy	Very trustworthy
a. Defra					
b. NFU					
c. Private vet					
d. Animal health officer					
e. Other farmers					

28. Have you attended any NFU meetings or events in the past 3 years?

Yes No

29. How much do you feel that the following groups/individuals understand practical farming issues?

	They know nothing about farming	They know a little about farming	They know a reasonable amount about farming	They know a great deal about farming	Not applicable
Defra staff					
NFU staff					
Private vet					
Animal health officers					
The general public					
Customers					

30. Have you had contact with the same Animal Health Officer more than once?

- Yes, I often speak to/see the same Animal Health Officer
- Yes, I have spoken to/seen the same Animal Health Officer a couple of times
- No, I have only spoken to/seen an Animal Health Officer on one occasion
- No, I have spoken to/seen a variety of different Animal Health Officers
- I haven't had any contact with Animal Health

31. How long have you been with your current private vet practice?_____
years

32. How important is it to always see the same vet?

- Very important
- Quite important
- Not at all important

33. How often do you see or speak to the following individuals (in person or over the phone)

	Every day	At least once a week	At least once a month	A few times a year	Not at all in the last 12 months
Relatives (not including those in your household)					
Other farmers					
Non farming friends/neighbours					
Private vet					
Animal health officer					
NFU representative					
Government representative					
Customers					

34. If you are ill in bed and need help to run the farm, could you ask anyone for assistance?

Yes No

If No go to question 36

35. Who could you ask for assistance? (tick all that apply)

Spouse/partner Relative (outside household) Another farmer
Other household member Farm employee Someone else

36. If you needed extra help with a TB test, could you ask anyone for assistance?

Yes No

If No go to question 38

37. Who could you ask for assistance? (tick all that apply)

Spouse/partner Relative (outside household) Another farmer
Other household member Farm employee Someone else

GENERAL QUESTIONS ABOUT YOU

38. How long have you been farming? _____ years

39. Are you from a farming family?

Yes No

40. Which age category do you fall into?

<25 36-45 56-65 >75
26-35 46-55 66-75

41. Are you...

Male or Female

42. What is your highest level of education?

No formal education Secondary School Undergraduate degree
Primary school College Postgraduate degree

43. Where do you live?

Cornwall Dorset Somerset
Devon Gloucestershire Wiltshire

Thank you very much for taking the time to complete the questionnaire.

Please return it in the enclosed postage-paid envelope to:

Rhiannon Fisher, Countryside and Community Research Institute, University of Gloucestershire,
Oxstalls Campus, Oxstalls Lane, Gloucester, GL2 9HW
