How companies respond to climate change: A network approach

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This thesis is submitted to Lancaster University for the degree of Doctor of Philosophy (Ph.D.).

~ Dedicated to my beloved family ~

Declaration

This thesis has not been submitted in support of an application for another degree at this or any other university. It is the result of my own work and includes nothing that is the outcome of work done in collaboration except where specifically indicated. Many of the ideas in this thesis were the product of discussion with my supervisors Professor Stefanos Mouzas and Dr. Alan Gilchrist.

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For any errors or inadequacies that may remain in this work, indubitably, the responsibility is entirely my own.

Abstract

This thesis studies the phenomenon of how companies respond to climate change. I use business responses to climate change as an example to examine the process through which managers assess and address externally generated pressures. Previous research on how companies respond to climate change is commonly limited by the assumption that companies function as isolated units independent of their wider network of business relationships. In this study, I proceed from the perspective that companies are, in fact, influenced by the interactions occurring as a result of continuous give-and-take exchange relationships. It is this move from the atomistic level of analysis and explanation to that of the business network that constitutes the theoretical lens to examine the empirical evidence that derives from five case studies of British energy supply companies. Driven by an iterative process of working with the senior leadership teams of these companies, this study offers some original insights in relation to how companies respond to climate change. Indeed, in each of the empirical cases, the senior leadership teams initiated activities in order to access the necessary resources, which were not available in concentrated form, but rather located within the company's business network. These successive interactions resulted in companies 1) *discharging* their responsibility by passing the impact to others, 2) *protecting* their resources and rationalising activities rather than bearing risks of change, and 3) *acting akin*, or have the propensity to adopt a herd mentality, to other actors with similar intrinsic values and beliefs rather than operating in isolation. Hereby, this study not only provides a more comprehensive explanation of how companies respond to climate change but also offers new evidence as to how companies interact and behave in business relationships and networks.

Keywords: Business networks, Interaction, Climate change, Energy

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List of abbreviations and acronyms

Climate change and the energy supply sector as the empirical setting of this study require the discussion of a number of technical and often abbreviated terms. For the purpose of convenience, I briefly explain the abbreviations that I have used most frequently in this thesis. A more comprehensive list can be found on the United Nations Climate Change website (United Nations, 2018).

Abbreviation/ acronym	*Definition*
BIG 6	Big Six Energy Suppliers: A reference used to describe the six oldest and market-dominating energy supply companies operating in the UK.
CCS	Carbon Capture and Storage: A technological process that captures, transports and stores waste carbon dioxide.
CO_2	Carbon dioxide: A naturally occurring gas. Scientists have identified its rapid increase in the Earth's atmosphere as a cause of climate change.
DSR	Demand-side response: A technological process to reduce energy consumption at peak times.
ECO	Energy Company Obligation: An energy efficiency policy introduced by the UK government.
EU ETS	European Union Emissions Trading System: The first and largest carbon emission trading scheme covering more than 11,000 companies in 31 countries (including the UK).
GHG	Greenhouse Gases: A mixture of gases (e.g., water vapour and carbon dioxide) with the capability of absorbing and emitting radiant energy.
GW	Gigawatt: A unit of energy often used when generating energy (1 GW = 1000 megawatts).
IPCC	Intergovernmental Panel on Climate Change: A body of the United Nations tasked with providing scientific insights into climate change as well as its economic and political impact.
MWh	Megawatt-hour: A unit of energy often used when consuming energy (1 MWh = 1000 kilowatt-hours).
PPM	Parts per million: The unit used to measure carbon in the atmosphere.

1 Introduction

1.1 Background to the research

Responding to external pressures poses a growing challenge for companies. In fact, as a result of the increasing transparency of business behaviour, *"any information on incidents are globally available within shorter and shorter time frames"* (Amann et al., 2007, p.33). Amplified by global media outlets, inaction on external pressures emanating from governments, industry groups and customers create substantial risks to companies (Amann et al., 2007; Aaltonen and Sivonen, 2009). Examples of external pressures include 1) the asbestos industry facing several thousand lawsuits as asbestos was proven to be deadly (Formuzis, 2017), 2) Nestlè causing infant illness and death as a result of selling bottle feeding products in third world countries (Muller, 2013) and more recently 3) Monsanto being sued as their Roundup herbicide was deemed as a cause of cancer (Zaveri, 2019).

In this study, I focus on an external pressure that has emerged over the past two decades, namely climate change. Climate change has started to develop as an external pressure as governments, industry groups and customers have demanded businesses to reduce their carbon emissions. The growing scientific consensus on the range and magnitude of adverse consequences of carbon emissions in the atmosphere has made it almost impossible for companies to ignore climate change (Bazerman, 2006; Ihlen, 2009; Chan et al., 2016).

Responding to climate change, however, requires governments, companies, industry groups and consumers alike to reconsider and change current patterns of production and consumption (Wittneben et al., 2012). While the 2016 Paris Agreement represents a step forward in global cooperation aimed at combating climate change, enabling a climate-resilient and low-carbon future may only be feasible when businesses, who have been responsible for *"nearly two-thirds of historic carbon dioxide and methane emissions"* (Heede, 2014, p.238), limit the ways in which their operations generate carbon emissions (Chan et al., 2016).

Unsurprisingly, over the past decade or so, business responses to climate change have moved to the forefront of organisation and management scholarship (e.g., Levy and Kolk, 2002; Kolk and Pinkse, 2004; Hoffman, 2005; Jones and Levy, 2007; Ihlen, 2009; Wittneben and Kiyar, 2009; Okereke and Russel, 2010; Slawinski and Bansal, 2012; Shevchenko et al., 2016; Wright and Nyberg, 2017). Early research on business responses to climate change commonly employed Carroll's (1979) continuum of corporate social responsiveness to classify responses as defensive, accommodative or proactive (e.g., Kolk and Levy, 2001; Kolk and Pinkse, 2004; Margolick and Russell, 2004; Jones and Levy, 2007).

In this context, Kolk and Pinkse (2004) found that companies lobby against any attempt to develop legally binding intergovernmental climate change treaties or national policies by questioning the scientific evidence, denying any responsibility and highlighting the high short-term costs relative to the low individual gains. As a result of growing socio-cultural, legal/regulatory and economic pressures, however, companies appear to have readjusted their stance towards climate change (Banerjee et al., 2003; Kolk and Pinkse, 2004). For example, research by Okereke (2007) suggested that business inaction on climate change may negatively impact a company's value and/or market share, and this may explain why companies have started to:

> *"*[…] *develop climate strategies that provide market advantages while minimizing risks, based on factors such as levels of exposure to legal and regulatory risks, environmental reputation, cost advantages and technological innovation."* (Wittneben et al., 2012, p.1434)

What follows in this thesis is an explanation of how companies respond to climate change. Interestingly, companies are both the source of the problem and part of a potential solution to the global challenge of climatic changes. They are the source of the problem because they are historically responsible for nearly two-thirds of all carbon emissions (Heede, 2014). Yet, companies also possess the financial, technological and organisational resources to address the causes of climate change in powerful and innovative ways (Howard-Grenville et al., 2014).

Previous organisation and management research on business responses to climate change suffers from a common limitation: a tendency to view companies *"as isolated units divorced from their prevailing social and political context"* (Wittneben et al., 2012, p.1435). In other words, business responses to climate change are seen as a task completed by an *individual* company rather than viewing companies as embedded within wider networks of continuous business and non-business exchange relationships (Easton and Håkansson, 1996; Gnyawali and Madhavan, 2001; Håkansson and Ford, 2002; Ritter et al., 2004). As a result, organisation and management scholars have hitherto predominantly focused on individual business responses to climate change.

Even in the most recent Special Issue on managerial responses to climate change published in the *British Journal of Management*, scholars do not adequately address this gap in our understanding (see Goworek et al., 2018 for an introduction to the special issue). This lacuna in the literature means that there has been no real attempt to articulate or explore the interaction within and across business relationships and networks that may help to explain how companies respond to climate change.

These theoretically derived doubts about organisation and management research on climate change were empirically confirmed when examining the business responses of five British energy supply companies. Driven by an iterative process of working with the senior leadership teams of these companies, it became evident that a significant factor explaining how these companies responded to climate change was a result of the interaction and behaviour in business relationships and networks.

This study, therefore, proceeds from the basis of a network approach. It is through this move from the atomistic, individual level analysis and explanation to that of the network approach that will constitute the core of this theoretical and practical form of explanatory work. Thereby, presenting the network approach as a theoretical perspective that seems to be a promising alternative to provide a more comprehensive understanding of how companies respond to climate change.

The current business marketing literature and home of the network approach, however, is characterised by a significant deficiency of discussion on how companies behave and interact with other actors in response to climate change. In an attempt to rectify this situation, this thesis examines the interaction and behaviour within and across business relationships and networks in response to climate change. To do so, I supplement the network approach with insights drawn from the *behavioural science literature*, which was central to enabling a more comprehensive understanding of the behaviour in business relationships and networks. By adopting this novel perspective, the present study seeks to challenge the organisation and management theories that are commonly employed to define and explain how companies respond to climate change.

Besides the importance of advancing the understanding of how companies respond to climate change, my personal motivation to embark on this intellectual journey was to make a contribution to addressing climate change. My interest in climate change can be traced back to watching Al Gore's movie *'An Inconvenient Truth'* in 2006. I was surprised that despite the increasing number of storms, droughts and other natural disasters that climate change had – at least partially – caused around the world, companies, governments and individuals alike continued to emit carbon emissions as usual. As a result of watching Al Gore's movie, I wanted to understand how individuals and companies, in particular, behave when responding to climate change.

Al Gore did not answer this question in his movie. He referred, however, to Pacala and Socolow's (2004, p.968) who suggested that *"humanity already possesses the fundamental scientific, technical, and industrial know-how to solve the carbon and climate problem"*. Pacala and Socolow (2004) present 15 different responses available to reduce carbon emissions simply by scaling up existing technologies (e.g., more energy-efficient technologies). What caught my attention at the time was that 13 out of these 15 options were related to the generation, supply and consumption of energy. This nurtured my interest in the energy sector.

Over the following years, I became increasingly interested in the global low-carbon energy transition. This interest is rooted in the fact that not only is the energy sector the single most emitting industry in Europe (Eurostat, 2017) and worldwide (IPCC, 2014), but also because the global demand for energy has risen tremendously over the past decade and is likely to continue to grow by an additional 28% by 2040 as a widening pool of developing countries prosper (EIA, 2017), let alone the electrification of other sectors such as transportation (European Commission, 2017). As part of this study, therefore, I negotiated access and engaged with the senior leadership teams of some of the UK's most prominent energy supply companies. As a result of having this rare high-level access, I was able to collect rich high-end access data on companies' responses to climate change driven by the CEO and senior leadership teams.

By setting the early empirical findings alongside the organisation and management literature on business responses to climate change, as well as the interactional and behavioural insights stemming from the network approach and the behavioural science literature, I developed an initial theoretical structure for the analysis of the empirical cases. This structure was driven not just from the theoretical understanding of the previous literature but also from the case studies. This systematic, iterative and logical research process (see Chapter 3 and Chapter 6 for more details about the methodology and empirical findings) allowed me to establish an initial theoretical structure that consists of three pillars: 1) *Network tensions*, 2) *Network interactions*, and 3) *Network outcomes*.

Indeed, when analysing each of the empirical cases, it appeared that the socio-cultural, legal/regulatory and economic pressures in response to climate change had triggered efforts to mitigate carbon emissions. It seemed that these efforts were largely driven by discontinuities between the new business requirements (emanating from contextual socio-cultural, legal/regulatory and economic developments) and the current operations of the focal companies. As a result of this empirical observation, I termed the first pillar of the initial theoretical structure as *Network tensions* in respect of the flux inherent within the sector outlined above.

Interestingly, in each of the empirical cases, the companies began to interact within and across their business relationships and networks in order to overcome these network tensions. To do so, companies initiated activities in order to access the necessary resources, which were not available in concentrated form, but rather located within the companies' business relationships and networks. In an attempt to account for these interactions I included *Network interactions* as the second pillar of the initial theoretical structure.

These successive interactions commonly resulted in a set of business behaviours. Such observable manifestations of the network interactions are covered in the third pillar of the initial theoretical structure, which I termed *Network outcomes*.

By following this chronological process in each of the cases, I derived an empirically driven and theoretically grounded structure for the study of business responses to climate change (see Chapter 2 for more details). Through this initial structure of *Network tensions*, *Network interactions* and *Network outcomes*, I was able to explain how companies respond to climate change. In fact, throughout this thesis I provide clear evidence that companies' successive interactions in response to climate change resulted in companies 1) *discharging* their responsibility by passing the impact to others, 2) *protecting* their resources and rationalising activities rather than bearing risks of change, and 3) *acting akin*, or have the propensity to adopt a herd mentality, to other actors with similar intrinsic values and beliefs rather than operating in isolation.

These findings contain several important implications for managers and policymakers, and could potentially contribute to the development of measures that will be more effective at mitigating climate change. Most importantly, however, I seek to make a substantial theoretical contribution by 1) raising doubts about the organisation and management theories that are commonly employed to define and explain how companies respond to climate change, 2) advancing the business marketing literature by developing a more comprehensive understanding of how companies interact and behave in business relationships and networks, and 3) counteracting the lack of empirical evidence that characterises much of the behavioural science literature.

In an attempt to further illuminate and specify how I seek to make these theoretical contributions, I now outline the specific research objectives and questions that will guide this thesis.

1.2 Research objectives and questions

In this thesis, I aim to explain how companies respond to climate change. In doing so, I establish an empirically derived and theoretically grounded conceptual framework of business responses to climate change. This conceptual framework emerged from investigating and answering the following two research questions:

1. *How* do companies respond to climate change?
2. *How* do companies interact and behave within and across their business relationships and networks when responding to climate change?

The first research question focuses on identifying the causal mechanisms that explain how companies respond to climate change. The second research question ensures that a full view of the interaction and behaviour within and across business relationships and networks is established. As outlined in the previous section, one of the key arguments put forward in this thesis is that the sources that explain how companies respond to climate change may be located within the interaction and behaviour in *business relationships and networks*. Collectively, answering these two research questions permits the development of a more comprehensive understanding of how companies respond to climate change.

By confronting these research questions with the five empirical cases of business responses to climate change, the present research challenges the conceptualisation of such business responses as atomistic and isolated activities of individual companies. In doing so, this study provides novel insights into the interaction and behaviour in business relationships and networks.

The first theoretical contribution of this study is to challenge the organisation and management theories that are commonly employed to explain business responses to climate change. By adopting a network approach and supplementing it with insights drawn from the behavioural science literature, the present research seeks to raise doubts about the organisation and management conceptualisation of such business responses as atomistic and isolated activities of individual companies (e.g., Kolk and Levy, 2001; Banerjee et al., 2003; Kolk and Pinkse, 2004; Margolick and Russell, 2004; Jones and Levy, 2007; Slawinski and Bansal, 2012; Shevchenko et al., 2016; Wright and Nyberg, 2017). Although significant progress into enabling a wider theoretical acknowledgement in developing a theoretical understanding of business responses to climate change has been developed in the extant literature, it is my hope to contribute to a more comprehensive understanding of how companies respond to climate change. Comprehensive, in this case, means moving beyond the individual company as the unit of analysis and examining the behaviour within and across business relationships and networks of actors affected by the focal company's response to climate change. I argue that this shift in the analytical focus is required urgently if we are to develop a more complete understanding of business responses to climate change.

The second theoretical contribution of this study is to advance the business marketing literature on interaction and behaviour in business relationships and networks. The present research contributes to the business marketing literature by opening the network interaction and behaviour 'black box' and, thereby, providing a systematic explanation of the micro-level processes of interaction and behaviour within business relationships and networks. Interestingly, although individual actors lie at the heart of business interaction (Ford and Håkansson, 2006; Medlin and Törnroos, 2007), only a few studies explore the associated behaviours within and across business networks (La Rocca et al., 2017). In fact, the business marketing literature tends to *'black box'* the role of actors and, as such, the relevant individual behaviours (Guercini et al., 2014). There is a striking lack of understanding of how actors interact and behave in business relationships and networks (Ford and Håkansson, 2006; Guercini et al., 2014; La Rocca et al., 2017).

Furthermore, a core component that has not been investigated empirically is *how* the interaction and behaviour within business relationships and networks may *translate* into specific network outcomes (Håkansson and Snehota, 2017). I address this issue by examining the interactions and behaviours in and around business responses to climate change; an empirical context that is equally seldom considered by business marketing scholars. Despite the growing concerns over global climatic changes, there are few business marketing-oriented studies on the subject (e.g., Veal and Mouzas, 2010, 2011, 2012; Finke et al., 2016).

Furthermore, based on these insights, I make a secondary theoretical contribution to the behavioural science literature. To date, behavioural scientists tend to focus on individual behaviours on the consumer side. Little is known, however, about how such individuals behave when they act in a business situation, embedded in a company (Ferraro, 2016). The few studies that have examined behavioural aspects in business situations commonly rely on partially hypothesised explanations and are usually based on experimental approaches in laboratory conditions (Kelman, 2011). There is a lack of empirical evidence that could contribute to explaining how behavioural biases play out 'in the real world' business situation (Marewski et al., 2010). This research seeks to close this gap in the literature. Next, I outline the structure of this thesis.

1.3 Thesis outline

This thesis is divided into seven chapters. This first chapter serves as an introduction to the study. In doing so, I have tried to convey not just the background to the research, but my personal motivation for conducting this study, the research objectives, research question and structure of this thesis.

In the second chapter, I lay out the theoretical lens that the research adopts and propose a novel, initial theoretical structure for the study of business responses to climate change. I begin by introducing the business responses to externally generated pressures in general and to climate change specifically, I then review the business tensions that climate change has engendered and scrutinise the outcomes stemming from business responses to climate change. Next, I problematise the previous research on business responses to climate change by introducing the network approach as an *alternative* theoretical lens. To do this, I examine the previous literature in and around business relationships and networks, and depict the extant research on interaction and behaviour; particularly in and around business responses to climate change. In the final section of the literature review, I utilise this theoretical understanding to propose the three pillars of *Network tensions*, *Network interactions* and *Network outcomes* that together comprise the initial theoretical structure for the study of business responses to climate change.

Moving on to the third chapter, I provide a detailed justification of the methodological procedures underpinning this study. In doing so, I explain the research paradigm by introducing my axiology, the critical realist epistemology and the network approach as the ontological stance. Furthermore, I justify the case study research method and explain why the chosen modes of data collection, data sources, data reporting and data analysis are the best fit for answering the research question at hand. I close the third chapter by showing that research ethics have been upheld at all stages of this study.

In the fourth chapter, I provide detailed information on the context and industry-specific aspects relevant to setting the empirical boundaries of this study. I begin by introducing the externally generated pressures emanating from climate change that build the context of this study. Then, I review how and why climate change arose as a global pressure on companies by explaining how the imbalance between nature and society emerged. Furthermore, I provide an outline of the contextual change (socio-cultural, legal/regulatory and economic) that have resulted from climate change and posed specific pressures on companies. Next, I highlight the relevance and fundamental role of the global energy supply sector in addressing climate change and turn my attention to the UK national energy supply sector. This includes establishing the specific characteristics of the UK energy supply sector, outlining the relevant energy and climate change regulation in the UK, as well as describing the UK's progress towards decarbonising its energy supply system.

In chapter five, I present five empirical cases of how companies respond to climate change. The first case examines the interaction and behaviour in and around one of the UK's largest energy supply companies' response to a new regulation, namely the ECO scheme. In the second case, I examine the interaction and behaviour of a large energy supply company when responding to climate change by attempting to decarbonise its gas-fired energy generation assets. To do so, the company intended to retrofit an existing gas-fired power plant with Carbon Capture and Storage (CCS) technology. The third case examines the interaction and behaviour when another large multinational energy supply company decided to restructure its energy generation portfolio in response to climate change. The fourth case provides insights into how an energy supply company responded to climate change by establishing itself as a provider of demand-side response technology. The fifth and final case examines the interaction and behaviour when a large energy supply company sought to realign its business towards carbon reduction technologies in response to climate change. What the cases have in common and what is of interest here, is that these were all interventions driven across differing business networks in order to respond to the global climate change issue.

In the sixth chapter, my attention turns towards analysing and discussing the five case studies introduced in chapter five. Here, I analyse the empirical findings stemming from each case by means of the three pillars of the initial theoretical structure (*network tensions*, *network interactions* and *network outcomes*). In doing this, I provide an overview of the five business efforts to respond to climate change. This includes scrutinising the actors involved and highlighting the observed network outcomes stemming from the business responses to climate change. Subsequently, I explain the observed networks outcomes by using theory. Hereby, I elucidate how companies respond to climate change.

In the seventh and final chapter, I draw conclusions and outline the implications drawn from the analysis and discussion in chapter six and the thesis as a whole. This chapter provides an overview of the findings as well as the theoretical, managerial and policy implications. I close this chapter by acknowledging the limitations of my study and by suggesting promising paths for future research in this area.

1.4 Conclusion

This chapter serves as the introduction to my thesis. I started by establishing the background to the research and identified the two prevailing gaps in the existing literature: On the one hand, the assumption in the organisation and management literature that companies function as isolated units independent of their wider network of business relationships; on the other hand, the limited understanding of interaction and behaviour in business relationships and networks. Besides formulating these two gaps in the literature, I have provided insights into my personal motivations for conducting this study. Thereafter, I described the research objectives and questions and outlined how my thesis contributes to knowledge. I closed this chapter by delineating the structure of this thesis.

In the following chapter, I review and problematise the previous organisation and management literature on business responses to climate change in light of the insights established from the business marketing and behavioural science literature. At the end of the next chapter, I propose an initial theoretical structure for the study of business responses to climate change.

2 Literature review

This chapter lays out the theoretical basis of this study by outlining how the existing organisation and management research has approached the study of business responses to externally generated pressures in general and to climate change specifically, why these approaches are limited in establishing a comprehensive understanding of how companies respond to climate change, how a network approach overcomes the shortcomings of previous research, and lastly why it is important to supplement the network approach with insights stemming from the behavioural science literature.

As such, I start with an introduction to business responses to externally generated pressures in general and to climate change specifically. Next, I review the business tensions that climate change has brought about and scrutinise the consequences stemming from business responses to climate change. Then, I problematise the current organisation and management approaches employed to explain business responses to climate change. Then, building on the business marketing literature in and around business relationships and networks, I introduce the network approach as an alternative theoretical lens. Lastly, I draw upon the behavioural science literature to dig deeper into the interactions and behaviours when companies respond to climate change.

Towards the end of this chapter, and largely as a result of an iterative process between the three distinct kinds of literature introduced above and the empirical findings presented in this study, I propose a novel, initial theoretical structure for the study of business responses to climate change. I close this chapter with a brief conclusion.

2.1 Business responses to external pressures

External pressures emanating from governments, industry groups, competitors and customers, increasingly require business attention (Christmann, 2004). Governments commonly establish a regulatory framework that demands companies to change their current pattern of behaviour (DiMaggio and Powell, 1983). Empirical studies of regulatory pressures have suggested that they may encourage companies to act more environmentally friendly (e.g., Henriques and Sadorsky, 1996; Dasgupta et al., 2000). In addition, companies face external pressures from industry groups as industry standards and social norms are being set (DiMaggio and Powell, 1983). Furthermore, competitors may implement novel strategies that are addressing, for example, environmental concerns of customers, calling other companies to respond by adjusting their own strategy (Abrahamson and Rosenkopf, 1993). Lastly, customers themselves may mount an external pressure on companies by making purchasing decision based on social, ethical and environmentally-responsible business conduct (e.g., Arora and Cason, 1995; Henriques and Sadorsky, 1996; Christmann and Taylor, 2001).

Within this plethora of complex external pressures, companies have adopted response strategies, such as *"adaptation strategy, compromising strategy, avoidance strategy, dismissal strategy, and influence strategy"* (Aaltonen and Sivonen, 2009, p.131). Unsurprisingly, the topic of external pressures is touched upon in several kinds of literature: Corporate Social Responsibility (CSR), Organisation Theory, Marketing, Strategic Management as well as many more. In the business ethics and CSR literature, Amann and colleagues (2007) have brought together insights from the literature introduced above to define business responses to external pressures as:

> *"The attempt to manage the business environment systematically and professionally, to ensure that business is done smoothly, with an unquestioned license to operate and an interaction that leads to mutual adaptation between corporations and society in a sense of coevolution."* (Amann et al., 2007, p.34)

Over the last two decades, the emergence of global climate change has led to additional external pressures emanating from government, industry groups, competitors and customers. As a result, business responses to climate change have shifted from defensive approaches (lobbying against legally binding climate change treaties and/or national policies, questioning the scientific evidence and denying any responsibility) to proactive approaches (encouraging a strong regulatory framework, mitigating the company's carbon footprint and seeking new market opportunities) (Kolk and Pinkse, 2004). At the same time, however, carbon emissions in the atmosphere have continued to rise (NASA, 2019). As climate change has brought about a range of external pressures from differing stakeholders, it represents a rare possibility to further enhance the understanding of business responses to external pressures in general and to climate change specifically.

Understanding how companies respond to climate change requires dismantling the dichotomy between businesses and the natural environment, reviewing the tensions that climate change has created for companies and establishing the consequences of business efforts to overcome these emerging tensions.

2.1.1 Businesses and the natural environment

Following Adam Smith's (1776) logic, famously manifested in *The Wealth of Nations,* it is often taken for granted that companies possess the right to maximise their profits. Despite the associated social and economic well-being, in many cases, the desire to maximise profits comes at the expense of harmful effects on the natural environment (e.g., air, water and soil pollution). Hardin (1968) vividly illustrates such a so-called tragedy of the commons by referring to the story of rational herdsmen sharing a common field. Driven by the desire to maximise personal gains, a sensible action for each individual herdsman is to add more and more animals to their herd without any limit. This is because the positive component remains with the individual herdsman (such as the proceeds stemming from one additional animal) and this significantly outweighs the negative component (such as the effects of overgrazing) which is shared by all herdsmen that have animals on the field. This behaviour of each individual herdsman, however, will inevitably lead to the degradation of the common field; meaning eventual ruin for all herdsmen (ibid, 1968). In that lies the tragedy: *"Each man is locked into a system that compels him to increase his herd without limit – in a world that is limited"* (Hardin, 1968, p.1244).

Following a similar rationale, companies conclude that it is in their own best interest to add more and more units of output (e.g., by building a new production plant) as the harmful effects (such as the additional carbon emissions) are suffered by the society as a whole. In a finite world, however, this means that if all companies add additional production plants, then the harmful effects will eventually deplete the natural environment. In fact, over decades, companies have neglected any responsibility for these negative effects; misuse, underinvestment and free-riding have been the status quo (Ansari et al., 2013). Hereby, companies vastly benefitted from clean air and a stable climate without bearing any of the costs related to maintaining it (e.g., Hardin 1968; Stigler, 1974; Ostrom, 1991). With this in mind, it seems rather unsurprising that climatic changes have emerged.

With the emergence of climate change, however, the socio-cultural values and norms have started to shift towards more sustainable forms of living, working and consuming

(Carvalho and Burgess, 2005). Simultaneously, governments have initiated legal/regulatory changes to promote business responses to climate change. This is frequently based on the idea that introducing property rights, i.e. assigning rights to perform certain actions, helps to account for the social costs associated with doing business (e.g., Coase, 1960). Hereby, at least theoretically, the degradation of a common resource can be limited (Hardin, 1968, 1998; Ostrom, 1999). Interestingly, Ostrom (1999) found that such top-down approaches are the most promising strategy as companies *"will not do this themselves"* (Ostrom, 1999, p.494). Hereby, governments can mobilise companies who *"possess the organizational, technological, and financial resources to address environmental problems"* (Jones and Levy, 2007, p.428).

The emerging socio-cultural and legal/regulatory changes have implications for the global economic system (Goodall, 2008; Wright and Nyberg, 2015). The socio-cultural and legal/regulatory changes have mounted externally generated pressures on companies (Nyberg et al., 2018); leading to implications for competitiveness and business survival (Lubin and Esty, 2010; Chatzidakis and Shaw, 2018). This, therefore, creates a tension between *"meaningful engagement with the grand challenge of climate change and an organizational focus on short-term profitability"* (Wright and Nyberg, 2017, p.1655). In the next section, I attempt to illuminate this tension more fully.

2.1.2 Business tensions in response to climate change

The increased attention on carbon emissions as a result of the socio-cultural and political changes worldwide have started to demand *"dramatic changes in how* [companies] *create value to eliminate their unethical negative impacts on the environment and society"* (Shevchenko et al., 2016, p.911). From the perspective of an individual company, these demands for a drastic action to reduce carbon emissions create tensions because the initial costs overweigh the perceived potential benefits (e.g., Moffatt, 2004). In other words, the business tensions brought about by climate change are between responding to climate change and short-term profitability (Okereke et al., 2012; Wright and Nyberg, 2017).

In fact, several national governments (including the UK) have started to establish a legal/regulatory framework that encourages measures in response to climate change. Typically this includes *"voluntary agreements, tradable permits, regulation and taxation"* (Hansford et al., 2004, p.197). In many cases, it is these emerging legal/regulatory frameworks designed to address network tensions that trigger business responses to climate change (Banerjee et al., 2003). This is largely because legitimacy, i.e. operating as a lawful entity, is a major concern for companies since governmentally imposed *"penalties, fines, and legal costs have punctuated the importance of complying with legislation"* (Bansal and Roth, 2000, p.718). Although companies have increasingly adopted more constructive approaches when responding to climate change, it is understood that they continue to *"look to governments to take the lead, as they argue the need for legislation to force their hand before they can justify action to their shareholders"* (Veal and Mouzas, 2010, p.426).

At the same time, climate change has created new economic opportunities such as markets for innovative low-carbon energy generation technologies. In fact, a well-conceived response to climate change may enhance business performance by ensuring long-term profitability by gaining a sustained competitive advantage (Bansal and Roth, 2000). Frequently stemming from a cost-benefit analysis of the potential measures to respond to climate change, companies driven by economic opportunities, or in other words competitiveness, focus on innovative processes that reduce *both* environmental impact and costs while increasing revenues as a result of marketing those activities (Cordano, 1993; Kolk and Levy, 2001). Furthermore, such responses contribute to minimising the risks associated with unexpected costs emerging from new *"regulations, fines, taxes, and* *caps on products and processes that produce greenhouse gases"* (Hoffman, 2005, p.32); particularly pressuring for companies with vested interests in fossil fuels (Wittneben et al., 2012).

Collectively, the socio-cultural, legal/regulatory and economic pressures have acted as trigger points for business responses to climate change. This is largely because the socio-cultural, legal/regulatory and economic developments have brought about discontinuities in the business environment that demand companies to respond to climate change. Business responses to climate change have emerged from these tensions, and it is these responses that I explore in the next section.

2.1.3 Business responses to climate change

Over the past two decades, business responses to climate change have grown in number and scale. Indeed, several research groups focused on climate change (e.g., The Climate Group; The Pew Center) have confirmed that companies have increasingly responded to climate change (Margolick and Russell, 2004; The Climate Group, 2005). This commonly includes internal measures focused on changes in technologies and processes that permit reducing the company's emissions (Kolk and Pinske, 2004). For example, taking advantage of cost savings stemming from energy efficiency (Pinkse and Kolk, 2009). A full list of business responses to climate change has been established by Kolk and Pinkse (2004) as well as Slawinski and Bansal (2012). In an earlier piece of work, Bansal and Roth (2000) have broadly defined such business responses to climate change as:

> *"A set of* […] *initiatives aimed at mitigating a firm's impact on the natural environment. These initiatives can include changes to the firm's products, processes, and policies, such as reducing energy consumption and waste generation, using ecologically sustainable resources, and implementing an environmental management system."* (Bansal and Roth, 2000, p.718)

Interestingly, what seems to characterise most of the organisation and management literature on business responses to climate change is the assumption that business responses to climate change are atomistic and isolated activities of individual companies (e.g., Kolk and Levy, 2001; Banerjee et al., 2003; Kolk and Pinkse, 2004; Margolick and Russell, 2004; Jones and Levy, 2007; Slawinski and Bansal, 2012; Shevchenko et al., 2016; Wright and Nyberg, 2017). An alternative view is that the resources that a company requires to respond to climate change are not available in concentrated form but rather are located within a company's business relationships and networks (Veal and Mouzas, 2010; Ferraro et al., 2015; Finke et al., 2016). Unilever's CEO Paul Polman elucidates this:

> *"The issues we face are so big and the targets are so challenging that we cannot do it alone, so there is a certain humility and a recognition that we need to invite other people in.* […] *It is very clear that no individual institution, government or company can provide the solution."* (as quoted in Confino, 2012)

Indeed, the scale and magnitude of emission reductions required to mitigate global climate change inherently require a combination and application of resources that go far beyond the capacity of *what* an individual company can achieve with its resources (Hoffman, 2005; Ferraro et al., 2015). The development of a more comprehensive understanding of business responses to climate change, therefore, requires moving beyond the individual company and take a network of companies as the unit of analysis. In fact, it is only through this shift in analytical approach that it will be possible to capture how businesses behave within and across business relationships and networks in order to access the resources required to respond to climate change.

Furthermore, the network as a unit of analysis permits unveiling the interactional and behavioural aspects at play when companies respond to climate change (e.g., Veal and Mouzas, 2010; Finke et al., 2016). These simply cannot be uncovered when limiting the study of business responses to climate change by focusing on individual companies separated from their wider networks of continuous business and non-business exchange relationships (Easton and Håkansson, 1996; Gnyawali and Madhavan, 2001; Håkansson and Ford, 2002; Ritter et al., 2004).

Surprisingly, previous organisation and management research has largely neglected to incorporate the ways in which companies behave within and across business relationships and networks when examining business responses to climate change. This suggests that the established literature only explains a part of the story while disregarding the parts that are potentially most relevant.

In an attempt to rectify this prevailing gap in the literature on business responses to climate change, I adopt a network approach as an alternative theoretical lens, supplementing this with insights drawn from the behavioural science literature. In doing so, I position this piece of work in and around business behaviour in business relationships and networks. In fact, I argue that it is this alternative theoretical lens, and the associated analytical shift from an individual company to a network, that permits the development of a more comprehensive understanding and robust explanation of how companies respond to climate change.

In the next section, I, therefore, turn my attention to introducing a network approach to business responses to climate change.

2.2 A network approach to business responses to climate change

The network approach is grounded in the embeddedness of firms in webs of interconnected business and non-business give-and-take exchange relationships (Easton and Håkansson, 1996; Halinen and Törnroos, 1998; Gnyawali and Madhavan, 2001; Håkansson and Ford, 2002; Ritter et al., 2004). This perspective rejects an atomistic view of businesses by assuming that competitive advantage stems from systems of exchange in which companies are deeply ingrained (Uzzi, 1996). More specifically, this approach emphasises that the social and economic networks of companies (Granovetter, 1985) explain the formation of alliances (Gulati, 1995), inter-organisational exchange (Uzzi, 1997) and business survival (Baum and Oliver, 1992). This view of firms as embedded in business relationships and networks has allowed scholars to unearth performance-enhancing processes such as *"interfirm resource pooling, cooperation, and coordinated adaptation"* (Uzzi, 1996, p.675).

In an attempt to illuminate the network approach further, in the next section I outline the relevance of business relationships and networks in general, I elucidate the behaviour of companies within and across their business relationships and networks, and depict the interactional as well as behavioural aspects of responding to climate change.

2.2.1 Business relationships and networks

"No business is an island" (Håkansson and Snehota, 1989, p.187). This metaphor is commonly used in the business marketing literature and particularly by scholars associated with the Industrial Marketing and Purchasing (IMP) Group to illustrate the interconnectedness between a company and its wider networks of relationships (e.g., Håkansson and Snehota, 1995; Ritter, 2000; Araujo et al., 2003; Möller et al., 2005; Ford and Mouzas, 2013; Ford and Håkansson, 2013; Freytag et al., 2016; Mouzas, 2016; Törnroos et al., 2017; Lowe and Rod, 2018; Mouzas and Ford, 2018). Indeed, IMP scholarship sees companies as embedded in wider networks of continuous business and non-business give-and-take exchange relationships (Easton and Håkansson, 1996; Halinen and Törnroos, 1998; Gnyawali and Madhavan, 2001; Håkansson and Ford, 2002; Ritter et al., 2004). Businesses engage in these exchange relationships when they perceive that value can be created, either directly or indirectly (Ritter et al., 2004; Mouzas and Ford, 2009). The IMP literature challenges the conventional view of island-like

businesses that are operating in isolation and thus raises the issue of managing internal and external relationships.

In fact, IMP scholars fundamentally challenge the assumption that firms are acting independently, proactively and are able to exist by themselves (Ford and Mouzas, 2008). Consequently, business activities are seen as being guided by a process of managing and integrating complex ongoing business and non-business relationships that are themselves controlled and influenced by other internal and external relationships. Ritter et al. (2004, p.175) add that *"firms are seldom in total control of all these relationships and are subject to the control and influence of others within and around the relationship"*. As a result business networks are to be seen as *"self-organizing systems"* (ibid).

This view of reality stands in stark contrast to the network understanding developed from an organisation and management studies perspective (e.g., Madhavan et al., 1998; Gulati et al., 2000); especially, that individual businesses choose, develop, manage and control networks with the purpose of enhancing their own performance. From the organisation and management studies perspectives, network characteristics are akin to the features of a market as the freedom of choice and the ability to develop, manage, control and change counterparts prevails (Ford and Mouzas, 2008). In the IMP literature, however, the idea of business interaction lies at the heart of the network approach. Business interaction refers to:

> *"The substantive process that occurs between business actors through which all of the aspects of business: material, financial and human and all of the elements of business: actors, activities and resources take their form, are changed and are transformed."* (Ford et al., 2008, p.12)

Through this process, actors transform themselves as well as the counterparts embedded in their business networks. From an analytical perspective, this requires viewing the process of interaction as distinct from the actors themselves. This separation is inherent in the assumption that *"interaction is a process that occurs between actors over time* […]

but which develops in a way that is not fully controlled" (ibid, p.10). Business relationships and networks, therefore, emerge through business interaction over time (Ford and Mouzas, 2013). Such evolving business relationships and networks are:

> *"*[…] *manifested in many forms, such as the 'quality' of a service delivery; the effort (or lack of it) that is devoted to a product adaptation; the stance taken in a negotiation; the timing of a payment or the commitment to a joint development."* (Ford et al., 2008, p.10)

While an actor might approach interactions based on an intent consistent with the overall strategy of its company, in some cases, if not all, the chosen approach to interaction is *"unconsidered, inconsistent, or be the result of inertia and simply continue the status quo"* (Ford et al., 2008, p.10). This is due to the difficulty of identifying and controlling the process of interaction and its outcome. In fact, although actors may approach interaction with the intention of achieving a pre-defined outcome, the actual outcome of interaction is beyond the control of actors as it is constituted through the behaviour of actors and evolves over time. Unsurprisingly, Ford et al. (2008, p.12) conclude that *"no single actor is or could ever be in control of what emerges from its interactions or be independent in the world of business"*. Regardless of the sheer uncontrollability of outcomes stemming from interaction, Ford et al. (2008) suggest that successive interactions can over time transform actors, activities and resources and it is in this that the outcome of business interaction is manifested.

IMP research discusses such network changes by examining the development of networks over time (e.g., Mattson, 1987; Håkansson, 1992; Harrison, 1999; Harrison and Easton, 2002; Mouzas and Ford, 2009). A common theme of this stream of research are the dynamics between network stability and radical change (Axelsson and Easton, 1992). While network stability is often stated as the default (Gadde and Håkansson, 1992), changes in networks may *"originate from and are mobilised by actors within that network"* (Harrison and Easton, 2002, p.546). Particularly relevant for this study is, however, that business networks seem to be comparably stable and resistant to externally generated pressures.

Indeed, Harrison and Easton (2002) suggest that within business networks a deep process/pattern exists *“that drives actors to minimise the impact of externally imposed changes”* (Harrison and Easton, 2002, p.551). As a result of network structuration over time, network actors repeat previous activities that have proven to successfully operate and survive (Håkansson, 1992), or as Harrison and Easton (2002, p.551) put it: *“Repetition of the ways of doing things has created an embedded pattern that represents the perceived best way of operating at the current time.”*. Externally generated pressures emanating from global climatic changes threaten this deep process/pattern. As a result, network actors are required to adjust existing and develop new patterns of interaction and behaviour in response to climate change. Since the success of new ways of working remains unknown, business networks tend to behave conservatively in such situations (Harrison and Easton, 2002).

In the process of adjusting existing and developing new patterns, the interaction and behaviour of network actors appear to be driven by attempts to systematically control and influence other actors (Gadde et al., 2003). This ambition is the inherent driving force of business interaction. Although actors may strive for central control of a network, the limited understanding of the network as a whole leads to the argument that ‘pluralistic’ networks are *“better able to respond to changing conditions”* (Gadde et al., 2003, p.360). This becomes particularly apparent when considering that the activities between two actors may spread across the entire network. In fact, actors may intend to utilise the emerging interdependencies by relating their own activities to the activities of counterparts. The unpredictability of the outcomes, however, leads to the conclusion that the problem-solving process in networks is beyond the ownership of an individual actor (Gadde et al., 2003).

Interestingly, a significant proportion of the resources necessary for addressing climate change are located within a companies' business relationships and networks (Veal and Mouzas, 2010). Since such resources are unevenly distributed across relationships and networks, actors engage in give-and-take exchange in order to obtain the resources of counterparts (Mouzas and Ford, 2009). This inevitably ingrains companies into a *"larger collective entity"* (Gadde et al., 2003, p.359). It is the behaviour in networks that enables actors to initiate activities leading to the exchange of resources (e.g., D'Antone et al., 2017).

The existing IMP literature suggests that the network behaviour required to obtain resources varies significantly since each actor has *"its own specific pattern of interdependencies in terms of how it relates to its most important counterparts and how they relate to others"* (Gadde et al., 2003, p.360). Since the behaviour in networks is a process that evolves over time, no actor is the natural centre which implies that networks are to be understood as *"loosely connected systems of actors and relationships in which no firm can dominate"* (Gadde et al., 2003, p.360). This underlying logic of networks, however, does not suggest that networks develop randomly. The contrary is the case; loosely connected systems of actors may follow patterns without an individual actor creating and orchestrating them (Resnick, 1998). Networks, therefore, represent a fuzzy context to which actors are exposed (Johanson and Mattsson, 1992).

In an attempt to dismantle the fuzzy network context within which actors need to interact in order to access resources, Ford and Håkansson (2013) have identified four principal network structures, stretching on a continuum from three relationships to no relationship, as illustrated in Figure 1 below.

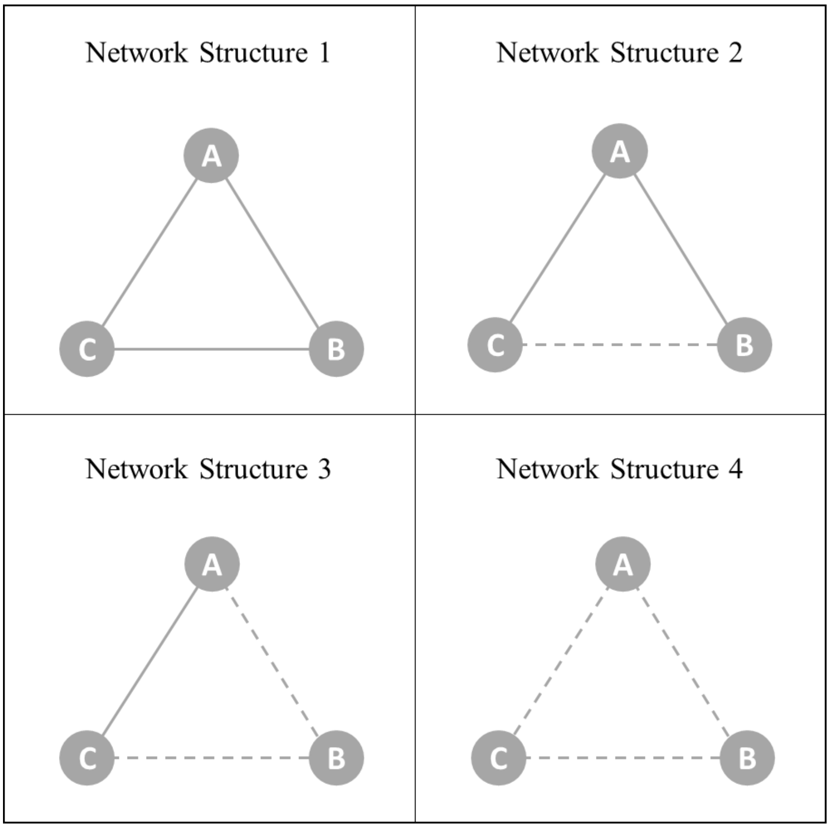

Figure 1: *The four principal structures of business networks*

While the solid lines in Figure 1 indicate a direct relationship between actors, the dotted lines show indirect relationships. Direct relationships are important resources for companies, connect a company to the rest of the network and allows obtaining the resources of counterparts (Gadde et al., 2003). Indirect relationships are interdependencies between companies who do not interact directly, but influence one another through network structures (Easton and Håkansson, 1996). Indeed, it is the study of triadic networks that recognises and allows investigating how companies interact with one another beyond direct relationships (Smith and Laage-Hellman, 1992). As actors are never interacting in just one relationship, actors are required to prioritise:

> *"*[…] *which relationship to use to address a particular problem as well as whether to develop relationships with new counterparts and whether to seek to abandon existing ones."* (Ford and Mouzas, 2010, p.958)

In other words, actors need to decide whether to create new relationships in order to address a problem or to consolidate within existing relationships structures. As the resources of companies are limited, actors need to allocate them effectively, for example, between *"intensifying sales and development interaction with existing counterparts or prospecting for new customers or suppliers"* (Ford and Mouzas, 2010, p.958). Therefore, over time, the behaviour in networks is driven by acting, reacting and re-reacting. This implies that actors face *"choices about how particular problems* […] *should be addressed"* (Ford and Mouzas, 2010, p.958). These non-exclusive choices embedded in business relationships and networks:

> *"*[…] *are likely to be taken simultaneously by a number of individuals in both of the companies in a relationship as they address a number of their own problems and those raised by counterparts."* (Ford and Mouzas, 2010, p.958)

Since actors rely on to a large extent on resources located within their business relationships and networks, actors interact to access the resources necessary to address their own short- and long-term problems as well as those of counterparts. In fact, such network resources relate to complementary resources of other companies and may be utilised as a multiplier of internal resources (Ford and Håkansson, 2006).

In order to shed further light on the fundamental role of resources for the examination of network behaviour in general and this study in particular, I now draw on the resource-based view of the firm (RBV). This theory has contributed significantly to our understanding of the role that resources play for companies and enables a more in-depth understanding of internal and network resources.

Predominately developed by Wernerfelt (1984) and Barney (1991, 2001), the RBV was conceptualised as a theory of competitive advantage that focuses on the link between the internal (strengths and weaknesses) characteristics and business performance. The RBV is built on the assumption that businesses *"within an industry (or group) may be heterogeneous with respect to the strategic resources they control."* (Barney, 1991, p.101). Moreover, it views resources as being characterised by a degree of immobility

(Barney, 1991). Indeed, this focus on internal characteristics seems important to this study since it recognises that:

> *"A bundle of assets, rather than the particular product market combination chosen for its deployment, lies at the heart of their firm's competitive position."* (Dierickx and Cool, 1989, p.1504)

This logic permits scholars and managers alike to identify how business resources need to be combined and applied in order to get a competitive advantage (Barney, 2001). Most pertinent to this study, however, are the two basic assumptions underpinning the RBV: resource heterogeneity and immobility.

The RBV is based on the assumption that business strategies emerge when conceiving of, and implementing, heterogenic and immobile business resources. In other words, businesses combine and apply a set of differing physical, human and organisational resources in order to take business action (Barney, 1991). If this heterogeneity and immobility of business resources did not exist, then no business would ever be able to gain a sustained competitive advantage as any other business would simply be able to implement the exact same strategy (Barney, 1991). Barney (1991) reiterates:

> *"Firms, in general, cannot expect to obtain sustained competitive advantages when strategic resources are evenly distributed across all competing firms and highly mobile."* (Barney, 1991, p.103)

Implicitly, this suggests that the behaviour of companies can only be understood when considering the network resources of individual actors. The RBV, however, remains limited in its ability to explain the impact of such exogenous factors (Priem and Butler, 2001). Paradoxically, despite the RBV aiming to unveil an advantageous combination and application of business resources based on the *"differences between firms"* (Wernerfelt, 1995, p.173), network resources receive little attention.

Notwithstanding the rich contribution of the RBV to our understanding of business resources, its assumption that companies are independent of exogenous factors seems flawed. Indeed, empirical observations stemming from the IMP literature show that companies are *"enmeshed in networks of complex interlocking interdependencies with each other"* (Ford and Mouzas, 2008, p.64). The RBV, however, does not take into consideration how network actors behave in order to enlarge their resource pool. This reconfirms the fundamental importance of employing the IMP literature to explain how companies mobilise network actors and access network resources when responding to climate change.

Having established the relevance of business relationships and networks in general, I now turn my attention specifically to examine the interaction in and around responding to climate change.

2.2.2 Interactional aspects of responding to climate change

Studies on the interactional aspects of responding to climate change are rare. Although some of the existing organisation and management literature on business responses to climate change implicitly acknowledges degrees of interaction (e.g., Kolk and Pinkse, 2005), this stream of research is characterised by a tendency to view business responses to climate change as isolated activities of individual actors. Unsurprisingly, this conceptualisation has been criticised on the basis that it:

> "[…] *obscures several important connections and relationships relevant for climate strategy. These include connections between the firm and industry groups, the relationship between market and non-market forces, and the role of a variety of societal and institutional factors."* (Wittneben et al., 2012, p.1435)

By adopting the IMP's network approach as the theoretical lens of this study, I attempt to close this gap.

Similar to organisation and management research, IMP scholars have been relatively quiet on the subject of business responses to climate change. The scarce IMP literature on business responses to climate change includes Veal and Mouzas (2010, 2011, 2012) and Finke et al. (2016). The latter have examined a case where efforts to respond to climate change broke down due to a set of barriers entrenched in the network interactions. Based on an in-depth case study of a network of actors in Germany, Finke et al. (2016) concluded that the multiplicity of interests held by actors involved in mounting a response to climate change acted as a primary barrier. In other words, the diverging underlying reasons that drove actors to participate in interaction in response to climate change *"hinder*[ed] *the process of interaction"* (Finke et al., 2016, p.100).

Furthermore, Finke et al. (2016) argued that this multiplicity of interests was aggravated by the sub-barriers economic reasoning, weak actor bonds and differing perceptions of the rules of the game. *Economic reasoning* refers to the economically egoistic behaviour of companies when interacting in response to climate change. In other words:

> *"Companies only invest finances, resources and time to interact within the network, when they expect that these interactions are financially or otherwise beneficial"* (Finke et al., 2016, p.100)

Weak actor bonds, on the other hand, relates to concerns about the intrinsic motivations when counterparts initiate business responses to climate change. Finke et al. (2016, p.100) add that *"this is amplified by a feeling of independency among actors when developing climate protection measures"*. Lastly, Finke et al. (2016) suggest that differing perceptions of the *rules of the game* may aggravate the multiplicity of interests when companies interact in response to climate change. Particularly, a diverging understanding of *"the structure and design of rules of the game can influence the way that actors interact with each other"* (Finke et al., 2016, p.100).

Interestingly, and most pertinent to this thesis, Finke et al.'s (2016) study suggests that the explanation of how companies react to climate change may, in fact, be an outcome of interactions within and across the business relationships and networks. This conclusion is strengthened through several studies conducted by Veal and Mouzas (2010, 2011, 2012). Their research has also examined the network interactions in the context of business responses to climate change. Interestingly, alongside the interactional aspects, their studies have unveiled a set of behaviours that seem to prevail when companies respond to climate change. This includes the recognition of risk, frames and reference points, as well as the abundance of conflicts and disputes (Veal and Mouzas, 2010).

The *recognition of risks* of actors relates to the interaction in business relationships and networks because of the perception that a company is exposed to externally generated pressures stemming from climate change (Veal and Mouzas, 2010). This recognition of risks occurs through either ‘risk as feeling’ or ‘risk as thinking’ (Loewenstein et al., 2001; Bazerman and Malhorta, 2006; Weber, 2006). While ‘risk as feeling’ refers to the actual experience of risks, ‘risk as thinking’ captures the recognition of risks at a distance. The proximity of ‘risk as feeling’ frequently leads to more immediate action (Bazerman and Malhorta, 2006; Weber, 2006). Responding to climate change is an example of ‘risk as thinking’ because most actors struggle to visualise or recall harm stemming from climate change (Kahneman et al., 1982).

Frames and reference points, on the other hand, refers to the way in which businesses base their interaction on existing frames and reference points (Veal and Mouzas, 2010). Interestingly, Veal and Mouzas (2010) suggest that companies take the emerging legal/regulatory changes as a frame for thinking about their action in response to climate change. Although such legal/regulatory demands may act as a driver for business responses to climate change:

> *“It is important to recognise that in basing a decision upon a standard, there is a fundamental shift in the decision type, from one based upon absolute effectiveness towards one based upon effectiveness relative to a reference point.”* (Veal and Mouzas, 2010, p.421; based on Kahneman and Tversky, 1979; Tenbrunsel et al., 2000)

According to Veal and Mouzas (2010), the third behaviour that seems to prevail when companies respond to climate change relates to the *abundance of conflicts and disputes*. In fact, Veal and Mouzas (2010) argue that business responses to climate change represent a case where self-interests of individual companies (egoism) frequently collides with the common interests in business relationships and networks (Markovits, 2004). Conflicts and disputes emerge when actors possess differing views of what such common interests are (egocentrism) (Markovits, 2004; Veal and Mouzas, 2010). In line with Hardin (1968), Veal and Mouzas (2010, p.422) conclude that these disagreements originate in the dysfunctionality of *"individual incentives for preservation of the resource* […], *resulting in damaging behaviour by the collective group of users"*. In fact, Hardin (1968) ultimately sees no technical solution to such behaviours and describes safeguarding global commons (such as a stable climate) as being a fundamentally human problem.

The behavioural aspects introduced above have highlighted some of the inherent behaviours that appear to occur when companies interact in response to climate change. Veal and Mouzas (2010, p.431) have provided an excellent starting point to further our understanding of how such behaviours go hand-in-hand with interactions *"among interdependent actors in complex and global networks dealing with technical and subjective issues"* such as climate change. Veal and Mouzas (2010) themselves, however, highlight the need to examine these behaviours at a finer resolution.

To do so, however, requires moving beyond the IMP literature on interaction in business relationships and networks. While the IMP work allows establishing an understanding of the connectivity across a company's business network, it remains limited in its explanatory value with regard to understanding the behavioural aspects. A robust answer to how companies respond to climate change, therefore, calls for the IMP literature to be supplemented by the behavioural science literature. Accordingly, the next section provides insights into the behaviour that underpins human activities and establishes the link to network interactions in response to climate change.

2.2.3 Behavioural aspects of responding to climate change

One of the central ideas in the behavioural science is that human behaviour is subject to cognitive limitations, typified by three bounds: Bounded rationality, bounded willpower and bounded self-interest (Thaler, 1996; Jolls et al., 1998). These three behavioural limitations, also known as behavioural aspects that underpin a considerable amount of human behaviour, raise questions about *"the central ideas of utility maximization, stable preferences, rational expectations, and optimal processing of information"* (Jolls et al., 1998, p.1476; see also Thaler, 1996).

Firstly, the so-called *bounded rationality* refers to the cognitive limitations that constrain human behaviour when solving problems (Simon, 1955, 1990). Indeed, contrary to the traditional economic assumption that mankind acts rationally, Simon (1955, p.99) established that rationality is bound by *"the access to information and the computational capacities that are actually possessed by organisms, including man"*. In other words, human cognitive abilities are limited and bound to limited information and processing capabilities. Mullainathan and Thaler (2000, p.5) put it simply: *"We have only so much brainpower, and only so much time, we cannot be expected to solve difficult problems optimally"*. As a result, humans tend to make judgements (beliefs) and choices that are irrational. Examples from the extensive list of how judgement may depart from rationality include 1) the irrational escalation of initial commitment, 2) the assumption that gain must come at the expense of another party, 3) the anchoring of judgements upon irrelevant information, 4) the ignorance of more relevant data, 5) the failure to learn from the other side's perspective, and 6) being overconfident (see Kahneman et al., 1982; Bazerman and

Neale, 1993). Collectively, the illustrations show that rationality *"of human choice is not always evidenced in reality"* (Simon, 1955, p.16).

Secondly, *bounded willpower* reflects that people may behave contradictory to their own long-term interests (Jolls et al., 1998). Such choices are predominately captured in Kahneman and Tversky's (1979) prospect theory which describes human decision making under uncertainty. Specifically, the seminal work of Kahneman and Tversky (1979) suggests that positively framed problems, i.e. the gains that can be obtained when addressing a problem, prompt risk-averse behaviour. Negatively framed decisions, i.e. what can be lost when not addressing a problem, prompt risk-seeking behaviour (Kahneman and Tversky, 1979). Furthermore, Kahneman and Tversky (1991), Tversky and Kahneman (1991) and Kahneman et al. (1991) found that human behaviour is characterised by loss aversion as individuals have the tendency to prefer avoiding a loss rather than risk losing resources. As a result, Jolls et al. (1998) point out that a bounded willpower emerges and causes people to behave contradictory to their own long-term interests.

Thirdly, *bounded self-interest* refers to the fact that people care about others and care about being treated fairly (Jolls et al., 1998). Hence, humans are willing to sacrifice themselves to help others (Mullainathan and Thaler, 2000). Indeed, contrary to the traditional economic assumption that self-interest is the primary driver of human behaviour, humans may take selfless action.

These three bounds put forward by behavioural scientists provide some clues as to what may or may not explain some of the behaviours in business relationships and networks. In fact, the review of the behavioural science literature shows that not only do behavioural limitations exist but that even more complex types may occur when multiple actors interact (Mnookin, 2003). It seems that the inverse relationship between the number of actors and the likelihood of reaching a positive result complicates the interaction. In an attempt to improve the chances of a positive result, individuals tend to behave in similar ways, a phenomenon known in the literature as herding (e.g., Kindleberger, 1978; Banerjee, 1992; Shiller, 1995, 2000; Mouzas and Ford, 2011).

Herd behaviour refers to the tendency of humans to act akin to others around them (Banerjee, 1992). In other words, *"People who interact with each other regularly tend to think and behave similarly"* (Shiller, 1995, p.181). The tendency to be part of such herds, however, may be characterised by irrationality. This includes motivations such as loyalty (e.g., Jost 1995) and frequently leads to irrationally supporting the herd's arguments while neglecting potential oppositions (Shiller, 1995).

Interestingly, a study conducted by Mouzas and Ford (2011), provides evidence that individual actors in business relationships and networks follow a similar pattern of behaviour. In fact, network actors may act alike and form herds based on joint understandings of a problem; this may occur unknowingly and even in the absence of any coordinated action. Such herding behaviour, so Mouzas and Ford (2011) conclude, may characterise activities when addressing a business problem.

Herd behaviour might help us to understand how companies form coalitions (Sebenius, 1983); a notion that appears intrinsically similar to the network approach. Rubin and Brown (1975) define such coalitional behaviour as:

> *"The unification of the power or resources (or both) of two or more parties so that they stand a better chance of obtaining a desired outcome or of controlling others not included in the coalition."* (Rubin and Brown, 1975, p.64)

Coalitions are often based on analogous intrinsic values and beliefs, meaning that a powerful coalition has the ability to block any agreement that may not be in line with its shared principles (Lax and Sebenius, 1991; Sebenius, 1995). Moreover, the dynamics within the coalition can lead to that coalition collectively exhibiting tough and unyielding behaviour (Hampson, 1995). Hence, coalitions – if performed in an imperfect manner – may be a source that explain the outcomes stemming from the interaction in business relationships and networks.

Besides these behavioural aspects that explain much of the human behaviour in general, the behavioural science literature also suggests that a set of behaviours are operating when responding to climate change (Bazerman and Hoffman, 1999). These include a limited cognition of the problem (Hoffman and Bazerman, 2007; Gifford and Chen, 2017), behavioural habits (Knox and Inkster, 1968; Aarts and Dijksterhuis, 2000; Lindenberg and Steg, 2007), discredence (Brehm, 1966; Opotow and Weiss, 2000) and uncertainty avoidance (Schiffman et al., 2006; Okereke, 2007). Overall, Gifford (2011) found a staggering amount of 36 different behaviours that may occur when responding to climate change.

Most pertinent to this study, however, is that human behaviour in response to climate change is driven by concerns over the scarcity of resources and the basic human belief of a fixed-resource pool (e.g., Bazerman et al., 2000). This may characterise responses to climate change as individuals perceive that they are not able to enlarge the planet and its resources are limited (Hardin, 1968). In fact, in such a situation, individuals benefit more when protecting their own business resources while continuing to exploit the natural resources. This behaviour will ultimately lead to an eradication of the resource (as vividly illustrated by the herdsmen tragedy earlier in this chapter) (ibid, 1968).

Behavioural scientists have argued that responding to climate change relies on the ability to overcome inherent behaviours such as egoism, egocentrism, hyperbolic discounting, the undoing bias and risk recognition. Here, it is fundamental to acknowledge the self-serving nature of actors (egoism) and diverging understandings of *what* the common interest is (egocentrism) (Markovits, 2004; Epley et al., 2006; Susskind and Weinstein, 1980). Moreover, humans have a tendency to hyperbolically discount benefits expected in the future (Weber, 2006). Thus, climate change mitigation may appear as a rather unattractive solution since immediate costs are incurred to create benefits that are discounted by the time they can be taken into account.

Bazerman and Hoffmann (1999) found that behavioural aspects influence the risk recognition of humans because they create a biased view of the world and often operate subconsciously. In other words, 'risk as feeling' is the core driver of risk perception. Climate change, however, influences the perception at the level of 'risk as thinking', meaning that individuals would only start to perceive climate change as a threat when examples of harm are visualised (Bazerman and Malhotra, 2006; Kahneman et al., 1982; Loewenstein et al., 2001; Weber, 2006).

These advances in the behavioural science could provide the incremental insights necessary to improve our understanding of the behaviour in networks. That said, however, the behavioural science literature is commonly based upon an examination of the behaviour of individual actors and hence can only shed light on how individuals respond to climate change. What is most pertinent to this study, in contrast, is the question of how such behaviours play out in the context of *business* responses to climate change. In fact, three fundamental changes are evident compared to the behaviour of individuals (Ferraro, 2016).

Firstly, the primary objective of a company is profit maximisation while an individual seeks to maximise utility. Secondly, businesses operate in a competitive environment that may affect individual behaviour. This could mean that competitiveness eliminates behavioural deficiencies. Thirdly, important decisions in companies are normally taken by a group of people rather than a single individual. Here, the behavioural science suggests that groups may be more rational and less prone to some of the behavioural deficiencies occurring at the individual level (ibid, 2016). These commonly hypothesised explanations, however, are usually based on experimental approaches in laboratory conditions (Kelman, 2011). There is a lack of pertinent empirical evidence that could contribute to explaining how these behaviours play out 'in the real world' and particularly within a business context (Marewski et al., 2010).

The IMP literature offers some clues as to how the insights stemming from the behavioural science may translate into a business situation. Guercini et al. (2014, 2015), for example, offer a starting point for examining the behavioural processes in business relationships and networks. Interestingly, Guercini et al.'s (2014) conceptual paper on behaviour in business relationships suggests that individual actors use heuristics in an effort:

> *"To make sensible decisions because the commitments they make and the solutions and arrangements they identify and implement have substantial economic consequences."* (Guercini et al., 2014, p.930)

Heuristics, as defined by Kahneman (2011, p.98), relate to *"a simple procedure that helps find adequate, though often imperfect, answers to difficult questions"*. According to Simon (1967, 1972), actors rely on these heuristics in order to overcome their behavioural deficiencies. Although Guercini et al. (2014) assume that such heuristic procedures are used by actors in business relationships and networks, empirical evidence that confirms or rejects this proposition is yet to be produced. In fact, Guercini et al. (2014) conclude that:

> *"Research on business relationships dealing with factors that explain individual behaviors has been limited, and most of the research on interaction in business relationships appears to 'black-box' individual interaction behaviors."* (Guercini et al., 2014, p.930)

Therefore, Guercini et al. (2014, 2015) call for further research on the interaction and behaviour within and across different business relationships.

In conclusion, the behavioural science literature provides incremental insights into how businesses may behave in business relationships and networks. What is yet to be understood, however, is whether such behaviours translate directly into the behaviour in networks. In an attempt to answer this question, in the next section, I employ the theoretical understanding outlined above to propose an initial theoretical structure for the study of business responses to climate change. Thereby paving the way for unveiling the interaction and behaviour in networks, and thus ultimately to explain how companies respond to climate change.

2.3 Towards an understanding of business responses to climate change

To develop a more comprehensive understanding of business responses to climate change, I propose an initial theoretical structure that consists of three pillars: 1) *Network tensions*, 2) *Network interactions*, and 3) *Network outcomes*. This initial structure was driven from the theoretical understanding developed by the previously reviewed literature but also from the case studies. In fact, each of the three pillars emerged through an iterative process of moving back and forth between the extant literature and the empirical cases. The resulting structure for the study of business responses to climate change has therefore been redefined repeatedly whenever the empirical findings provided new insights. Before outlining this initial theoretical structure in more detail, I ought to provide an explanation of how I derived each of the pillars.

During the early stages of analysing the empirical findings in light of the organisation and management literature on business responses to climate change, as well as the interactional and behavioural insights stemming from the network approach and the behavioural science literature, I realised that in each case it appeared that the socio-cultural, legal/regulatory and economic changes in response to climate change had triggered efforts to mitigate carbon emissions. This was largely driven by a discontinuity between the needs emanating from contextual socio-cultural, legal/regulatory and economic developments and existing business practices. As a result of this empirical observation, I termed the first pillar of the initial theoretical structure as network tensions.

Interestingly, in each of the empirical cases, the companies began to interact within and across their business relationships and networks in order to overcome such network tensions. To do so, companies initiated activities in order to access the necessary resources which were not available in concentrated form but rather located within the company's business relationships and networks. In an attempt to account for these interactions and behaviours I included network interaction as the second pillar of the initial theoretical structure.

These successive interactions and behaviours commonly resulted in observable outcomes which are covered in the third pillar of the initial theoretical structure: network outcomes.

From this chronological process in each of the cases, I derived an empirically driven and theoretically grounded structure for the study of business responses to climate change that seeks to elucidate the interaction and behaviour in business relationships and networks.

Within and across these three interrelated pillars of this structure, I focus on the three dimensions of actors, activities and resources. In fact, I hope that by now the attentive reader will have realised that I have implicitly introduced actors, activities and resources throughout the literature review as they are fundamental for the study of business responses to climate change. To further illuminate these three pillars, I draw upon the Actors, Activities and Resources (AAR) Model originally developed by Håkansson and Johanson (1992).

The AAR Model emphasises that the totality of interdependencies in business networks can only be *"captured through an integrated view of the relationships among all these dimensions"* (Easton and Håkansson, 1996, p.407). The first dimension of the AAR model refers to individual companies as actors that possess resources and perform activities (Gadde et al., 2003). These actors purposefully combine activities and resources in order to address and resolve short- and long-term problems (Guercini et al., 2014).

The second dimension of the AAR model relates to successive interaction aimed at integrating and coordinating activities with counterparts (Ford et al., 2008). In doing so, the activities of actors (e.g., production, logistics, etc.) become more or less systematically linked. Depending on the strength of the emerging activity links, actors are able to benefit from synergies such as lower costs or increased efficiency (Ford et al., 2008).

The third and final dimension of the AAR model relates to the resources of actors. Through the process of interaction the resources of two actors *"become more or less adapted and more or less mutually tied together"* (Ford et al., 2008, p.14). This could include both tangible (e.g., plants, equipment) and intangible (e.g., knowledge) resources. As an outcome of interaction over time, resource ties *"arise as the two parties in a relationship confront and mutually adapt their resources"* (Ford et al., 2008, p.14).

The three dimensions of actors, activities and resources comprise the content of the behaviour in business relationships and networks, and hence scrutinising the network tensions, network interactions and network outcomes in and around these dimensions permit the development of a more comprehensive understanding of business responses to climate change and ultimately enables an explanation of how companies interact and behave in response to climate change.

To do so, however, requires looking at the entire structure across the dimensions of actors, activities and resources for each of the three pillars of network tensions, network interactions and network outcomes. In fact, while each stage is individually significant for the study of business responses to climate change, it is only through the amalgamation of all three pillars that allows the development of a more comprehensive understanding.

Figure 2 below illustrates this theoretically derived and empirically grounded structure for the study of business responses to climate change.

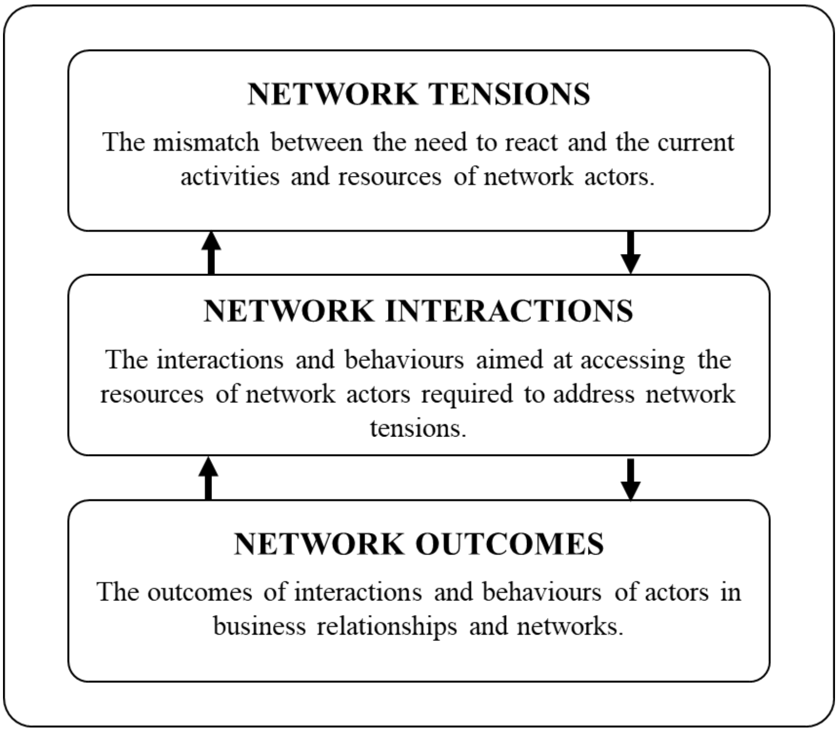

Figure 2: *An initial theoretical structure for the study of business responses to climate change*

Having established the importance of the three dimensions of actors, activities and resources, I now provide a more detailed explanation of the three pillars: 1) *Network tensions*, 2) *Network interactions,* and 3) *Network outcomes*.

2.3.1 Network tensions

Network tension, as the first pillar of the initial theoretical structure for studying business responses to climate change, refers to the tension between current operations (e.g., the business focus on short-term profitability) and the emerging need to change (e.g., decarbonising business operations). Such tensions are driven by discontinuities between the needs (emanating from contextual socio-cultural, legal/regulatory and economic pressures) and existing business offerings (existing business patterns). Here, the emphasis is on how these tensions play out across the actors, activities and resources domains of the AAR model when scrutinising the interaction and behaviour in business relationships and networks.

The network tension aspects of the proposed theoretical structure were derived by setting the empirical findings against the organisation and management literature on business responses to climate change and against the interactional and behavioural insights stemming from the network approach and the behavioural science literature. Besides providing strong evidence of such network tensions throughout all of the five empirical cases underpinning this study, the existing knowledge, particularly the work of Okereke et al. (2012), as well as that of Wright and Nyberg (2017), highlights the fundamental importance of analysing the ways in which climate change, in particular, has created tensions within companies and their wider business relationships and networks. In fact, it is only a comprehensive understanding of such network tensions that can provide the basis for unearthing the interactional and behavioural aspects that explain how companies respond to climate change. This is largely because it appears to be the network tensions that reinforce the ways in which businesses interact and behave in relationships and networks and thus ultimately respond to climate change.

2.3.2 Network interactions

Network interactions, as the second pillar of the initial theoretical structure for studying business responses to climate change, refers to the interaction in business relationships and networks aimed at overcoming the network tensions that contextual changes, and its antecedents, have brought about. In fact, network interactions relate to scrutinising the ways in which actors initiate activities to access the resources required to respond to climate change. The network interactions pillar is built on the notion that the resources a company requires to respond to climate change are not available in concentrated form but rather located within a company's business relationships and networks. This was suggested by previous research (Veal and Mouzas, 2010; Ferraro et al., 2015) and vividly illustrated in each of the empirical cases.

Besides the strong evidence for the interactional and behavioural aspects in the empirical cases, the relevance of the network interactions pillar came through particularly in the previous work by Ritter et al. (2004), Mouzas and Ford (2009), Veal and Mouzas (2010), Ansari et al. (2013) and Finke et al. (2016). Collectively, these studies highlight that developing a comprehensive understanding of how companies respond to climate change, requires moving beyond the individual company to take a network of companies as the unit of analysis. In fact, capturing how companies interact in business relationships and networks is vital to understanding how businesses access the network resources required to respond to climate change.

Furthermore, analysing the network interactions when studying business responses to climate change permits an understanding of the mechanisms ingrained in the interactions and behaviours within the network that may explain the observed network outcomes. As previous research suggests, the interactional aspects ingrained in the network behaviour may include the multiplicity of interests held by actors (e.g., Finke et al., 2016) as well as the recognition of risk, framing and reference points, the abundance of conflicts and disputes (e.g., Veal and Mouzas, 2012), bounded rationality, bounded willpower and bounded self-interest (e.g., Thaler, 1996). How these behaviours play out at the network-level simply cannot be uncovered when investigating individual companies. The interaction in relationships and networks of businesses is, therefore, a central element of the initial theoretical structure for studying business responses to climate change.

2.3.3 Network outcomes

Network outcomes, as the third and final pillar of the initial theoretical structure for studying business responses to climate change, refers to outcomes stemming from successive interactions and behaviours over time. Such network outcomes are observable and manifested in the ways in which the network interaction has transformed actors, activities and resources. It is these that are the observable manifestations of the phenomena that I encounter.

Previous research on network outcomes related-aspects stemming from business responses to climate change is limited. According to Finke et al. (2016) business interaction in response to climate change can lead to either inaction or action, while the latter *"may not always be the case"* (Finke et al., 2016, p.95). What the extant literature does not do, however, is to provide a more nuanced understanding of what brings about network outcomes. In fact, the *"sheer unknowability of effects and outcomes in a network"* (Ford and Mouzas, 2007, p.8) implicitly calls for establishing a deeper understanding of network outcomes. To do so, the third and final pillar of the initial theoretical structure accounts for the network outcomes that stem from business behaviour within and across their wider business relationships and networks aimed at accessing the resources necessary to respond to climate change.

This seems particularly pertinent in the case of business responses to climate change because what appears to underpin all of the behaviours identified in the literature review (i.e., short-term economic objectives, a reliance on growth, uncertainty avoidance, overreliance on rules and regulations, and organisational inertia) (e.g., Bazerman and

Hoffman, 1999, 2007; Okereke, 2007; Gifford, 2011; Veal and Mouzas, 2010; Finke et al., 2016; Shevchenko et al., 2016; Wright and Nyberg, 2017) is that no individual company alone possess the resources necessary to respond adequately to climate change (Veal and Mouzas, 2010; Finke et al., 2016). It is only through analysing what brought about the network outcomes that permit answering the question of how companies respond to climate change.

2.4 Conclusion

This chapter has laid out the theoretical basis of this study. I started by providing an introduction to business responses to externally generated pressures in general and to climate change specifically. Next, I reviewed the business tensions that climate change has brought about. Then, I problematised the current organisation and management approaches employed to explain business responses to climate change. Furthermore, building on the business marketing literature in and around business relationships and networks, I outlined the network approach as an alternative theoretical lens. Next, I drew upon the behavioural science literature to dig deeper into the interactions and behaviours when companies respond to climate change.

Towards the end of this chapter, and largely as a result of an iterative process between the three distinct kinds of literature introduced throughout this chapter and the empirical findings presented in this study, I proposed an initial theoretical structure for the study of business responses to climate change.

In the following chapter, I describe the methodological procedures underpinning this study.

3 Methodology

This chapter outlines the methodological procedures underpinning this study. I begin by describing the research paradigm, thereby outlining my axiology, justifying critical realism as the research epistemology and elucidating the network approach ontology. I then provide insights into the research process of retroduction and systematic combining. Next, I explain the case study research method and outline the data sources as well as the data reporting. Subsequently, I introduce my approach to data analysis and show that research ethics have been upheld at all stages in the conduct of this study. I close this chapter with a brief conclusion.

3.1 Research paradigm

Research paradigms refer to the basic beliefs and worldview of the researcher. This includes *"the nature of the 'world', the individual's place in it, and the range of possible relationships to that world"* (Guba and Lincoln, 1994, p.107). To account for the basic beliefs and worldview that ultimately drove the inquiry articulated in the research questions, I now turn to the study's axiology, epistemology and ontology.

3.1.1 Axiology

I would be naïve to argue that this thesis – just like any other research project – has been conducted in isolation from my personal values and beliefs. As suggested by Ponterotto (2005, p.131), therefore, *"the researcher should acknowledge, describe, and 'bracket' his or her values, but not eliminate them"*. Over the next few paragraphs, I concentrate on exactly this by highlighting the personal values that – at least to a certain degree – may have influenced the way in which I have conducted this study.

While the fact that I am born in Germany may play a minor role in terms of my non-native English, what seems more pertinent to this study is my interest in understanding responses to climate change. As highlighted in the introduction, my interest in climate change can be traced back to watching Al Gore's movie *'An Inconvenient Truth'* in 2006. I was surprised that despite the increasing number of storms, droughts and other natural disasters that illustrate the threats stemming from global climatic changes, companies, governments and individuals alike continued to emit carbon emissions as usual. As a result of watching Al Gore's movie, I wanted to understand how individuals and companies, in particular, behave when responding to climate change.

Throughout my undergraduate and postgraduate studies in International Business, I was educated about companies and their inherent drive for profitability. Little, however, was taught about the negative externalities (such as carbon emissions) related to making such profits. Therefore, I signed up for an Interdisciplinary Summer School Programme on Climate Change, International Politics as well as Social and Political Philosophy at the University of Cambridge. It was during this time that I realised how little the international research community understands the processes of responding to climate change. It was this that prompted me to embark on the intellectual journey of conducting this study.

In the next section, I introduce critical realism as my epistemological stance.

3.1.2 Epistemology – Critical realism

In this thesis, I employed an epistemological stance that is in line with the critical realist perspective. Understanding the epistemological assumptions underpinning this study is crucial as it is reflected in the interpretation of my empirical findings. In other words, it builds the basis for *“claiming to know what we know”* (Easton, 1998, p.370). The central element of critical realism is the underlying assumption *“that there is a reality ‘out there’ waiting to be discovered and that reality is independent of us”* (Easton, 1998, p.373). Since it is difficult to prove or disprove whether there is a ‘real world’ out there or not, however, it is that *“we behave as if it was true, as if the world was real”* (Easton, 2010, p.119). I am therefore aware that the findings presented in this study are only one version of the story that could have been told.

The reason for adopting a critical realist perspective is rooted in its ability to answer the research questions underpinning this thesis. Indeed, by utilising the critical realist epistemology I was able to unearth why certain events occurred and not merely that they took place (Mason et al., 2013). This is due to the structure of causal explanation on which critical realism is based upon:

> *“Causality concerns not a relationship between discrete events (‘Cause and Effect’) but the ‘causal powers’ or ‘liabilities’ of objects and relations, or more generally their ways of acting.”* (Sayer, 1992, p.104)

Easton (2010) puts it in slightly less abstract terms: entities (organisations, people, relationships, etc.) are nested within structures (departments, processes, etc.) that affect one another through causal powers (e.g., to persuade other entities) and liabilities (e.g., to be rejected by other entities). Most pertinent to this study, however, is that these causal powers or liabilities will, if a specific condition is given (e.g., a demand is matched with a suitable offer), cause an event (e.g., sale) and, if a specific condition is not given (e.g., an offer does not match the demand), then will cause a different event (e.g., no sale) (Easton, 2010). It is these causal powers or liabilities that explain how companies respond to climate change. The logic underpinning this structure of the causal explanation is based on Sayer's original model (Sayer, 1992); illustrated in Figure 3 below.

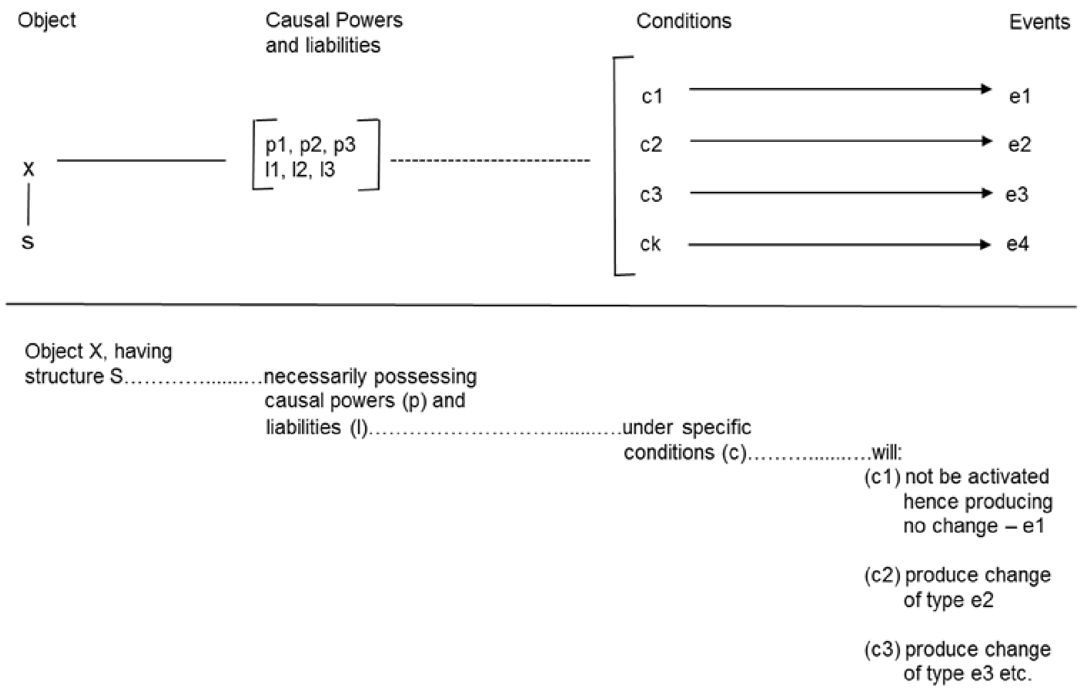

Figure 3: *The structure of causal explanation (Sayer, 1992, p.109)*

An essential premise of critical realism is the distinction between two types of relations between entities, namely necessary and contingent relations. Easton (2010, p.121) simplifies the differences between the two types of relations by stating that entities *"can have some relation (necessary) that will affect one another and some (contingent) that may affect one another".* Necessary relations occur when entities are dependent on one another and cannot exist without their counterpart (Easton, 2010). An example from Sayer (1992, p.89) vividly proves this by referring to the slave and master relationship:

"The relation between a slave and a master is necessary, in that what the object is dependent on is its relation to the other; a person cannot be a slave without a master and vice versa".

The ways in which the necessary relations of entities cause events are multifaceted; in one case it is characterised by rich information while in another case it is inherently logical (Easton, 2010). What is essential to this study, however, is the need to specify even the most trivial necessary relations. This is because necessary relations are embedded in a larger construct of referential and interdependent relations between entities which will affect one another (Easton, 2010).

Contingent relations, as the second type of relations between entities, are present when *"it is neither necessary nor impossible that they stand in any particular relation"* (Sayer, 1992, p.89). Entities can, therefore, exist without their counterpart but may affect one another (Easton, 2010). In fact, critical realists acknowledge the fundamental importance of identifying the contingent relations since they are *"the product of causal processes and have their own causal powers and liabilities"* (Sayer, 1992, p.140). Unsurprisingly, when specifying both necessary and contingent relations it is essential to explain the events related to the phenomenon under study (Easton, 2010). A critical realist would argue, however, that these events cannot occur without being experienced and thus I differentiate between experience, events and mechanisms (Easton, 1998).

In this regard, Bhaskar (1978) suggests distinguishing between the real, actual and empirical domain (Table 1 schematically illustrates Bhaskar's classification of these domains). The domain of reality is highlighted by crosses (X) to signpost where mechanisms, events and experiences are present or possible. In the real domain, the existence of events presupposes the existence of mechanisms that created those events

(Tsoukas, 1989). Although these events occur in the actual domain, they are only experienced by the observer in the empirical domain (Bhaskar, 1978).

	Real domain	**Actual domain**	**Empirical domain**
Mechanisms	X		
Events	X	X	
Experiences	X	X	X

Table 1: *Classification of the real, actual and empirical domains (Bhaskar, 1978, p.2)*

While this sounds reasonably straightforward in Bhaskar's (1978) classification, in practice it turned out to be a key challenge; particularly the process of untangling the asynchronous nature of events – which were observed through the experience of the participants – and the mechanisms which created them. In an effort to overcome this challenge and thereby allowing to provide a robust explanation of why an event occurred rather than just what happened (Mason et al., 2013), I focused on repeatedly asking myself about each event: *"'what makes it happen', what 'produces', 'generates', 'creates' or 'determines' it, or, more weakly, what 'enables' or 'leads to' it"* (Sayer, 1992, p.104).

Following this procedure has helped me to identify the string of causal powers and liabilities to develop an understanding of why the events occurred in the way they did and what must be true to have brought about these events in each of the five empirical cases. I argue that it was only through adopting a critical realist perspective, with its inherent focus on identifying causal mechanisms, that allowed me to move from answering what has happened to the more important question of why the events occurred in the way they did (Mason et al., 2013). Based on this argument, I see critical realism as being the ideal research epistemology to answer the research question of how companies respond to climate change.

In the next section, I outline how the critical realist epistemology is linked to the network approach as the ontological precept of this study.

3.1.3 Ontology – The network approach

At the most basic level, ontology refers to the underlying *"assumptions about how the world is"* (Easton, 2002, p.108). In line with the thinking originally established by the IMP Group, I see the world as consisting of exchange relationships and interdependencies that build the structures in which actors, activities and resources interact (Håkansson and Johanson, 1992; Håkansson and Snehota, 1995). Within these structures, it is fundamental to capture both mechanism and context since *"causal outcomes follow from mechanisms acting in context"* (Pawson and Tilley, 1997, p.58).

The context describes the *"conditions which allow the mechanism to come into operation"* (Pawson and Tilley, 1997, p.58). Interestingly, the causal mechanisms that explain why events unfolded in the way they did can only be unearthed when considering the context in which these events occurred. Based on what Pawson and Tilley (1997) describe as the mode of generative causation, I illustrate the interplay between an action, mechanism, outcome and context in Figure 4 below.

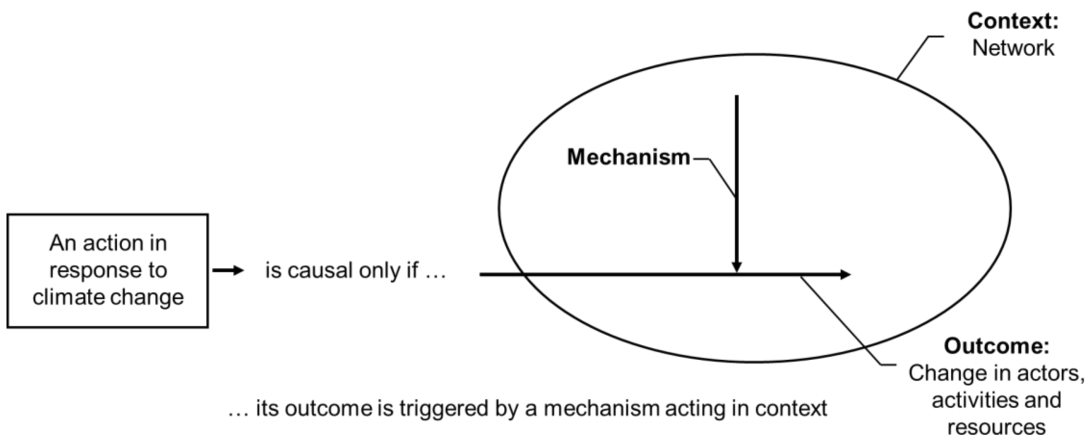

Figure 4: *Generative causation of business responses to climate change (adapted from Pawson and Tilley, 1997, p.72)*

The process of taking into account the broader context in which business relationships and interdependencies take place is referred to as a network ontology; although the term network is to be seen in its metaphoric sense (Easton and Araujo, 1994; Mouzas and Ford, 2009). Employing the network approach as the underpinning ontology of this study facilitated deconstructing the necessary and contingent relations between entities by acknowledging both their dyadic nature as well as the context in which these relations occur (Anderson et al., 1994; Easton, 2002; Mouzas, 2006).

It is important to reiterate, however, that I take a *"less prescriptive and more universal perspective"* on relations, focusing on the nature of the phenomenon of business responses to climate change rather than the performance of a dyadic relationship (Easton, 2002, p.107). Indeed, by emphasising that the occurrence of a phenomenon is relative to the context in which it is embedded, the network ontology aided me to overcome the inherent challenge of so-called 'dyadic atomization' (Granovetter, 1992; Anderson et al., 1994). In other words, Easton and Araujo (1994, p.75) explain that *"all real life exchange takes place in the context of relations more extensive than the* *exchange itself"* (emphasis of the original work by Macneil, 1986, p.577). It is therefore particularly the higher level of aggregation, at which the network ontology operates, that enabled me to move beyond the analysis of dyadic relations and unearth the causal explanation for the interactions and behaviours in business relationships and networks (Mouzas, 2006).

The inherent focus on business relationships and networks that defines the network ontology, however, is intrinsically linked to the methodological challenge of determining the boundaries of the networks under study. In fact, since networks are characterised by flexibility and interconnectedness with a multiplicity of other networks, at least in theory, they do not have natural boundaries and hence are limitless and indefinite. In practice, however, it is impossible to capture the entirety of all necessary and contingent relations (Rowley, 1997; Mouzas and Ford, 2009). In order to overcome this challenge, I used the research objective of answering how companies respond to climate change to determine the specific network boundaries (Easton, 2010). Hereby, the network boundaries equate to the limits of the underlying ontological assumptions about how the world is. I further illuminate my process of setting network boundaries in the research method section on *Data reporting*.

In the next section, I introduce retroduction and systematic combining as the research process that I adopted in this study.

3.2 Research process

The research process refers to the researcher's primary method of analysis and approach to developing theory. In this section, I introduce this by describing retroduction and systematic combining as the procedures that guided the conduct of this study.

3.2.1 Retroduction

The research process under critical realist conditions is inherently driven by retroduction, i.e. the identification of causal mechanisms (Easton, 2010). Retroduction, as a meta-process underpinning this study, can be best defined as a *"mode of inference in which events are explained by postulating (and identifying) mechanisms which are capable of producing them"* (Sayer, 1992, p.107). Retroduction involves 'moving backwards' in the research process by asking *"What happened?"*, *"Why did it happen?"* or in other words *"What must be true in order to make this event possible?"* (Easton, 2010, p.123). This does not mean that I hypothesised causal mechanisms and then collected the data, however. Instead, it rather followed Easton's (2010, p.124) assumption that *"in practice, the process is likely to be an iterative one"*. In fact, this tied in well with the *Data analysis* procedures explained later in this chapter as the analysis of the data was an iterative process rather than following linear conventions. The research process was, therefore, one of systematic combining (Dubois and Gadde, 2002).

3.2.2 Systematic combining

When I started to conduct this study, I was faced with the decision of either following an inductive or deductive approach. Inductive cycles of data collection focus on generating theory from empirical data (Dubois and Gadde, 2002). In this approach, the literature is sought after the data has been collected, which is commonly referred to as grounded theory (e.g., Glaser and Strauss, 1967). On the other hand, deductive cycles of data collection are based on identifying a phenomenon of interest and developing a theoretical structure that allows testing these propositions through empirical data (Dubois and Gadde, 2002; Easton, 2010). As the process of conducting this study unfolded, however, I found it challenging to keep inductive and deductive approaches distinct. It was impossible for me to go entirely theory-free into the data collection and analysis. With a purely deductive approach, on the other hand, I felt restricted in my ability to generate theory through the case studies. In an attempt to overcome these limitations, I used systematic combining as a procedure to guide the research process.

Systematic combining is grounded in an abductive logic (e.g., Peirce, 1931) which allows *"constantly going 'back and forth' from one type of research activity to another and between empirical observations and theory"* (Dubois and Gadde, 2002, p.555). Guided by systematic combining, the research process underpinning this study started by developing an initial theoretical structure consisting of theoretically-derived preconceptions about the empirical phenomenon of business responses to climate change. It was the unanticipated insights gained from empirical observations, however, that led me to re-examine the literature in order to include the nuances related to the interactional and behavioural aspects in business relationships and networks. In line with Dubois and Gadde (2002), it was this evolving conceptual framework that guided the research process. I, therefore, repeated the process of constantly moving between initial theoretical structure, empirical observation, data analysis, conceptualisation as well as drawing and verifying conclusions about how companies respond to climate change.

Adapted from Dubois and Gadde (2002), I illustrate the systematic combining research process and the associated interplay of theory, initial theoretical structure, the empirical world and the case in Figure 5 below.

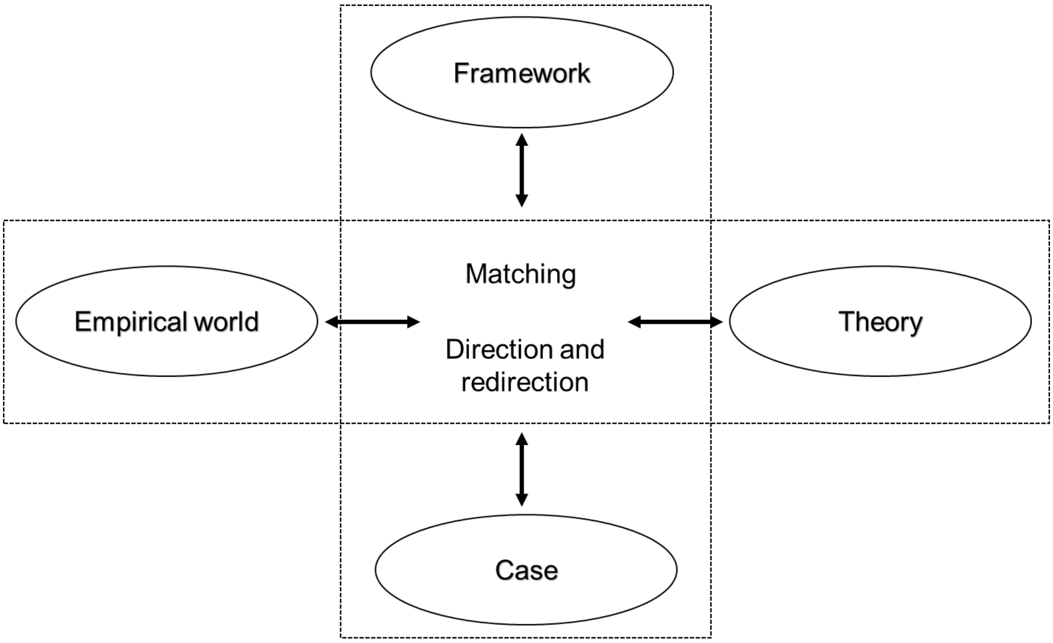

Figure 5: *Systematic combining (Dubois and Gadde, 2002, p.555)*

In the next section, I focus on answering how the critical realist epistemology, the network ontology as well as the research process of retroduction and systematic combining have enabled the development of five in-depth case studies. It is these cases that formed the empirical basis for the provision of a causal explanation of how companies respond to climate change.

3.3 Case study research method

In this section, I introduce the case study approach as the prevailing research method of this study. To do this, I start by outlining how the research objectives, as well as the epistemological and ontological precepts, drove the selection of the research methods. Next, I explain the method for data collection, outline the rationale for selecting the cases (casing) and review how the cases were reported and analysed.

3.3.1 Research method

My decision to select the case study research method was an outcome of the research objectives as well as the underlying epistemological and ontological assumptions. The objective of my study was to explain how companies respond to climate change. In line with this research objective and the critical realist epistemology, I had to select a research method that would allow me to develop valid explanatory knowledge to dismantle the causes of how companies respond to climate change. Furthermore, the network ontology inherently required the identification of such causal mechanisms and the context in which entities operate. The research methods, therefore, had to be based on sources of empirical data that describe entities in relation to their context.

As a result of this requirement, I have chosen the case study research method. I argue that the case study research method is well-suited to meet all the requirements stated above. In fact, Yin's (2009) definition of a case study indicates how well it fits with the research objectives as well as the epistemological and ontological precepts of this study:

> *"A case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident."* (Yin, 2009, p.18)

One common shortcoming of case study research, however, is the challenge of 'only' investigating *"one or a small number of social entities or situations"* (Easton, 2010, p.119). Consequently, the issue of generalisation needs consideration. *Positivists* would argue that one case cannot be generalised because case studies are inferential when statistically generalising to the whole population (Easton, 1998). In line with the critical realist epistemology, however, I did not aim to enumerate frequencies (statistical generalisation) but rather to identify causal explanations that allowed me to expound and generalise theoretical propositions (analytical generalisation) (Yin, 2009).

By scrutinising the nature of the phenomenon under study (business responses to climate change) as well as the underlying assumptions of the critical realist epistemology and the network ontology I further illuminate how rigorous and coherent the case study research method is for this study.

Firstly, the objective of this study is to shed light on business responses to climate change which, by its nature of being a contemporary phenomenon, requires rich and timely data in order to be able to specify the causal mechanisms at play (Easton, 1998; Halinen and Törnroos, 2005). The case study method, which is usually conceived as an empirical inquiry into a contemporary phenomenon, permits the capture of rich and timely data by using *"multiple sources of evidence"* (Yin, 2009, p.18). In fact, Halinen and Törnroos (2005, p.1286) confirm that *"case research is particularly welcome in new situations where only little is known about the phenomenon".* The empirical phenomenon of responding to climate change represents such a new situation.

Secondly, critical realist research seeks to develop valid explanatory knowledge of mechanisms that create an *"event or set of events (i.e. case) by unpacking and describing the contingent causal power of objects that brought them about"* (Easton, 1998, p.382). The case study research method is inherently driven by being inquisitive and allowing to unveil the underpinning causal mechanisms and hence is well-suited to achieve this aim of critical realist researchers. Easton (1998, p.379) illustrates this match between critical realism and case study research method by stating that the latter enables:

> *"*[…] *to disentangle complexities and to conceptualise and reconceptualise, test and retest, to be both rigorous and creative and above all to seek for the underlying reality through the thick veil which hides it."* (Easton, 1998, p.379)

Thirdly, the network ontology reasons that the causal explanation of a mechanism can only be achieved when capturing the context in which entities operate and create events (Pawson and Tilley, 1997). Unsurprisingly, Halinen and Törnroos (2005, p.1286) suggest that it is particularly the case study research method that permits this because it is based on the notion of providing a *"many-sided view* […] *of a situation in its context"*. The case study method can, therefore, be said to fit well with the underlying network ontology. Furthermore, it is the complexity associated with capturing both mechanism and its context that, *"requires a methodology which can handle rich sources of data and multiple forms of data collection"* (Easton 1998, p.385).

In light of these specifications, I conclude that the case study research method is justified as the most suitable research method since this study is 1) investigating a contemporary phenomenon, 2) aiming to develop explanatory knowledge, and 3) capturing mechanisms and its context. In the next section, I introduce the types of primary data and supplementary types of data sources and how I collected them.

3.3.2 Data sources and data collection

This study is based on a widespread of data sources that serve as evidence. In fact, as a direct outcome of constantly going 'back and forth' between the different types of research activities (systematic combining), the emerging cases are built on a multiplicity of different data sources (Dubois and Gadde, 2002). Yin (2009) distinguishes six types of data sources for case study research, namely documentation, archival records, interviews, direct observation, participant observation and physical artefacts. A rigorous case study is based on multiple types of these data sources as *"no single source has a complete advantage over all the others"* (Yin, 2009, p.101). Moreover, Easton (1998) suggests that the underpinning epistemological and ontological assumptions of the researcher drive the type of data source that is collected. I, therefore, had to collect data from sources that would allow me to unveil the causal mechanisms operating and creating events within a context.

Moreover, the combination of different data sources had the advantage of permitting the triangulation of evidence. Data triangulation, as defined by Huberman and Miles (1994, p.438), refers to *"self-consciously setting out to collect and double check* *findings, using multiple sources and modes of evidence"*. Indeed, it was this mode of triangulation, embedded in the data collection process, which allowed me to provide a causal explanation of the mechanisms that explain how companies respond to climate change.

An additional advantage of using multiple data sources was that this multiplicity possesses the ability to reveal *"aspects unknown to the researcher, i.e., to discover new dimensions of the research problem"* (Dubois and Gadde, 2002, p.556). For me, this became particularly apparent throughout the research process of systematic combining.

In light of these specifications, the types of data underpinning this study are semi-structured interviews as well as supplementary documentation such as policy fora transcripts, consultations, legislative documents as well as strategy and emission reduction policy documents and media releases. Figure 6 illustrates and quantifies this convergence of evidence.

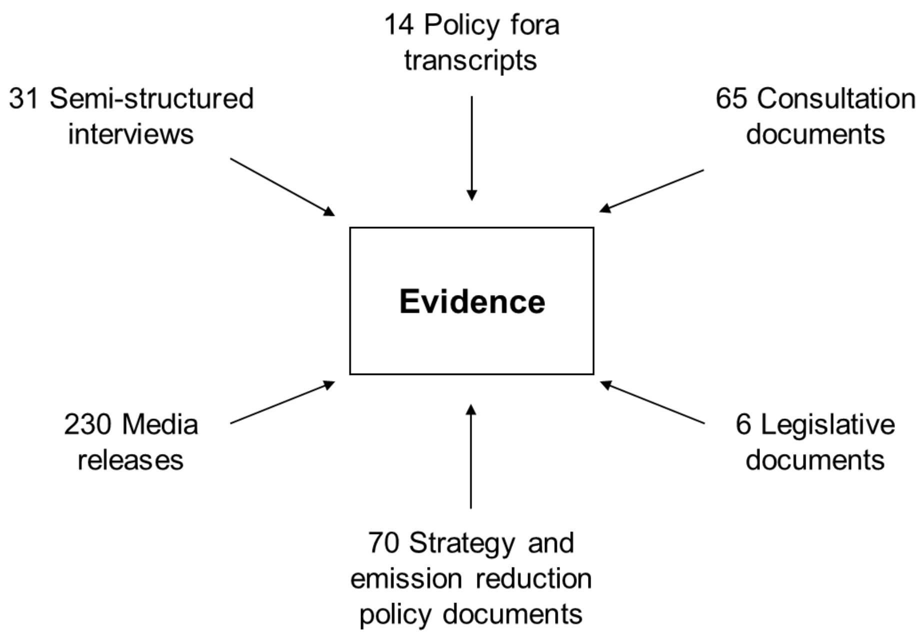

Figure 6: *The convergence of evidence*

In the next section, I provide more details on the nature of the interviews as the primary type of data as well as documentation as the supplementary type of data.

3.3.2.1 Semi-structured interviews

This study is based upon 31 in-depth semi-structured interviews as the primary type of data source. Interviews are *"probably the most widely used method employed in qualitative research, a central resource for social science"* (Edwards and Holland, 2013, p.1). Yin (2009) confirms that this is particularly true in case study research since case studies are concerned with human behaviour and events. In line with Edwards and Holland (2013), as well as Yin (2009), I found that it was the well-informed interviewees who were able to provide the best insights about the interactions and behaviours, as well as events, that explain how companies respond to climate change.

I adopted a semi-structured approach to interviewing as this allowed me to probe answers and modify questions based on the topics opened up by the interviewee. The resulting dialogue between the interviewee and myself enabled me to gather *"the context and content of the interview, how the interviewee understands the topic(s) under discussion and what they want to convey to the interviewer"* (Edwards and Holland, 2013, p.29). For each interview, I delineated a broad structure of topics that guided the discussion but remained flexible enough to pursue additional topics which suggested fruitful and relevant insights. The typical structure of topics pertinent to the interviews was:

1) The interviewee's role in the company
2) The company's understanding of climate change
3) The company's responses to climate change
4) The company's engagement with other actors in response to climate change

I argue that it was particularly the controlled flexibility characterising the semi-structured interviews underpinning this study that enabled me to minimise inaccurate preconceptions about the empirical world and to redefine the initial theoretical structure and conceptual framework of business responses to climate change (retroduction and systematic combining).

I recruited the interviewees for this study based on their ability to provide insights into the business relationships and networks in the context of responding to climate change. The nature of studying business networks, however, came with the paramount challenge of gathering multi-faceted insights from all actors embedded within a network. It, therefore, seemed intuitively appealing to me to engage with participants during industry conferences. Firstly, this had the advantage of having multiple network actors in one place at the same time. Secondly, attendees were industry or government experts in the topic under discussion. Thirdly, it allowed me to engage with potential interviewees during the networking sessions to share information about my research. Interestingly, whether or not I talked to a specific attendee during the industry conferences, seemed to play a minor role in how likely the eventual participation in my study was. In fact, when inviting conference attendees to participate in the study, it was rather the notion of sharing the experience of attending an event on a specific topic *both* relevant to the interviewee and myself that helped me to recruit interviewees.

Throughout the process of conducting this study, I attended five industry conferences in the UK with the specific purpose of engaging with potential interviewees. After each event, I contacted selected attendees via email to invite them for an interview (see Appendix 1 for a sample email). Throughout the data collection process, I sent approximately 600 email enquiries and received nearly 150 responses. Some conference participants respectfully declined my invitation, others agreed to participate but it turned out to be impossible to find time for the interview. While the participant recruitment process was somewhat random in the beginning, it became more focused as the five distinct cases emerged (see Table 4: Overview of case studies on page 88). Ultimately, I conducted 31 interviews of which 28 were directly related to the case studies (see Table 3: Data source material on page 77 for more details). Each interviewee was able to provide insights into the specific behaviour in business relationships and networks in the context of responding to climate change. Moreover, I gathered multi-faceted insights from multiple actors embedded in a business network.

The location of interviews was determined by convenience and accessibility for the interviewee and me. It was crucial to ensure that interviews were not interrupted and that audio recording was possible. As illustrated in the sample participant recruitment email (Appendix 1), I asked the interviewee to choose between a face-to-face and telephone interview. Most interviewees preferred the latter option because of their busy schedules and the additional work associated with hosting me as a visitor to their organisation. The advantage of conducting interviews via telephone was that it was time-efficient, saved travel expenses and allowed a wider geographical spread. This was particularly important as I continued to conduct telephone interviews with interviewees located in the UK while completing a three-month research visit at Nankai University in Tianjin, China.

I acknowledge that this came at the expense of not being able to gather information about the interviewee's appearance, non-verbal communication and the physical context (Edwards and Holland, 2013). Since some interviews were conducted face-to-face or via Skype™ and therefore offered the benefits of visual contact, however, it became clear that it is the in-depth insights into how interviewees' experienced specific events, rather than their appearance, non-verbal communication and the physical context that would ultimately allow the underlying mechanisms that explain how companies respond to climate change to be uncovered.

Answering the question of how many interviews are sufficient to allow the underlying mechanisms to be unveiled is fundamental in any study conducted under critical realist conditions. The ideal number of interviews depends on the uniqueness and complexity of the phenomenon under study, as well as practical issues such as the time and finances available (Edwards and Holland, 2013). In this study, I used the concept of saturation as an indicator of a sufficient number of interviews. Saturation describes the point in the interview process at which the insights gained from an additional interview are incremental since interviewees largely repeat arguments that have been made by other interviewees (Edwards and Holland, 2013). This point was reached after approximately 25 interviews. I continued to conduct six additional interviews, however, as I had already scheduled these when the first signs of saturation appeared. The insights that I gained from the additional interviews were incremental which I interpreted as indicative of having reached a sufficient degree of saturation.

In the next part, I introduce the supplementary documentation (e.g., policy fora transcripts, consultation documents, legislative documents and strategy as well as emission reduction policy documents and media releases) that I used to triangulate the insights gained from the semi-structured interviews.

3.3.2.2 Supplementary documentation

This study is based upon 14 policy fora transcripts, 65 consultation documents, 28 legislative documents, 70 strategy and emission reduction policy documents and 230 media releases as supplementary data sources. The explicit role of this documentation was to supplement and triangulate the data collected through the 31 semi-structured interviews. In fact, as suggested by Yin (2009), this documentary information has helped me to corroborate and augment the semi-structured interviews in four different ways.

Firstly, the documentary information allowed me to verify the names of organisations, names of individuals and technical information that were mentioned during the interviews. By the nature of this study, the interviewees frequently referred to their interaction with other organisations. In some instances, it was only through the documentation collected from the policy fora that allowed me to identify the correct spelling of these organisations and names.

Secondly, the documentation contained specific details that helped me to corroborate information gathered from the interviews. This study required to discuss socio-cultural, legal/regulatory and economic pressures and how such contextual changes triggered interactions and behaviours within their organisation and across the business network. Here, it was predominantly the legislative documents (e.g., UK Energy Act 2004; Climate Change Act 2008) that helped me to corroborate the statements about such changes and the interwoven array of events that occurred as observed by the interviewees; particularly the legal/regulatory demands were often quite complex.

Thirdly, the documentation provided insights into the network of actors that were potentially involved in a case as it commonly included participation lists. It is important to highlight, however, that I have not taken these network actors and their potential interactions as definitive findings but rather as *"clues worthy of further investigation"* (Yin, 2009, p.103). Indeed, although policy forum participation lists have indicated network actors and their potential interaction, it was the semi-structured interviews that enabled me to gain more specific empirical insights.

Lastly, the documentation proved to be a valuable source of information when preparing for the interviews. I repeatedly used the insights gained from documentary data to delineate the structure of topics that guided the discussion during the semi-structured interviews. Nonetheless, I used the documentary information only as an indicator of topics that might be relevant for a specific interviewee. The structure of topics remained flexible enough to allow the pursuit of additional issues that arose through the interview process.

I followed a systematic approach to identifying the documents relevant to this study; repeatedly asking myself how the document at hand helped to 1) answer the research questions; 2) advance the conceptual framework; and/or 3) triangulate the empirical insights. This served as a guide for the systematic search for the supplementary documentation necessary to build in-depth cases. I acknowledge, however, that documentation, just like any other type of data, is associated with a set of disadvantages (Yin, 2009).

Firstly, documents may not always be entirely accurate and *"should not be accepted as literal recordings of events that have taken place"* (Yin, 2009, p.103). This shortcoming of documentary information was apparent when I collected the policy fora transcripts. As stated at the beginning of each transcript:

> *"Despite the best endeavours by Westminster Forum Projects and its suppliers to ensure accuracy, text based on transcription may contain errors which could alter the intended meaning of any portion of the reported content."* [Policy Forum 12, p.1]

In an attempt to counteract this issue, I used the insights gained from documentation as indicative of topics that may bring about a fruitful addition to the semi-structured interviews. The documentary information was only included in the cases when the information was corroborated through such an interview and/or other secondary data sources.

Secondly, Yin (2009, p.105) raises the issue of falsely assuming that documentary information *"contain the unmitigated truth"*. Here, it is important to acknowledge that any documentation collected to inform the cases underpinning this study has actually been written with a specific purpose and for a specific audience. The purpose and target audience of strategy and emission reduction policy documents, for example, were most likely not to have envisaged for this study. Therefore, I have adopted a process of constantly identifying and critically evaluating the underlying objectives that led to the production of any documentation that is included as supplementary data. Cooper (1998) argues that it is this process that limits the risks of falsely interpreting documentary information.

In light of the shortcomings of documentary information, I have to reiterate that documentation was never seen as a stand-alone entity but was used to indicate topics worthy of further investigation, as well as to supplement, corroborate, augment and triangulate the insights gained through semi-structured interviews or other secondary data sources. I now briefly describe each type of supplementary documentation that I used in this study.

The first type of documentary information that I collected were transcripts of 14 policy fora. Although this type of documentation is available publicly, it was only through attending five of these events that I was able to collect the information. As the empirical focus of this study is the UK energy sector, the documentary data that I collected through attending and/or accessing transcripts was from energy sector-related policy fora organised by Westminster Forum Projects (WFP). The Westminster Forum Projects describes its purpose as following:

> *"The forums organise senior-level conferences on a wide range of public policy areas. None of the forums has a policy agenda of its own, other than simply to raise the quality of debate on public policy developments and to create opportunities for informed discussion. Each WFP forum is structured to*

> *facilitate the formulation of 'best' public policy by providing policymakers and implementers, and those with an interest in the issues, with a sense of the way different stakeholder perspectives interrelate. Usually, this is through impartially-framed, inclusive discussion conducted either in public or under the Chatham House Rule. Forum conferences are frequently the platform for major policy statements from senior Ministers and regulators, Opposition spokesmen and leading opinion-formers in industry and interest groups. Conferences regularly receive prominent coverage in the national media and trade press."* (Westminster Forum Projects, 2017)

I have used the WFP's policy fora relevant to the UK energy sector as a means to indicate topics worthy of further investigation, as well as to supplement, corroborate, augment and triangulate the insights gained through semi-structured interviews. The policy fora took place between March 2016 and March 2017 and the written transcript of each event was normally distributed approximately ten working days after the event. Although this type of documentation is publicly available, the documents were not free of charge (£80 per transcript). I was fortunate, however, that the WFP's team supported my study by offering complimentary access to these documents. Furthermore, the Editorial Board of the WFP has granted permission to reference the transcripts in this study. A detailed list of the specific events upon which the policy fora transcripts are based can be found in Table 2.

Date	*Event name*	*Location*
March 2016	Energy policy for London – security, infrastructure and sustainability	London
March 2016	UK energy security: supply, storage and resilience	London
April 2016	Next steps for UK domestic energy efficiency policy	London
May 2016	Next steps for renewable energy in Scotland	Edinburgh
June 2016	The future of research and innovation in the energy sector	London
July 2016	Nuclear energy in the UK: innovation, skills, and supply chain development	London
July 2016	Delivering Electricity market Reform and priorities for new Contracts for Difference	London
July 2016	Realising Wales' energy potential	Cardiff
October 2016	Competition in the UK energy market	London
November 2016	Implementing the smart meter roll-out	London
November 2016	The future for Scotland's energy sector	Edinburgh
December 2016	Future of the UK electricity network	London
March 2017	Priorities for energy security in the UK	London
March 2017	Next steps for energy efficiency policy in England	London

Table 2: *Policy fora dates, name and location*

The second type of documentary information that I collected were 65 consultation documents. This included industry responses and other documents related to government proposals for new regulations relevant to the UK energy sector. Through these consultations, the UK government gathered industry views and evidence on matters that should be taken into account in the design and implementation of new regulation. Understanding the ways in which companies responded to the consultations in and around the UK energy sector helped me to identify the concerns of companies about the emerging legal/regulatory changes. The consultation documents that I collected covered the *CCS Commercialisation Competition* and the *Electricity Market Reform*.

The third type of documentary information that I collected were 28 legislative documents. This included documents related to 22 intergovernmental climate change negotiations organised by the United Nations Framework Convention on Climate Change (e.g., the Kyoto Protocol, the Paris Agreement), and six UK national legislation related to energy and/or climate change (e.g., Climate Change Act 2008; Energy Act 2011). Although not legally binding, the intergovernmental agreements provided a framework that guided governmental activities when formulating and implementing climate change policies.

The UK legislation related to energy and/or climate change, on the other hand, represents the legally binding set of rules and regulations formulated and implemented by the UK government under which business networks operate. The Climate Change Act 2008, for instance, provides regulatory guidance by setting the UK carbon emission reduction target for 2050 of at least 80% lower than the 1990 baseline. More specifically, the *Energy Company Obligation (ECO)* scheme, as an explicit measure to reduce carbon emissions, is based on the Gas Act 1986, the Electricity Act 1989 and the Utilities Act 2000. The ECO requires energy suppliers to implement energy efficiency measures in low-income households (this was particularly pertinent to the first case: *'Utiliko's response to the ECO scheme'*). Understanding how the ECO scheme and other legal/regulatory changes influence business behaviour was only feasible by including UK national legislation as documentary information.

The fourth type of documentary information that I collected were 70 strategy and emission reduction policy documents. This type of documentation was important in order to develop an in-depth understanding of the business responses to climate change. For example, the Sustainability Reports of the case companies provided detailed information about the company's emission statistics and the ways in which the company planned to respond to climate change.

The fifth and final type of documentary information that I collected were 230 media releases. This included publications by the case companies as well as media reports related to the case companies. By gathering these documents, I was able to unearth the ways in which the companies publicly committed to and justified their response strategies. Furthermore, such media releases also provided insights into the way in which the emerging socio-cultural, legal/regulatory and economic changes prompted the business responses to climate change.

Collectively, these five types of documentary information have helped me to supplement, corroborate, augment and triangulate the data collected through semi-structured interviews. Table 3 summarises both the primary and supplementary types of data sources used for each of the five cases.

Case	*Actors*	*Documents*
Case 1: Utiliko	6 respondents (Interview and/or policy forum contribution) 01-05 *Utiliko* (01 Chief Corporate Officer; 02 Managing Director for Offshore; 03 Head of Business Development; 04 Development Manager; 05 Energy Policy Manager); 06 *Exxelo UK* (06 Policy Manager)	9 Policy fora; 6 Consultations; 1 Legislation; 12 Strategy and emission reduction policy documents; 10 Media releases
Case 2: Olectra	6 respondents (Interview and/or policy forum contribution) 01-03 *Olectra* (01 Chief Executive Officer; 02 Head of Wholesale Policy; 03 Business Development Manager); 04-05 *PlentiOil* (04 Carbon Capture & Storage Manager; 05 Analyst); 06 *Planwey* (06 Regional Director)	9 Policy fora; 16 Consultations; 3 Legislations; 22 Strategy and emission reduction policy documents; 55 Media releases
Case 3: Energize	6 respondents (Interview and/or policy forum contribution) 01-03 *Energize* (01 Chief Executive Officer; 02 Board of Directors; 03 Head of Orientation); 04-05 *MDfE* (04 Head of Energy Security; 05 Analyst); 06 *Mygrid* (06 Capacity Market Manager)	10 Policy fora; 31 Consultations; 2 Legislations; 11 Strategy and emission reduction policy documents; 27 Media releases
Case 4: Vonergy	8 respondents (Interview and/or policy forum contribution) 01 *Vonergy* (01 Chief Executive Officer); 02-03 *Xidoa* (02 Chief Executive Officer technology; 03 Chief Commercial Officer); 04 *Morhaven International* (04 Director of Facilities and Project Management); 05 *Pantegis* (05 Chief Operating Officer); 06-07 *Gryd* (06 Director of UK System Operator; 07 Spokeswoman); 08 *MDfE* (08 Head of Electricity Systems)	12 Policy fora; 12 Strategy and emission reduction policy documents; 86 Media releases
Case 5: Connectica	8 respondents (Interview and/or policy forum contribution) 01-04 *Connectica* (01 Chief Executive Officer; 02 Managing Director; 03 Commercial Director; 04 Head of Environment); 05-06 *Ecovair* (05 Founder; 06 Chief Executive Officer); 07 *Qubeta* (07 Advisor); 08 *MDfE* (08 Head of Regulation)	10 Policy fora; 12 Consultations; 13 Strategy and emission reduction policy documents; 52 Media releases

Table 3: *Data source material*

To conclude, in this section I have justified the selection of semi-structured interviews as the primary type of data source and documentation as a supplementary type of data source. In doing so, I have outlined the systematic procedures underpinning the collection of the data sources. I hope thereby to have managed to overcome some of the inherent criticisms of the case study research method and qualitative interviews.

Firstly, I counteracted the critique of interviews being anecdotal and illustrative with the concept of saturation as well as the supplementation, corroboration, augmentation and triangulation through the documentary data sources. The process of conducting semi-structured interviews was repeated until a certain degree of repetitiveness in interviewee responses became apparent. Moreover, even if all 28 interviews utilised to across the five case studies were anecdotal and illustrative, then the supplementary data sources provided the confidence needed to suggest that the insights were based on valid and robust evidence.

Secondly, the insights gained from interviews may be seen as leading to descriptive findings. The critical realist epistemology overcomes this descriptive nature, however, since it acknowledges the differences between the empirical, the actual and the real, and seeks an explanation that is fundamentally interpretive in nature (Easton, 2010). The critical realist conditions underpinning this study have contributed to interpretive rather than descriptive findings, therefore.

Thirdly, it may be argued that studies based on qualitative interviews lack rigour, are unsystematic and biased. Here, it is particularly the structured approach that I applied to sampling, the transparency about the topics that I used to guide the discussion in the semi-structured interviews as well as the supplementary documentation and the systematic procedures underlying the data collection, data reporting and data analysis procedures that characterise the rigorousness of this study.

Fourthly, the issue of the limited replicability and generalisability of interviews is frequently raised. I argue that the transparent and systematic procedures followed in the sampling process as well as the detailed outline of the topics that were covered in the semi-structured interviews, provide a solid basis for replicating the interviews underpinning this study. With regards to the issue of limited generalisability, under critical realist conditions, the aim is to identify the causal explanation that allows expounding and generalising theoretical propositions (analytical generalisation) (Yin, 2009). It is the analytical generalisation of insights gained from multiple types of data sources (semi-structured interviews and supplementary documentation) that justifies the case study research method as *"a rigorous, coherent one based on justified philosophical positions"* (Perry, 1998, p.799).

3.3.3 Empirical setting

In this section, I describe the selection of the UK energy sector as an empirical setting of this study.

The selection of the UK energy sector as the empirical setting of this study was inherently driven by the research objective, as well as the underlying epistemological and ontological assumptions. The empirical setting had to enable the capture of 1) the contemporary phenomenon of business responses to climate change, 2) rich, timely and multiple sources of data necessary to specify the causal mechanisms that, *"operate to cause events to happen"* (Easton, 1998, p.378), and 3) the context in which objects operate and create events (Pawson and Tilley, 1997). I reached the conclusion that the UK energy sector meets all of these requirements.

Firstly, the UK energy sector is inevitably required to respond to climate change in order to achieve the UK carbon emission reduction targets for 2050 of at least 80% lower than the 1990 baseline. Since this target was set in the Climate Change Act in 2008, the UK energy sector has embarked on a long-term transition towards a low-carbon energy supply system. While this transformation progressed rapidly in the beginning, from 2015 onwards it has slowed down as concerns about the security of energy supply and maintaining energy affordability interfered with governmental policies aimed at reducing energy sector-related carbon emissions. This interplay is commonly referred to as the 'energy trilemma' (e.g., Boston, 2013). The UK's Department of Energy & Climate Change (which became part of the Department for Business, Energy & Industrial Strategy as of July 2016), for instance, stated in a report on delivering UK energy investment:

> *"Our new policies for investment and reform had to address the 'energy trilemma' – the challenge of keeping the lights on, at an affordable price, while decarbonising our power system."* (Department of Energy & Climate Change, 2014, p.4)

The slower pace of this transformation in recent years has irreversible effects on the natural environment (Stern, 2006; Hess, 2013). Since neither the UK government nor individual companies alone have the necessary resources (Veal and Mouzas, 2010), mounting a notable response to the challenge of reducing energy sector-related carbon emissions unavoidably requires the interaction of multiple actors involved in the UK energy sector. Consequently, the UK energy sector represented an ideal empirical setting for a case study in and around the empirical phenomenon of business responses to climate change.

Secondly, the contemporary nature of the UK energy sector's transition towards a low-carbon energy supply system has enabled the gathering of rich, timely and multiple sources of data. For example, the *Westminster Forum Projects* organised 14 energy sector-related events between March 2016 and March 2017. This indicates the availability and depth of the timely data which is necessary to specify the causal mechanisms that, *"operate to cause events to happen"* (Easton, 1998, p.378). The UK energy sector is, therefore, an empirical setting that is well-suited for case study research conducted under critical realist conditions.

Lastly, the network ontology underpinning this study assumes that the world consists of business relationships and networks that build the structures in which actors, resources and activities interact (Easton and Araujo, 1994; Mouzas and Ford, 2009). In these structures, it is fundamental to capture both the mechanism and its context since *"causal outcomes follow from mechanisms acting in context"* (Pawson and Tilley, 1997, p.58). The UK energy sector as the empirical setting of this study permitted capturing the socio-cultural, legal/regulatory and economic changes that triggered much of the interactions and behaviours in the business relationships and networks in which entities operated and created events.

In the next section, I outline how I reported the primary and secondary sources of data collected in the empirical setting of the UK energy sector. In doing so, I justify the multiple case design and describe the process of drafting as well as reporting of the cases.

3.3.4 Data reporting

In this section, I justify the multiple case design and delineate the process of drafting as well as reporting of the cases. I close this section with a summary of each case and outline the reasons for selecting these specific cases.

As the next step, I was faced with the challenge of *"describing the phenomenon and context richly"* (Folger and Turillo, 1999, p.756) while maintaining the underlying replication logic and the possibility of cross-case comparisons. Interestingly, the literature on case study research is predominately driven by a rather positivistic approach of scholars such as Yin (2009), Eisenhardt (1989) or Miles and Huberman (1994). Positivist case study researchers prefer a multiple case study design due to the underlying replication logic and the possibility of cross-case comparisons.

Yin (2009, p.53), for example, argues that *"the evidence from multiple cases is often considered more compelling, and the overall study is therefore regarded as more robust".* In line with this, Eisenhardt (1989, p.545) states that *"a number between 4 and 10 cases usually works well"* as it leads to theories being *"better grounded, more accurate, and more generalizable"* (Eisenhardt and Graebner, 2007, p.27). The multiple case study design has been criticised, however, for only scratching the surface and thus neglecting the deep structures and context in which causal mechanisms operate and create events (Dubois and Gadde, 2014). The epistemological and ontological assumptions underpinning this study, however, required the unveiling of such mechanisms embedded in the interplay between the social processes, practices and events experienced by entities and capturing the context which *"allow the mechanism to come into operation"* (Pawson and Tilley, 1997, p.58). This calls for going *"deeper into one case instead of increasing the number of cases"* (Dubois and Gadde, 2002, p.558).

I solved this dilemma by selecting five deep probing cases; a number of cases at the lower end of Eisenhardt's (1989) ideal quantity of four to ten cases. This allowed me to maintain the richness of information necessary to describe a phenomenon and its context while at the same time ensuring the robustness, accuracy and analytical generalisability of the theoretical contribution. Here, it is important to acknowledge that although I was seeking a certain degree of replication and comparisons across most or all of these cases, each case is to be seen as a *"very powerful example"* (Siggelkow, 2007, p.20) that takes the *"rich context surrounding the cases into consideration"* (Dubois and Gadde, 2014, p.1278). Indeed, it was this process of combining the multiple case design with the richness of a single case that allowed the unearthing of *"new theoretical relationships and question old ones"* (Dyer and Wilkins, 1991, p.614). Through this, I was able to overcome the shortcomings of both single and multiple case studies.

In the next part, I describe the process of the drafting and reporting of these cases.

I drafted and reported the five cases with the aim of convincing *you*, the reader, that, *"the knowledge or 'finding' is worth paying attention to"* (Hogg and Maclaran, 2008, p.132). To do so, I have put the highest emphasis on the concept of "*representation, i.e. the way case studies are written and reported to the audience"* (Borghini et al., 2010, p.17) as this usually helps the reader to accept the findings stemming from the case study as one possible reality (Stern, 1998).

In the business marketing domain, case study findings are commonly presented *"through a description and narration of the case, the use of protagonists' verbatim and narratives as well as the use of graphics, tables, and figures"* (Borghini et al., 2010, p.16). Eisenhardt and Graebner (2007), however, highlight that overreliance on graphics, tables and figures to summarise the case study might come at the cost of less detailed narratives which may disappoint the reader. I have therefore included only one network figure per case and focused instead on narrating the case in a rich and lively way as this approach *"unveils the dynamics of the phenomena and helps us identify similar dynamics in the reader's own research or daily life"* (Borghini et al., 2010, p.18). Thereby, I hope to have provided clarity in respect to the construct that is being studied and, at least to some extent, made reading the cases enjoyable; with an ‘aha’ experience (Dyer and Wilkins, 1991) or ‘wow’ factor (Young, 2002).

When writing up the cases, I was struggling with the dynamics of acting as a case study writer and researcher. While in my role as a case study writer I aimed at developing a rich and lively story, in my role as a researcher I had to provide robust evidence to support the proposed contribution to theory (Eisenhardt and Graebner, 2007; Borghini et al., 2010). This was particularly important given that, when employing a multiple case study design, theory is to be regarded as the *“overarching organizing frame”* (Borghini et al., 2010, p. 18) which needs to be *“demonstrated by evidence from at least some of the cases”* (Borghini et al., 2010, p.18). Since supporting every aspect of a theoretical contribution in the story is difficult to achieve and rarely feasible, however, summarising the empirical findings in the form of *“extensive tables and other visual devices”* (Eisenhardt and Graebner, 2007, p.29) enables the researcher to prove that the theoretical contribution is grounded in-depth and is supported by detailed empirical evidence. I have described each case in a rich and lively way in the *Empirical Findings chapter* and included a summary of such evidence in graphics, tables, and figures in the *Analysis and Discussion chapter*. Hereby, I hope to have provided the evidence for the theoretical propositions stemming from the cases without unduly inhibiting the readability of the *Empirical Findings chapter*.

Furthermore, when writing each case I focused on *“sticking to the theoretical background and asking which details really help tell the story and illustrate the mechanism behind one's arguments”* (Borghini et al., 2010, p.18). For this reason, I have written each case narrative based on a standardised structure in order to streamline the search for patterns across cases. This structure originally derived from the theoretical understanding of business responses to climate change as established towards the end of the literature review but was updated based on the retroduction and systematic combining research process. As a result, each case is structured in and around the three pillars that comprise the initial structure for the study of business responses to climate change as put forward in the *Literature Review chapter*, namely 1) Network tensions, 2) Network interactions and 3) Network outcomes.

At the beginning of each case, I introduce the relevant actors and describe the contextual changes that triggered the company's response to climate change (network tensions). Next, I depict the key relationships and interactions within and across the business network affected by the company's activities in response to climate change (network interactions). This unfolds a rich and lively story that enables the underlying mechanisms that explain how companies respond to climate change to be unearthed (network outcomes).

By writing the case narratives based on the empirically derived and theoretically grounded framework of network tensions, network interactions and network outcomes, I aimed to facilitate cross-case comparisons while trying *"to make representation as close as possible to the phenomena under scrutiny"* (Borghini et al., 2010, p.23). It was through this systematic approach to reporting the empirical findings that I hope to have assisted the reader to understand the causal mechanisms underpinning the interactions and behaviours in business relationships and networks, and thus ultimately to explain how companies respond to climate change.

Before I introduce each of the cases in the next section, it is vital to specify how I have set the case boundaries (following-up on the brief introduction earlier in this chapter). Given that there are no natural boundaries in the empirical world (Dubois and Gadde, 2002), the connected relationships between the actors that construct a business network are theoretically limitless (Easton, 1995). Since *“one can never study the entire industrial network” (*Halinen and Törnross, 2005, p.1287), however, I had to set case boundaries that allow sufficient relevant aspects to be captured so as to reveal the causal mechanisms that explain how companies respond to climate change. I, therefore, set the case boundaries based on the aspects relevant to capturing 1) the contemporary phenomenon of business responses to climate change, 2) the rich, timely and multiple sources of data necessary to specify the causal mechanisms that, *“operate to cause events to happen”* (Easton, 1998, p.378), and 3) the context in which entities operate and create events (Pawson and Tilley, 1997).

Furthermore, the network ontology underpinning this study required distinguishing between *“what belongs to the case network and what belongs to its context”* (Halinen and Törnroos, 2005, p.1287). According to Knoke (1994), a distinct separation between a network and its context can be achieved by focusing on either actor attributes, types of relations or a critical event. In this study, critical events or, in other words, the business response to climate change (such as establishing an energy supply company as a supplier of 100% renewable energy), defined the network boundaries.

Moreover, in line with Håkansson and Johanson’s (1992) AAR model, each of the case networks in my study contains all actors (organisations involved in the critical events), activities (the interactions between those actors) and resources (the currency in the interaction process). It was these ‘whole’ networks that I used as the unit of analysis (e.g., Mouzas, 2006). The context of the case networks included the socio-cultural, legal/regulatory and economic changes that have triggered the interactional and behavioural processes within and across the business network. The combination of all the considerations explained above led to five deep probing cases.

This study is based on five cases of business responses to climate change. In the next section, I briefly introduce each of the five cases and provide a justification for including the case in this study.

I have selected each case based on systematic procedures aimed at developing a comprehensive understanding of the issues I sought to engage with, in terms of answering how companies respond to climate change. A comprehensive understanding, in this context, refers to providing robust empirical evidence that enables a rigorous examination of the causal mechanisms at play that explain how companies respond to climate change. In an effort to permit cross-case comparability with regards to the socio-cultural, legal/regulatory and economic changes that triggered the company's response to climate change, I focused on a single industry in a single country: The UK energy sector.

Table 4 summarises the five cases by referring to their specific roles within the UK energy supply sector, a company profile, the contextual changes that primarily triggered the companies' response to climate change and a brief description of the subsequent activities in response to climate change.

Case	***Industry***	***Company profile***	***Contextual change***	***Activities in response to climate change***
Case 1: Utiliko	Supply of electricity and gas; Operation of distribution network	One of the UK's largest energy supply companies driving towards being carbon neutral by 2050 (in 2010, 90% of its energy generation was from fossil fuels).	The ECO scheme as a legal/regulatory pressure that focuses on mitigating carbon emissions and addressing fuel poverty.	In 2012, the company decided to comply with the ECO scheme (a regulation focused on addressing fuel poverty and carbon emissions) in the most effective way.
Case 2: Olectra	Supply of electricity and gas	One of the UK's largest operators of renewable generation assets (3.3 GW in 2012).	The Carbon Capture and Storage (CCS) commercialisation competition as a legal/regulatory pressure that offers funding for developing CCS for gas-fired power plants.	In 2012, the company decided to retrofit its gas-fired power plant with CCS technology.
Case 3: Energize	Supply of electricity, gas and heating	One of the UK's largest emitters of carbon emissions (42 megatons of carbon emissions in 2014).	The Climate Change Act and the Renewables Obligation as legal/regulatory pressure that set the UK carbon emission reduction targets and imposes fines.	In 2014, the company decided to restructure its energy generation portfolio with the aim of establishing itself as a renewables-only energy supply company.
Case 4: Vonergy	Supply of electricity and gas to commercial and industrial energy consumers	One of the UK's largest energy supply companies specialised in supplying energy to large commercial and industrial energy consumers (8.2 GW generation capacity and 200,000 British commercial and industrial energy customers).	The Energy Entrepreneurship Fund (EEF) and the Capacity Market Mechanism as a set of supportive regulatory mechanisms in order to enable further growth of the DSR market in the UK.	In 2014, the company decided to expand its product portfolio in response to climate change and establish itself as a provider of demand-side response (DSR) technology.
Case 5: Connectica	Supply of electricity and gas	One of the UK's largest energy supply companies (twelve million domestic energy customers in 2014).	The financial benefits of providing carbon reduction technologies as economic pressure. Socio-cultural and legal/regulatory pressures may have additionally influenced the business response.	In 2015, the company decided to establish itself as a provider of connected home technologies.

Table 4: *Overview of case studies*

I now introduce each case in chronological order and provide a justification for including each case in this study.

The first case examines how one of the UK's largest energy supply companies is driving towards being carbon neutral by 2050 (in 2010, 90% of its energy generation was from fossil fuels). The case describes the company's efforts to comply with the ECO scheme (a legal/regulatory change that focuses on mitigating carbon emissions and addressing fuel poverty). Moreover, the case provides insights into the interactions with seven actors (a ministerial department, a social housing association, an administrative body, an insulation company, domestic energy consumers, a small energy supply company and an energy industry association). These interactions were driven by the focal company's effort to install energy efficiency measures in domestic households.

The second case examines how one of the UK's largest operators of renewable generation assets (3.3 GW in 2012) responded to climate change. The case describes the company's efforts to decarbonise its gas-fired power plant. Moreover, the case provides insights into the interactions with eight actors (a multinational Oil and Gas company, two ministerial departments, three energy services companies, a local authority and a technology test centre). These interactions were driven by the focal company's effort to retrofit a gas-fired power plant located in Scotland with CCS technology.

The third case examines how one of the UK's largest emitters of carbon emissions (42 megatons of emissions in 2014) responded to climate change. The case describes the company's efforts to restructure its energy generation portfolio with the aim of establishing itself as a renewables-only energy supply company. Moreover, the case provides insights into the interactions with five actors (a ministerial department, a multinational energy distribution and transmission company, domestic and industrial consumers, an energy supply company and the EU ETS).

The fourth case examines how one of the UK's largest energy supply companies specialising in supplying energy to large commercial and industrial energy consumers (8.2 GW generation capacity and 200,000 British commercial and industrial energy customers) responded to climate change. The case describes the company's efforts to establish itself as a provider of demand-side response (DSR) technology. Moreover, the case provides insights into the interactions with six actors (a DSR technology provider, a multinational hospitality company, an energy supply company, a distribution network operator, a ministerial department and a diesel-power generation company).

The fifth and final case examines how one of the UK's largest energy supply companies (twelve million domestic energy customers in 2014) responded to climate change. The case describes the company's efforts to establish itself as a provider of connected home technologies. Moreover, the case provides insights into the interactions with five actors (a connected home technology provider, an independent research organisation, domestic energy consumers, an advertising agency and a ministerial department).

These five cases are outlined in chronological order of occurrence in time to allow their historical sequence to be preserved. This was intended to safeguard the temporal aspects relevant to the analysis of how companies respond to climate change.

In the next section, I outline the systematic procedures that I applied to analyse these five empirical cases.

3.3.5 Data analysis

The purpose of this section is to describe how I got from over 10,000 pages of raw data to final conclusions. As a starting point, I begin this description by introducing some of the challenges associated with qualitative data analysis. I then outline the explanatory power of the theoretical structure which guided the data analysis process. Next, I describe the systematic data analysis procedures underpinning this study by outlining the sequences: 1) raw data, 2) data reduction, 3) coding, 4) memo writing, and 5) conclusions. By being precise and transparent about the data analysis procedures I hope to convince the reader that I managed to overcome the challenges associated with qualitative data analysis and hence that my study offers credible, robust and rigorous findings.

In the introduction to their seminal book on *'Qualitative Data Analysis'*, Miles and Huberman (1994) describe qualitative data as being 'sexy' but habitually associated with a lack of well-formulated methods of analysis. However, if qualitative data analysis procedures are outlined explicitly and applied in a systematic manner, then qualitative data can be *"a source of well-grounded, rich descriptions and explanations of processes in identifiable local contexts"* (Miles and Huberman, 1994, p.1). If not, then one should question the reliability and validity of conclusions stemming from qualitative studies. Miles (1979, p.591) illustrates this by asking, "*how can we be sure that an 'earthy', 'undeniable', 'serendipitous' finding is not, in fact, wrong?*".

While some researchers continue to put little emphasis on vindicating their data analysis procedures based on the argument that, *"the unequivocal determination of the validity of findings is impossible"* (Miles and Huberman, 1994, p.2), others argue that qualitative data analysis is an art form which inherently requires an intuitive approach. What is clear, however, is that on too many occasions the reader is left alone with *"classifications and patterns drawn from the welter of field data, in ways that are irreducible or even incommunicable"* (Miles and Huberman, 1994, p.2).

A slightly more reasonable – yet not acceptable – excuse for disregarding explicit qualitative data analysis procedures is that researchers possess different epistemological and ontological assumptions about what constitutes 'reality' and therefore the necessity of defining general laws for qualitative data analysis is in doubt (Miles and Huberman, 1994). Here, I acknowledge that one may question whether critical realism, just like any other research paradigm, offers the 'right' answer. The outcome, of what would probably be an extensive philosophical discussion, will most likely depend on accepting or rejecting its basic assumptions. As for this study, I accept the critical realist views of the world and, as argued earlier in this chapter, it is the most suitable approach for the research objectives underpinning this study. Consequently, the procedures described in this section are not to be seen as definite laws for qualitative data analysis but rather to assist the reader in understanding the steps that I followed to derive at the conclusions.

The data analysis was based on the initial theoretical structure derived from the literature review (see Figure 2: An initial theoretical structure for the study of business responses to climate change, p.45). This initial theoretical structure, however, was modified whenever I gained unanticipated insights from the empirical findings. It was this theoretically derived and empirically grounded structure that guided the data analysis process. It is important to highlight, however, that the initial theoretical structure is to be interpreted as assisting the development of explanation rather than to create labels that are set in stones. In fact, the explanatory power of the initial theoretical structure guided the process of specifying the causal mechanisms that explain how companies respond to climate change. Elman (2009, p.122) states that such explanatory typologies *"invoke both the descriptive and classificatory roles of typologies, albeit in* *a way that incorporates their theoretical focus"*. The explanatory typology that I adopted in this study consists of a descriptive, classificatory and explanatory function. Elman (2009) summarises the purpose of these functions by referring to their 'analytical move(s)' and 'question(s) answered'. See Table 5 for a simplified outline of what Elman (2009, p.122) calls the *"goal of typologies"*.

	Descriptive	***Classificatory***	***Explanatory***
Analytic move(s)	Defines compound concepts (types) to use as descriptive characterisations.	Assigns cases to types.	Makes predictions based on combinations of different values of a theory's variables. Places data in relevant cells for congruence testing and comparisons to determine whether it is consistent with the theory.
Question(s) answered	What constitutes this type?	What is this a case of?	If my theory is correct, what do I expect to see? Do I see it?

Table 5: *Goals under the explanatory typology (Elman, 2009, p.122)*

The strength of studies that adopt explanatory typologies is the inherent requirement to question the accuracy of the existing theory when the empirical findings suggest an alternative reality (Elman, 2005). In fact, Elman (2005) argues that it is the self-conscious approach underpinning the explanatory typology that provides reassurance about the rigour of the research and improves transparency (Elman, 2005).

In line with the explanatory typology, I used the initial theoretical structure as a guide for the process of data analysis. Indeed, I followed an explanatory typology by repeatedly asking questions, such as 'How can theory explain my empirical findings?' and more specifically 'How can the existing literature on interactions in business relationships and networks as well as the behavioural science literature help to explain the observed business responses to climate change?'.

In the next section, I describe how the explanatory typology underpinning my data analysis translated into a specific sequence of data analysis procedures. Figure 7 illustrates this process, based on Miles and Huberman (1994) as well as Friese (2012), and this serves as a structure for the remainder of this section.

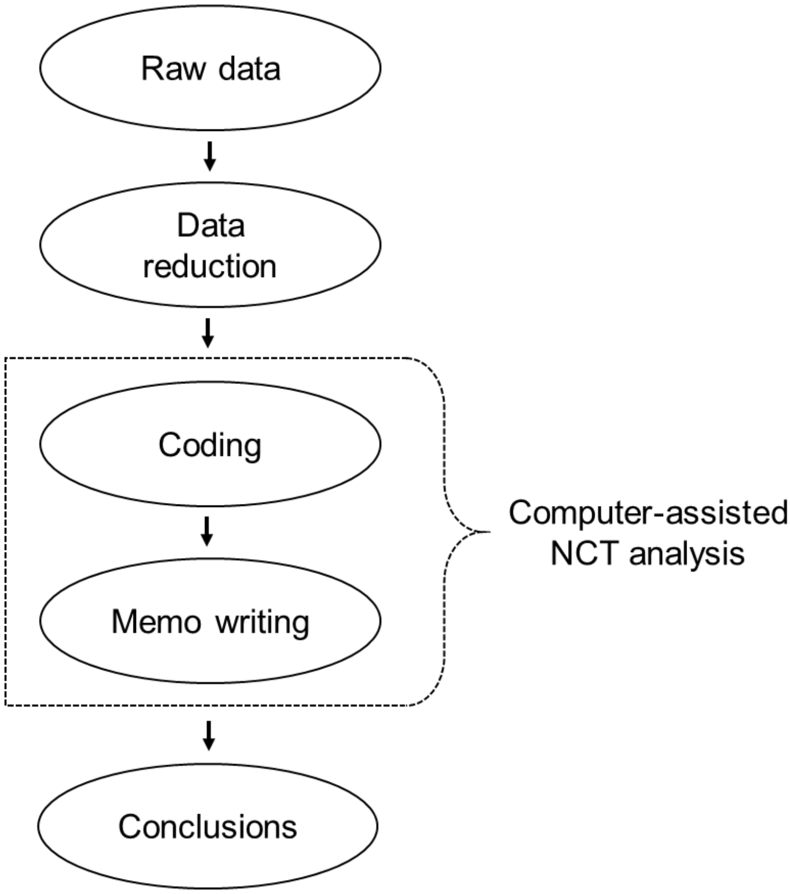

Figure 7: *Sequence of data analysis (adapted from Miles and Huberman, 1994 & Friese, 2012)*

3.3.5.1 Raw data

The starting point for the process of data analysis was when the first items of raw data had been gathered. By raw data, I mean the primary sources of data, such as the transcripts of semi-structured interviews, and supplementary sources of data, such as the policy fora transcripts, consultation documents, legislative documents, strategy and emission reduction policy documents as well as media releases. During the process of collecting the raw data, I constantly moved 'back and forth' between empirical observations and the initial theoretical structure. Based on these early insights, and guided by a research process of retroduction and systematic combining, I collected additional raw data and sharpened the initial conceptualisations.

3.3.5.2 Data reduction

Data reduction refers to *"the process of selecting, focusing, simplifying, abstracting, and transforming the data that appear in written-up field notes or transcriptions"* (Miles and Huberman, 1994, p.10). During the data reduction stage of the data analysis process, I faced several analytical choices that had the potential to shape the conclusions stemming from the data analysis. For example, I had to make well-conceived decisions about which parts of the over 10,000 pages of raw data should be coded, which parts were vital for the development of a coherent and rigorous analysis and which parts would ultimately reveal the causal mechanisms of how companies respond to climate change. In an effort to follow systematic data analysis procedures, I used software to help sharpen, sort, focus, discard and organise the raw data.

Using software to aid the data analysis not only helped me to be more systematic and explicit in the process of analysing the data, but it also offered the flexibility to adjust analytical variables through the research process (Tesch, 1989). This was particularly pertinent to this study because of the systematic combining research process that required a process of continuously going 'back and forth' between data analysis and theories (Dubois and Gadde, 2002). Furthermore, Ragin and Becker (1989) point out that using computer-aided analysis is particularly beneficial when adopting a case study research method as it allows *"interconnected arguments about interrelated events"* to be revealed (Miles and Huberman, 1994, p.44). Indeed, using computer-aided qualitative data analysis software (CAQDAS) helped me to elevate the data analysis, historically characterised by handicraft using pen and paper, to a more rigorous and efficient level.

The decision of which CAQDAS programme to use was predominately driven by the reliability of the software. In a Lancaster University PhD Research Training Programme on 'Choosing and Using Software for Qualitative Data Analysis', two programmes, namely ATLAS.ti and Nvivo, were introduced. Although both options offered similar tools and functions, ATLAS.ti was known to be less vulnerable to crashes. Hence, I decided to use ATLAS.ti.

It is important, however, to elucidate that any CAQDAS programme *"does not actually analyse data; it is simply a tool for supporting the process of qualitative data analysis"* (Friese, 2012, p.1). The strength of CAQDAS programmes is to find coded data segments and show their interconnectedness. Yet, it was my task *"to tell the computer, by way of coding, which data segment has what kind of meaning"* (Friese, 2012, p.1). This leads critics (e.g., Smith and Hesse-Biber, 1996) to question the adequacy of software in a qualitative research context by asking, *"if the computer doesn't do the coding, then what it is good for?"* (Friese, 2012, p.1). I find this critique rather paradoxical. After all, most of such critics are probably using a word processing software despite the fact that they still need to type the words themselves. Friese (2012, p.1) reiterates:

> *"Software frees you from all those tasks that a machine can do much more effectively, like modifying code words and coded segments, retrieving data based on various criteria, searching for words, integrating material in one place, attaching notes and finding them again, counting the numbers of coded incidences, offering overviews at various stages of a project, and so on. By using ATLAS.ti, it becomes much easier to analyse data systematically and to ask questions that you otherwise would not ask because the manual task involved would be too time consuming."* (Friese, 2012, p.1)

In the following paragraphs, I describe how I conducted the computer-aided analysis. Friese (2012) defines this process as a journey through unknown territory (empirical data) while having some preconceptions (initial theoretical structure) about *what* may or may not prove to be the ‘reality’ under critical realist conditions. In fact, it was the CAQDAS programme ATLAS.ti that enabled me to manoeuvre through the empirical data in order to draw and verify conclusions.

3.3.5.3 Coding

I coded the data based on noticing, collecting and thinking as the three components that Friese (2012) labels as a computer-assisted NCT analysis:

1. *Noticing.* This referred to the early stages of my data analysis and involved reading the interview transcripts and documentary information in order to identify specific incidents in the data that seemed relevant to answering how companies respond to climate change. Thereby, I was able to derive initial ideas for basic descriptions of such incidents.
2. *Collecting*. This referred to the process of discovering further incidents that were similar to and fitted under the same basic descriptions (code names) as the incidents identified in the earlier stages of the data analysis. As suggested by Corbin and Strauss (2008), this helped me to compare incidents based on similarities and differences. As an outcome, I grouped similar incidents into main or subcategories.
3. *Thinking.* This referred to the brainpower it took to notice first incidents in the data, to identify similarities between incidents and when grouping the incidents into categories. Naturally, without the ability to think critically and question the possible causal mechanisms that led to the occurrence of an event it would be impossible to complete the data analysis process.

Below I describe more specifically how I explored the data, identified incidents, coded them, added structure to the code list and then started to take descriptive codes to a more abstract and conceptual level.

I began the NCT analysis by importing the raw data into the CAQDAS software ATLAS.ti and then reading the interview transcripts and policy fora transcripts. As I was going through the documents, I started to code what was the easiest to recognise: the names of organisations and interviewees. The typical *'participant code'* followed the structure *P* for the participant, *Int* for Interview, *EnSup* for energy supply company (or alternative format for other types of organisations), then an abbreviation of the company name and lastly the interviewee name (e.g., *P_Int_EnSup_CompanyName_IntervieweeName*). I have used these shortened codes because only the first 20 characters of code appear when running queries in the ATLAS.ti code management tool.

While attaching the participant codes, I started to notice interesting bits and pieces that appeared relevant to explaining how companies respond to climate change. I highlighted such incidents and assigned the first descriptive codes. While reading further, I came across similar and different incidents. Whenever they fitted under an already established code, I simply attached the same code; in case they did not, I developed new descriptive codes.

As suggested by Friese (2012, p.230) a first saturation point is reached when *"you no longer notice anything new, when no codes are added and you can only apply already existing ones"*. I reached this point after I had compiled a list of 828 different descriptive codes (see Appendix 2 for a sample of descriptive codes). The next step was to structure these codes by creating *"more abstract conceptual-level codes and developing codes into categories and subcategories"* (Friese, 2012, p.231).

I structured the code list by developing categories that captured related codes. Here, I used code frequencies as pointers for what may or may not become a category code. Although frequencies of codes do not provide definite answers, it helped me as an indicator for codes that I may want to subsume as in a category or subcategory. Some codes only appeared once or twice in the code list but nonetheless were fundamental and hence also needed to be put under a more abstract conceptual-level code.

It was at this stage that I re-evaluated the initial codes and developed them into more abstract and conceptual level codes. Here, it was the process of reading through the 'quotations', i.e. the raw data underpinning the descriptive codes, which allowed me to identify commonalities and differences between codes. Based on these insights, the first ideas emerged and I was able to define labels for categories and subcategories. In fact, particularly at this stage, employing a computer-assisted analysis was a key advantage because it permitted me to *"look at only a selection of the data"* (Friese, 2012, p.96).

The second stage of coding was characterised by applying the code list, developed in stage one, to the remaining primary sources of data, such as transcripts of semi-structured interviews, and supplementary sources of data, such as policy fora transcripts, consultation documents, legislative documents, strategy and emission reduction policy documents, and media releases. Although the majority of new insights gained from the additional raw data fitted well under the structure determined by the code list, in some instances I was struggling to apply the codes and hence I continued to add a few new codes and made minor modifications.

Friese (2012) describes this process as a way of validating the code list. Furthermore, Saldaña (2009, p.149) states that the purpose of the second stage coding is *"to develop a sense of categorical, thematic, conceptual, and/or theoretical organization"*. At the end of the second stage, the code list was even further structured and applied to the primary and secondary sources of data. Table 6 below illustrates the first-order categories under which I summarised the codes. This list made it possible to access the data systematically which was a prerequisite for starting the conceptual level analysis.

First-order categories	
Carbon-intensive	Internal assessment
Commercial Opportunity	Lack of infrastructure
Competition	Lack of technological expertise
Cost-effective	Loss aversion
Costs	Lower profitability
Decommissioning	Market forces
Earnings driver	Offsetting
Egoism	Profitability
Fines	Reference points
Fixed-resource pie	Risk
Frames	Shareholder pressure
Herd behaviour	Upfront investment
High rate of return	Wakeup call
Higher energy prices	

Table 6: *First-order categories*

Based on these first-order categories, I moved on to the conceptual level analysis.

3.3.5.4 Memo writing

At the memo writing stage of the data analysis process, my analytical focus shifted towards the conceptual level. In other words, I set the first-order categories derived from the empirical data against the initial theoretical structure in and around network tensions, network interactions and network outcomes, as established in the literature review (see Figure 2 on page 45). While once again immersing myself in the data, I wrote memos about my thoughts and interpretation of coded incidents that I found helpful to explain how companies respond to climate change. Thereby, I attempted to link the data segments that illustrated aspects of the initial theoretical structure.

In fact, I was astonished at how the process of writing such memos helped me to progress seamlessly to a more conceptual level of analysis. At the end of the memo-writing process, I had established second-order themes as well as the aggregate dimensions derived from the systematic combining research process.

Figure 8 below illustrates the first-order categories, second-order themes and aggregate dimensions.

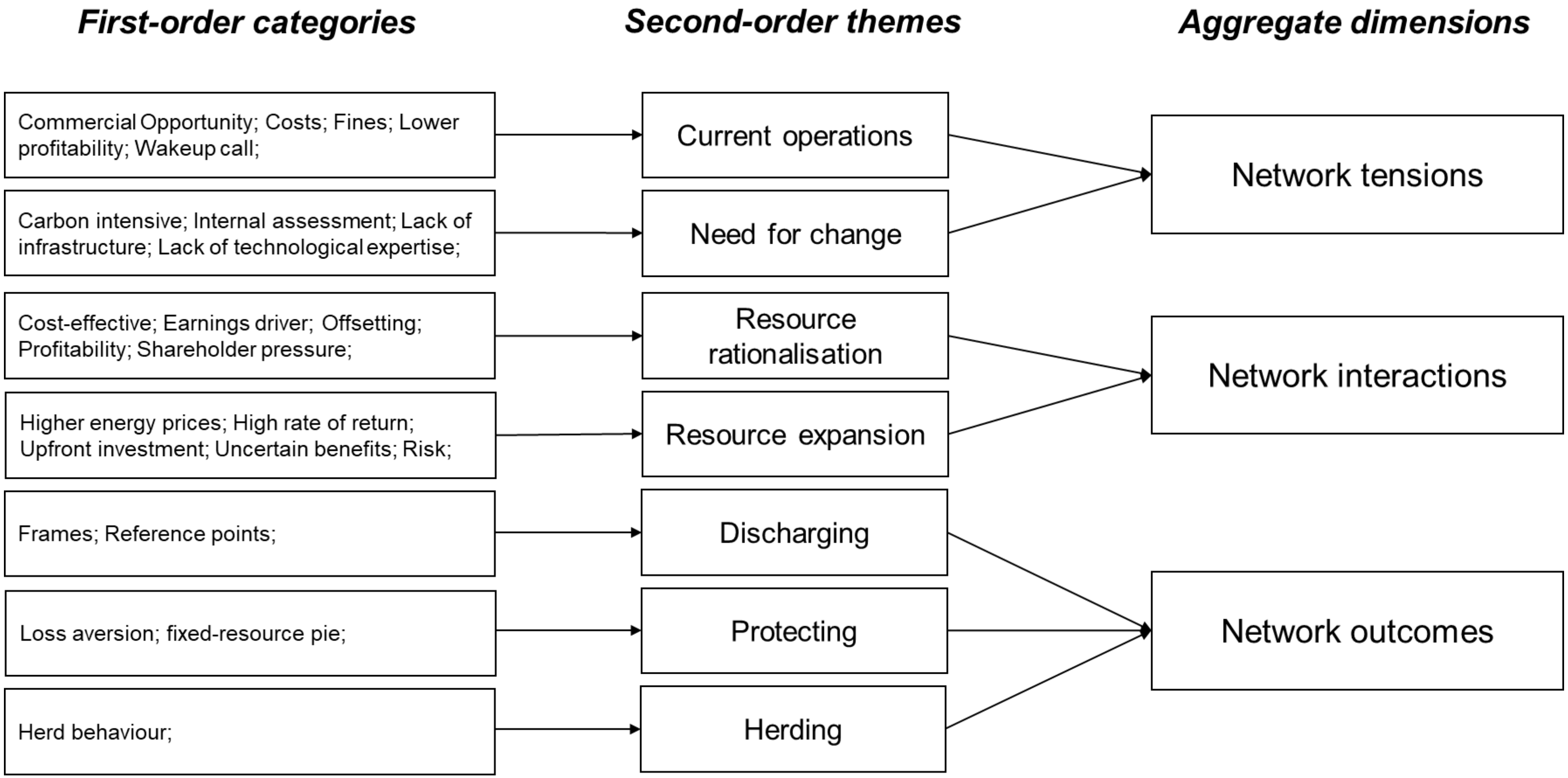

Figure 8: *Data structure*

It was at this stage that the potential explanations of the observed network outcomes (*discharging*, *protecting*, *herding*) became apparent. I then employed theory to explain why the observed network outcomes emerged and, hereby, provided a potential explanation of how companies respond to climate change. Specifically, I created a checklist of all the interactional and behavioural aspects that have been identified throughout the literature review and examined whether any of these may have occurred in the five case studies of business responses to climate change.

Interestingly, three sets of behaviours in networks soon emerged: 1) Frames and reference points; 2) Loss aversion and the belief in a fixed-resource pie; and 3) Herd behaviour. In fact, these network behaviours resulted in companies 1) *discharging* their responsibility by passing the impact to others, 2) *protecting* their resources and rationalising activities rather than bearing risks of change, and 3) *acting akin*, or have the propensity to adopt a herd mentality, to other actors with similar intrinsic values and beliefs rather than operating in isolation. At this stage, it seemed plausible to infer that antecedents related to these network outcomes reinforce one another in business relationships and networks, and I used theory to explain the three observed network outcomes. To ensure the robustness of the findings, however, further validation of these insights was required.

3.3.5.5 Conclusions

The final stage of the data analysis procedures underpinning this study was to draw and verify conclusions. Throughout the process of analysing the data, I made notes which ultimately fed into writing the memos. Such notes typically included explanations and propositions of potential factors that explain how companies respond to climate change. I kept these notes, which may be interpreted as early-stage conclusions, as pointers of what might be true instead of seeing them as definite findings. It was only throughout the course of the data analysis process that some conclusions became more explicit and grounded while others simply did not seem to hold up.

Miles and Huberman (1994, p.11) see such verifications as taking different forms, it *"may be as brief as a fleeting second thought crossing the analyst's mind during writing, with a short excursion back to the field notes, or it may be thorough and elaborate, with lengthy argumentation and review"*. As a result of verifying each conclusion drawn throughout the data analysis process, I was able to ensure the validity of the findings stemming from this study. Drawing and verifying conclusions represented the final stage of the data analysis procedures underpinning this study.

In the next section, I demonstrate that I have followed ethical procedures at all stages in the conduct of this study.

3.4 Research ethics

Following best practice for research ethics should be of paramount importance for any research project undertaken around the world. Unfortunately, in many cases, this does not hold true and, consequently, the rights of humans, companies or animals are not respected. In an attempt to counteract this issue, I have put the highest emphasis on complying with the Lancaster University Research Ethics Code of Practice (GAP/2009/0521). These standards are set up to ensure the *"dignity, rights, and welfare of participants"* (Lancaster University Research Ethics Code of Practice, 2009, p.1) and are somewhat similar to the Research Ethics Framework developed by the Economic and Social Research Council (ESRC). The ESRC has laid out six key principles of research ethics which can be labelled 1) Integrity and quality, 2) Transparency, 3) Confidentiality and anonymity, 4) Voluntary participation, 5) Avoiding harm, and 6) Partiality and conflicts of interest. I use these six key principles of research ethics as a structure for the remainder of this section. The

Lancaster University Research Ethics Committee (UREC) has reviewed the measures that I have put in place to uphold these principles and granted ethical approval on 17th November 2015 (UREC RS2015/47).

The first principle of research ethics underpinning this study is *integrity and quality*. Integrity refers to upholding moral principles such as complying with the law (e.g., national legislation, codes of ethical practice, Human Rights Act) as well as seeing openness and honesty as the norm (e.g., about research methods, procedures or findings). Quality, on the other hand, refers to the standard of excellence and fitness for purpose of all procedures that eventually led to writing this thesis.

Throughout the process of conducting this study, I have put several measures in place in order to meet the highest standards of *integrity and quality*. Firstly, I complied with national legislation, I studied both the Lancaster University Research Ethics Code of Practice and the Research Ethics Framework laid out by the ESRC to ensure that I was following their principles and, at all stages, I safeguarded the rights of anyone directly involved in, or indirectly affected by, my research. Secondly, I put the highest emphasis on openness and honesty by providing a detailed outline of the research methods, with a particular focus on how I drew and verified conclusions based on the raw data (see section 3.3 for details). Thirdly, I aimed for a standard of excellence that would allow parts of this thesis to be published in world-leading journals in my field of study (e.g., *Academy of Management*, *British Journal of Management, Industrial Marketing Management*, *Organization Studies*). The fitness for purpose has been particularly stressed in this methodology chapter as I offer an explicit justification of why the applied case study research method is ideal for answering the research questions posed. Lastly, the *integrity and quality* of this study has been reviewed continuously, both internally (e.g., Lancaster University Research Ethics Committee, the Marketing Department first-year PhD upgrade panel, the Doctoral Conversations Initiative in the Marketing Department, and in frequent meetings with my supervisors) and externally (e.g., a Doctoral Colloquium at the 31st Annual IMP Conference 2015 at the University of Southern Denmark in Kolding).

The second principle of research ethics is *transparency*. This refers to openness and accountability for all the processes that led up to writing this thesis. In particular, this includes explicitly stating and making anyone involved in the research project aware of the research purpose, the underpinning methodology, and requirements for participation, highlighting potential risks and outlining how the research findings may be disseminated. In this regard, I have focused on establishing the research purpose (e.g., in the *Introduction chapter*) and I have justified the underpinning case study research method in the *Methodology chapter*. Furthermore, I developed a detailed Participant Information Sheet that provided details for participants (see Appendix 3). The document answered questions such as 'What is the purpose of this study?', 'What will I be asked to do if I take part?', 'What will the interview involve?', 'What are the possible risks of taking part?' or 'What will happen to the results of the study?'. I made this explicit from the outset and I gave participants the opportunity to ask questions about the project.

The third principle of research ethics, followed throughout the process of conducting this study, is *confidentiality and anonymity*. Confidentiality refers to keeping participant information private; this would typically include personal data (e.g., names of interviewees and organisations). Anonymity, on the other hand, refers to the state of withholding sensitive information (e.g., names or unusual features) that would allow the identification of individuals. Upholding confidentiality and anonymity was particularly important because the policy fora (see Table 2 on page 74) were held under the Chatham House Rule, which reads as follows: *"Participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other* *participant, may be revealed"* (Chatham House, 2018, p.1). In order to achieve this, I have treated all information as confidential and in accordance with the UK Data Protection Act (1998). It was only me who had access to any raw information that one could be associated with a particular participant. Any information that I shared was anonymised, including through the use of pseudonyms. I stored personal details and the research content in two separate, encrypted and password protected files.

The fourth principle of research ethics is *voluntary participation*. This refers to the requirement that participants took part in this study based on their own free will and that their rights, dignity and welfare were respected. I made this clear from the outset of the study by providing an answer to the question, *'Do I have to take part?'* in the Participant Information Sheet (Appendix 3). I explicitly stated that participation in this study is entirely voluntary and that it is completely up to the participant to decide whether or not they want to take part. Moreover, I highlighted that the participant can withdraw from the study at any time, without having to provide any reason.

The fifth principle of research ethics refers to *avoiding harm*. This includes ensuring that no one experiences any distress, embarrassment or anxiety as an outcome of being involved in this study. I, therefore, had to ensure that participants and I are not harmed psychologically, physically, legally, socially or economically. Although I would argue that taking part in this study generally bore very low risks for any kind of distress, embarrassment or anxiety, I acknowledged – in the Participant Information Sheet – that the specific interactions and behaviours when responding to climate change may be perceived as a sensitive topic. I, therefore, encouraged participants to raise any doubts about the study and reiterated that they had the right to end the interview at any time. I have also dedicated time towards the end of each interview to clarify whether the participants felt that the information provided may lead to any distress, embarrassment or anxiety. All participants confirmed that the information they provided did not cause them any distress, embarrassment or anxiety, although, they commonly asked for confidentiality and anonymity.

The sixth and final principle of research ethics underpinning this study is *partiality and conflicts of interest*. Partiality refers to any form for a preference of one participant over another, or for research finding over another. A conflict of interest, on the other hand, refers to a situation in which a person or organisation has multiple diverging aims through which personal benefits are possible. The chosen research method ensured that I remained independent of any participant or the organisations that they represented. In the Participant Information Sheet, I explicitly stated that there are no specific benefits from taking part other than insights into how companies within the UK energy supply sector respond to climate change.

3.5 Conclusion

This chapter has discussed the research paradigm (axiology, epistemology and ontology), outlined the research process of retroduction and systematic combining, and justified the case study research method. Furthermore, I explained the process of data collection, sources and reporting. In addition, I provided insights into my approach to data analysis. I closed this chapter with an illustration of how research ethics have been upheld at all stages of conducting this study.

In the next chapter, I will examine the context and industry-specific aspects that act as the empirical boundaries of this study.

4 Context and industry definition

This chapter outlines the context and industry-specific aspects relevant to this study. In doing so, this chapter serves as a justification for why the UK energy supply sector is one of the best empirical examples for developing theory in and around business responses to climate change. In fact, by 2015 the UK managed to reduce the carbon emissions from its energy supply sector by 39% compared to 1990 levels (HM, 2016). Despite this seemingly positive trend, the UK national energy sector remains the single most emitting sector in the UK, accounting for almost one-quarter of the total UK carbon emissions annually (CCC, 2015). As a result, the UK energy supply sector is exposed to a variety of contextual changes, ranging from socio-cultural and legal/regulatory to economic demands.

Furthermore, a 2016 Progress Report issued by the UK Committee on Climate Change (CCC) revealed that the progress to meet the 2030 and 2050 emission reduction targets continues to be insufficient. The UK CCC, therefore, called for significant efforts to foster collaboration between multiple actors to enable further reductions in carbon emissions (CCC, 2016). This provides an ideal context for examining the interaction and behaviour in business relationships and networks when companies respond to climate change. This rationale will be explained further across the rest of this chapter.

I begin by describing what brought about the imbalance between nature and society, and why, as a consequence, the world is experiencing climatic changes. I then offer an outline of the contextual changes that emerged as a result of climate change (socio-cultural, legal/regulatory and economic). Furthermore, I explain the role of the global energy supply sector in responding to climate change and introduce the UK's national energy transition. I close this chapter with a brief conclusion.

4.1 The emerging imbalance between nature and society

Several contextual changes have emerged as a result of global climatic changes. Therefore, it is necessary to answer the question of what has happened in recent history to have brought about these climatic changes. If one leaves the hard science on climate change aside, answering this question is surprisingly simple.

The world's population was relatively stable until the mid-18th century and then increased rapidly from 1900 to reach nearly 7.6 billion as of mid-2017 (UN, 2017). This growth in population has created unprecedented demand for energy, food and transportation. The increasing demand led to significant economic growth. This explosion of economic activity, however, came with a negative externality called 'carbon emissions'. Carbon emissions are released into the atmosphere when fossil fuels are burned. Almost in step with population and economic growth, carbon emissions have increased steadily since the 19th century and have significantly picked up speed in recent years (IPCC, 2014). As of May 2019, the accumulated emissions in the atmosphere stand at the highest ever rate of almost 411 ppm (NASA, 2019). Figure 9 below illustrates the increase in population, economic growth and the rise in carbon emissions from 1960 until 2016.

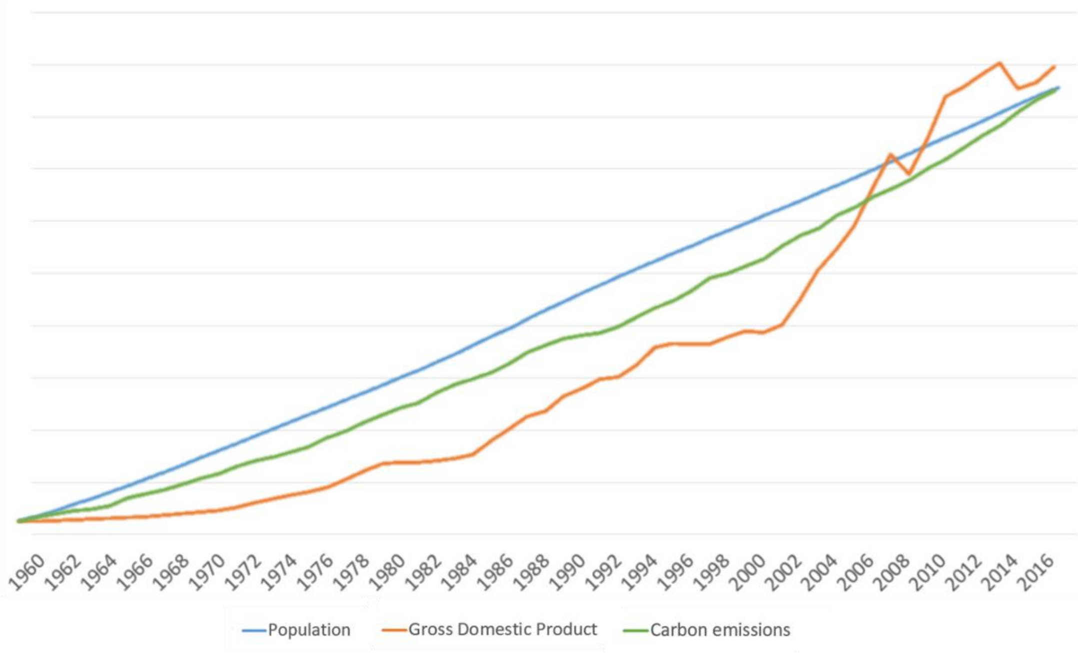

Figure 9: *Global population, economic and carbon emission trends (Based on data from IMF, 2017; UN, 2017; NASA, 2019)*

Fully understanding the implications that population and economic growth have on nature, however, requires explaining the role that carbon emissions play in the world's ecosystem. After all, for most people, the consequences of carbon emissions in the atmosphere might not be entirely evident and figures such as 411 ppm have little to no meaning.

The temperature on planet Earth is determined by the amount of energy (sunlight) reaching the Earth minus the infrared (heat) that is radiated back into space. According to the French scientist Jean-Baptiste Joseph Fourier, this would lead to an average Earth's surface temperature of -18°C, and hence the world would be frozen (e.g., Giddens, 2009; Howard-Grenville et al., 2014). Fortunately, the world is surrounded by a mixture of gases (nitrogen, oxygen, carbon dioxide, methane) and water vapour.

Collectively, these gases comprise the atmosphere that both allows plants and animals to survive and serves to trap some of the infrared radiation leaving the Earth, thereby increasing the average surface temperature.

The influx in carbon emissions stemming from economic activities have – at least partially – caused global temperatures to increase by 1.2 °C from pre-industrial levels and, on the current trajectory, this number is forecasted to reach 4 °C by 2100 (Bataille et al., 2016; WMO, 2016). The higher temperatures have already altered the world's climate system and future changes are likely to be even more significant (IPCC, 2014). Glaciers and ice caps have started to melt leading to rising ocean levels and flooding of coastal areas as well as of low-lying countries (Meehl et al., 2007). Moreover, extreme weather events (such as heatwaves, droughts, floods and storms) are occurring more frequently and are forecasted to further increase in intensity (IPCC, 2014). The 2017 hurricanes, for example, have severely damaged large parts of the Caribbean and the south-east coast of the United States. They have been fuelled and gained magnitude through water evaporated by the warmer oceans; a direct outcome of higher temperatures. Almost always, such consequences disproportionally affect the world's poor who simply do not have the resources to protect themselves (Arnold and Bustos, 2005; see Delaporte and Maurel, 2016, for a study on the impact of climate change on agriculture in Bangladesh).

While the economic growth will most likely continue along with the increase in population (8.6 billion by 2030; 9.8 billion by 2050; and 11.2 billion by 2100), a parallel rise in emissions may transform the Earth into an inhabitable planet (IPCC, 2014; UN, 2017). The planet will survive; the more pressing query is whether the human species will (e.g., Giddens, 2009; Wittneben and Kiyar, 2009; IPCC, 2014).

Answering this question in the affirmative will largely depend on how humanity responds to what is frequently referred to as one of the greatest challenges of the 21st century (e.g., Wittneben and Kiyar, 2009). Where humanity, and companies, in particular, focus their attention, largely depends on the contextual changes that act as a stimulus for responses to climate change. In the next section, I turn my attention to reviewing the contextual changes that climate change has brought about.

4.2 Contextual change in response to climate change

Over the past two decades, climate change has substantially altered the context in which businesses operate (Nyberg et al., 2018). This is manifested in socio-cultural (e.g., sustainable lifestyle choices, anti-consumption), legal/regulatory (e.g., international agreements, national legislation, policies, standards) and economic (e.g., greening of capitalism, competitiveness, profitability) changes. Below, I depict the externally generated pressures emerging from the socio-cultural, legal/regulatory and economic changes that have acted as a stimulus for business responses to climate change (Galbreath, 2011).

4.2.1 Socio-cultural

Socio-cultural pressures operating at the individual, national and even global level may act as a trigger for business responses to climate change. This is because climate change is experienced, understood and shaped by society (Chatzidakis and Shaw, 2018). In fact, decades of rising standards of living and the explosion of the world's population have enabled unprecedented demands for products and services (Carrington et al., 2016). This social reproduction and consumption, however, was – and still is – based on the economic use of the natural environment (UNEP, 2012, 2013), which is fundamentally unsustainable (Shove, 2010).

With the emergence of climate change, the socio-cultural values and norms have started to shift towards more sustainable forms of living, working and consuming (Carvalho and Burgess, 2005). It has been recognised that over-consumption represents a principal challenge that needs to be altered if society wants to mitigate global climatic changes (e.g., Carley and Spapens, 2017). Anti-consumption (e.g., the resistance to acquiring and using a polluting car) and socially responsible consumption (e.g., making a purchase based on a company's role in society and ethical behaviour) indicate the evolving socio-cultural pressures (Black et al., 2010).

Interestingly, it appears that, at least in Western countries, these socio-cultural changes increasingly determine purchasing decisions (Roberts, 1996). For example, a study conducted by Vershoor (1997), 75% of consumers stated that the ethical behaviour of companies influences their consumption behaviour. Simultaneously, developing countries such as Nigeria, Russia and Saudi Arabia focus widely on ever-more consumption. Take, for example, the pollution from petrol-driven electricity generators in Russia, the millions of old cars imported from the West in Nigeria or the extensive air-conditioning in Saudi Arabia. Even more worryingly, in developed countries, only a very few consumers are actually translating their environmental concerns into actual purchasing behaviours (e.g., Caruana et al., 2016). Öberseder et al. (2011, p.457) explain this so-called attitude-behaviour gap as *"positive attitudes toward buying products from socially responsible companies, but these positive attitudes are not transferred into actual purchase behavior"*.

This implies that the socio-cultural changes demand companies to respond to climate change but consumers are not willing to reward the responses with extensive purchases. Business responses to climate change may be triggered by socio-cultural changes but, at the same time, limited by the extent to which consumer's value and financially reward such responses (Adger et al., 2009). In other words, while socio-cultural changes play a central role in response to climate change, they can also constrain business responses to climate change (Leiserowitz, 2006).

Furthermore, socio-cultural changes are not occurring autonomously but are embedded in a variety of legal/regulatory changes that climate change has brought about.

4.2.2 Legal/regulatory

Legal/regulatory changes initiated by national governments are designed to promote business responses to climate change. In fact, the increasing amount of carbon emissions in the atmosphere, the emerging socio-cultural concerns about the consequences of climate change and the intergovernmental climate change agreements (e.g., Paris Agreement) have pressured national governments *"to regulate industries and corporations to promote deep reductions in emissions and foster rapid changes in business practices and culture"* (Okereke et al., 2012, p.11).

National governments have therefore started to alter the legal/regulatory framework. This commonly involves setting environmental protection standards (e.g., banning harmful materials and equipment) and directly regulating the activities of companies (e.g., introducing taxes on carbon emissions to increase costs of pollution) (Stavins, 1997; Ang et al., 2016). For a detailed overview of the legal/regulatory options in response to climate change see Stavins (1997).

Such legal/regulatory changes are based on the aim of reducing carbon emissions. In many countries, however, such legal/regulatory demands to mitigate emissions are patchy or even non-existent (Wittneben, 2009; Okereke et al., 2012). In fact, many national governments *"have struggled to craft a strong, integrated, and comprehensive regulatory system for managing climate change"* (Keohane and Victor, 2011, p.7). For example, following the March 2011 Fukushima nuclear disaster, the German government decided to close down all nuclear power plants by 2022 (Okereke et al., 2012). As a consequence of this reduction in nuclear power plants, which are a source of zero-carbon energy supply, Germany had to continue running highly polluting coal-fired power plants. As a result, in 2017, 40% of Germany's total energy supply was based on coal (Bloomberg, 2017). This example indicates the conflicting pressures that national governments may face when crafting a legal/regulatory framework that seeks to decarbonise its economy.

Additionally, in many countries, the emerging legal/regulatory changes have proven to be *"ineffective as a tool to lower emissions"* (Okereke et al., 2012, p.24). This is largely because of concerns over the increasing costs of a low-carbon energy supply system (Bassi et al., 2013). In fact, in a recent study, Ang et al. (2016) found that the legal/regulatory changes introduced by the UK's government in response to climate change have increased the unit electricity price by 37%, thereby hampering national economic growth and weakening the global economic competitiveness of British companies. A similar congruence of thinking leads Okereke et al. (2012, p.11) to the conclusion that *"the pressure to achieve deep emission reductions and economic growth simultaneously poses challenges to business and government"*.

This suggests that legal/regulatory changes in response to climate change are not occurring autonomously but are linked to economic changes.

4.2.3 Economic

Climate change has altered the economic context in which business responses to climate change occur. In fact, the emerging socio-cultural and legal/regulatory changes have had implications for the global economic system (Goodall, 2008; Wright and Nyberg, 2015). Disparte (2017, p.1), for example, suggests that climate change puts *"nearly $2.2 trillion in economic output at risk through 2025"*.

For centuries the cost-effectiveness of fossil fuel-based energy generation has enabled unprecedented economic growth and underpins much of the contemporary business activities. With the realisation of the environmental consequences of carbon emissions and the resulting socio-cultural and legal/regulatory changes, however, it has become increasingly costly to run a carbon-intensive business (Nyberg et al., 2018); leading to implications for competitiveness and business survival (Lubin and Esty, 2010; Chatzidakis and Shaw, 2018).

Interestingly, the logic underpinning the ways in which businesses address these emerging economic changes is based on ideas related to economies of scale (O'Reilley et al., 2018). In fact, it appears that the economic context in which business responses to climate change occur pressures companies to run emission reduction initiatives based on the assumption that *"existing economic, social and political arrangements can remain largely unchanged by applying a 'common-sense' and universal organizational principle of efficiencies via economies of scale"* (O'Reilley et al., 2018, p.221).

Despite the emerging socio-cultural, legal/regulatory and economic changes, very few companies have embraced a truly radical transformation in response to climate change (Okereke et al., 2012). This calls for an alternative conceptualisation and novel approaches to develop a more comprehensive understanding of how companies respond to climate change.

One industry that appears particularly pertinent in responding to climate change, and one that has actually embarked on a transition towards low-carbon, is the global energy supply sector.

4.3 The relevance of the global energy supply sector

With almost 50% of the global annual carbon emissions, the energy supply sector is the largest single emitter of carbon emissions (IPCC, 2014; IEA, 2016). Moreover, the annual emissions stemming from the global energy supply sector have increased by 3.1% annually between 2000 and 2010, and continue to do so (IPCC, 2014). Predominantly based on burning fossil fuels, the global energy supply sector is one of the underlying causes of climate change (Giddens, 2009; IPCC, 2014). Interestingly, the factors that have brought about the dependence on fossil fuels as a primary source of energy are similar to the causes of the climatic changes described in the first section of this chapter.

Indeed, the increase in population and the associated economic growth demanded a supply of energy at a scale that was impossible to meet with the traditional low-carbon energy sources (e.g., animals, water and windmills). In the search for more concentrated sources of energy, coal-fired power plants gained significant attention. From the 19th century onwards, coal established itself as the dominant source of energy (Fouquet, 2010). It is evident, however, that this shift was an unsustainable solution as the natural environment was no longer able to absorb the influx in carbon emissions stemming from an energy supply system based on fossil fuels (IPCC, 2014). The global energy supply sector has therefore moved to the forefront in the global quest to address climate change (Giddens, 2009).

Meeting the targets set in the Paris Agreement requires halving emissions from the global energy supply sector by 2050, and completely decarbonising the sector by 2100 (Bataille et al., 2016). This endeavour is particularly complex since the energy supply sector is deeply ingrained in every aspect of human life. Government energy policies can therefore never be solely based on establishing a more sustainable energy supply system but must also ensure affordability and the security of supply (Hammond and O'Grady, 2017). Taken together, these three aspects are referred to as the energy trilemma. While the energy trilemma may slow down the global transition towards a low-carbon energy system, it is still feasible to make substantial progress in decarbonising the global energy supply sector. I now turn my attention to the existing options to do so.

Decarbonising the global energy supply sector can be achieved through a range of measures spanning from improving energy efficiency, eliminating fugitive emissions in fossil fuel extraction (e.g., flaring) as well as in energy transmission and distribution, and switching to low-carbon energy supply technologies (e.g., renewable energy) (IPCC, 2014). No single measure alone, however, will reduce carbon emissions satisfactorily and hence it requires a diversified investment across all options. Combining and significantly scaling up these measures *"can solve the carbon and climate problem in the first half of this century"* (Pacala and Socolow, 2004, p.968).

In the next section, I introduce the UK energy supply sector as the industry context of this study.

4.4 The UK national energy transition

The UK energy supply sector is the single most emitting sector in the UK, accounting for almost one-quarter of the total UK carbon emissions annually (CCC, 2015). This has led to substantial efforts by the UK government to alter the legal/regulatory framework to promote decarbonising the sector.

In the 1990s, the approach to achieve this followed a market logic (Keay, 2016). The government tended to leave it to market forces to reduce carbon emissions. From 2000 onwards, however, the approach shifted towards following a government logic and a centrally coordinated approach to responding to climate change (ibid, 2016). The government started to implement a national climate change policy framework that forces companies to reduce their emissions.

While the government logic generally offers a higher carbon emission reduction potential (Hammond and O'Grady, 2017), the UK government has not reconciled these two approaches as they emerged over time. As a result, the UK transition towards a low-carbon energy supply system finds itself in a limbo between market-oriented and government-coordinated policies (Keay, 2016). Over the following paragraphs, I review these policies. In doing so, I outline the UK energy and climate change policy as these are the most pertinent policy areas for the UK energy supply sector.

The energy policy in the UK is driven by three fundamental objectives: affordability, the security of supply and decarbonisation (Foxon, 2013; DECC, 2014). Although the relative importance of each objective has changed over time, the Climate Change Act in 2008 led to a substantial increase in efforts related to decarbonisation. As the most central UK policy aimed at addressing climate change, and due to its considerable impact on the energy supply sector, it requires a more detailed review.

The UK Climate Change Act of 2008 included the world's first legally binding emission reduction target set by a national government (HM, 2016). Passed by the UK Parliament in 2008, the Climate Change Act requires the UK to cut carbon emissions by 80% below 1990 levels by 2050. Furthermore, it set up the Committee on Climate Change (CCC) as an independent and science-based advisory body responsible for setting 'carbon budgets' and holding the UK government accountable for putting emission reduction measures in place (Foxon, 2013).

The carbon budgets set by the CCC determine the total amount of carbon emissions to be emitted in a five-year period. The first three carbon budgets cover the period from 2008-2012, 2013-2017 and 2018-2022 required maximum total emissions of 3,018 $MtCO_2e$, 2,782 $MtCO_2e$ and 2,544 $MtCO_2e$ respectively (HM, 2016). Annual carbon emissions were subsequently set to be no more than 1,950 MtCO2e in the fourth carbon budget (2023-2027) and to 1,725 MTCO2e in the fifth carbon budget (2028-2032). Meeting these carbon budgets would equate to a 57% reduction from 1990 levels by 2032, and would keep the UK on track to reach the overall target of 80% fewer emissions by 2050.

Achieving this, however, continues to be challenging since it requires decarbonising almost all sectors of the economy, and especially energy supply, transportation and heating, in a fair and cost-effective way (HM, 2016). Although challenging, the CCC reassures that even with today's technologies it is feasible to reach the targets under the 2008 Climate Change Act (CCC, 2016). In an attempt to achieve this, the UK government has designed a range of policies in order to encourage scaling up low- and zero-carbon sources of energy supply.

By way of contextual and industry-specific information pertinent to this study, I have summarised the most relevant UK energy policies in Table 7 below.

Year	Policy name	Brief description
2001	Climate Change Levy (CCL)	A tax on electricity consumed by companies. Fuels used for the electricity generation and from renewable sources are exempt.
2002	Renewables Obligation (RO)	Obliges energy suppliers to generate a specific proportion of their total energy production from renewable sources.
2005	European Union Emissions Trading System (EU ETS)	An emissions trading scheme that establishes maximum greenhouse gas allowed to be emitted by participants. Permits for any excess emissions must be traded in the system.
2012	Energy Companies Obligation (ECO)	A scheme that encourages energy efficiency measures. It obliges energy suppliers to reduce greenhouse gas emissions and minimise costs for home heating. Under ECO2, this also involves an obligation to reduce emissions from rural and low-income areas.
2012	Energy Entrepreneurs Fund (EEF)	Provides funding for the development and demonstration of energy efficiency, electricity generation and heat/electricity storage technologies, products and/or services.
2013	Carbon Price Floor (CPF)	Imposes a tax on fossil fuel-based generation of electricity. Establishes a minimum 'floor' price for emissions of UK energy suppliers participating in the EU ETS.
2013	Green Deal (GD)	A loan scheme for households and companies to finance energy-saving measures. Loan repayment through energy bills.
2014	Capacity Market (CM)	Incentivises investment in secure energy supply. The required capacity is contracted as a result of a competitive auction. Successful energy suppliers committed to the delivery of electricity in exchange for a steady payment. The CM is a main element of the Electricity Market Reform (EMR) that encourages diverse investments in a low-emissions energy mix.
2014	Contracts for Difference (CfDs)	Electricity supply price guarantee contracts with the national government. If the pre-agreed electricity price exceeds the market price, the generator pays the government; and vice versa when the pre-agreed price is below the market price. The CfDs are a main element of the Electricity Market Reform (EMR).

Table 7: *UK energy and climate change policy (based upon Ang et al., 2016)*

As a result of these policies, the energy supply sector-related emissions are down by 39% relative to 1990 levels (HM, 2016). In fact, the UK's energy supply companies have racked up investments in renewable energy sources. For two consecutive years (2015 and 2016), no other European country has invested more in renewable energy than the UK (US$ 24 billion) (REN, 2017). The UK has not only met the first (2008-2012) and second (2013-2017) carbon budget, it has also set the groundwork for meeting the third (2018-2022) carbon budget. While the progress so far is remarkable, moving ahead with the

UK's transition towards a low-carbon energy supply system is facing significant challenges.

Indeed, a recent progress report released by the UK Committee on Climate Change (CCC, 2016) suggests that on current carbon emission projections, the UK would not meet the fourth carbon budget (2023-2027) by 10% and the fifth carbon budget (2028-2032) by 18%. The report concludes that today's legal/regulatory demands are not enough as they at best would *"deliver around half of the emissions reductions required by 2030"* (CCC, 2016, p.12). As a result, Keay (2016, p.247) concludes that *"without the coordination and direction which could come from a centralised approach or the efficiencies and innovation which might emerge from a more consistent market based policy"* the UK risks meeting every single aspect of the energy trilemma.

While the emissions reduction targets have been met so far, its continued success will be largely dependent on driving further change through the cooperation of all actors involved in the UK's low-carbon energy transition (Parkes and Spataru, 2017). This makes the UK national energy transition one of the best empirical examples for developing theory in and around the interaction and behaviour in business relationships and networks. Indeed, the UK's transition towards a low-carbon energy supply system is difficult to achieve without getting the energy supply companies themselves onboard (Foxon, 2013).

In the next section, I introduce the UK's national energy network.

4.5 The UK's national energy network

The UK's national energy sector is dominated by six energy supply companies: British Gas, EDF, E.ON, RWE nPower, Scottish Power and SSE. Collectively, these energy companies are known as the 'BIG-6' and comprise the UK's energy supply network. These six energy supply companies have a market share of approximately 85% of all energy supply in the UK. The remaining 15% is split between smaller energy supply companies such as Co-operative Energy, First Utility, OVO, Utilita, Utility Warehouse and others (Ofgem, 2017).

Energy supply companies are responsible for all stages from energy extraction to the delivery of electricity to consumers (IPCC, 2014). The process typically begins with the extraction of elementary inputs such as minerals, materials or land use (extraction stage). These inputs are then either processed into energy and fuel (processing stage), directly transported to power stations (transportation stage) or injected into electricity generation facilities (generation stage). Electricity is then generated by burning fossil fuels and natural gases, through nuclear reactions or through renewable energy sources. Once the electricity is generated, it is fed into the grid system that distributes the electricity across the country to the final consumer (distribution stage) (Hammond and O'Grady, 2017).

By way of contextual information, in 2016, the UK's electricity was generated from four key sources of energy: natural gas (43%), renewables (24%), nuclear (21%) and coal (9%). The remaining 3% is covered by oil and other minor sources (based on 2016 figures reported in BEIS, 2017). The recent policy decision to phase out coal as a source of energy has led to a reduction in electricity generated from coal of 59% relative to 2015 figures. Natural gas has picked up some of the gap in supply that has been left by using less coal. Electricity generated from natural gases increased by 43% relative to 2015 figures. Low-carbon electricity generation (including renewables and nuclear) accounted for almost half of total electricity generation in 2016. A more detailed look at electricity generated from renewables (24% of total electricity generation) shows a substantial increase in electricity generated from Solar PV (+36%) while Wind (-14%) and Hydro (-15%) have supplied less electricity (BEIS, 2017). I have illustrated the UK electricity generation by of source of energy in Figure 10 below.

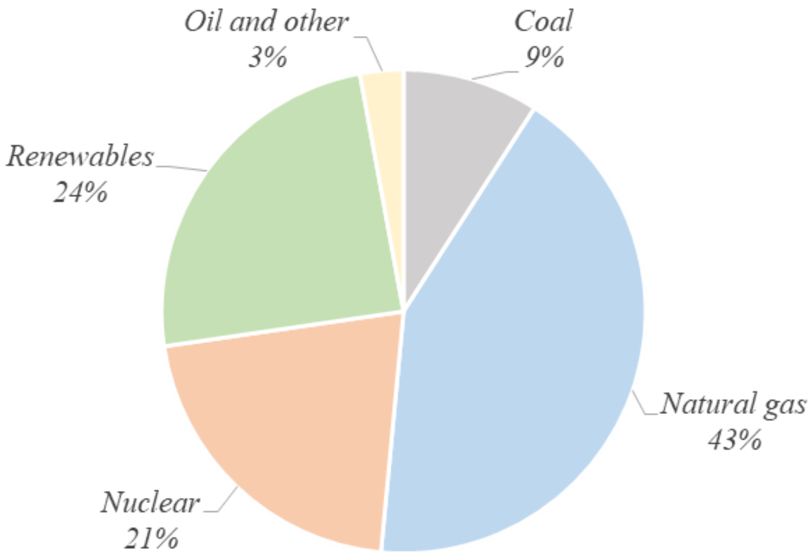

Figure 10: *UK electricity generation by the source of energy (2016) (Based upon data from BEIS, 2017)*

This mix of energy sources is predominantly supplied by the six energy supply companies that dominate the UK’s energy supply sector. Interestingly, these energy supply companies aim at increasing revenues by selling the maximum amount of electricity at the lowest possible costs (UKERC, 2006). Indeed, the underlying business model disincentivises these companies from reducing their customers’ electricity consumption (Hannon et al., 2013). While this has been recognised by the UK government and policies have been implemented to incentivise companies to sell fewer units of electricity (e.g., the Energy Company Obligation), the emission reductions stemming from less demand for electricity alone may not suffice to meet the fourth and fifth carbon budgets as well as the commitments under the Paris Agreement. Doing so requires changes in current patterns of electricity generation and consumption. The question, however, is how UK energy supply companies respond to the contextual changes (socio-cultural, legal/regulatory and economic) emanating from climate change. In the next chapter, I introduce five cases of how companies do exactly this.

4.6 Conclusion

This chapter has provided the context and industry-specific aspects necessary to comprehend the empirical cases. I started by describing why an imbalance between nature and society emerged, and how this brought about climatic changes. I then offered an outlined of the changes in the socio-cultural, legal/regulatory and economic pressures that occurred in response to climate change. Next, I explained the fundamental role of the global energy supply sector in responding to climate change. I closed this chapter by giving information about the UK national energy supply sector.

In all, I hope that this chapter has highlighted the timely and relevant nature of studying how British energy supply companies respond to climate change. In the next chapter, I outline five cases stemming from my empirical investigation of the UK energy supply sector.

5 Empirical findings

This chapter presents the empirical findings stemming from five in-depth case studies of business responses to climate change. The first case provides insights into an energy supply company's efforts to respond to a regulation aimed at mitigating carbon emissions. In the second case, I describe how an energy supply company respond to climate change by decarbonising its gas-fired energy generation assets. The third case describes a multinational energy supply company's efforts to establish itself as a renewables-only energy supply company. In the fourth case, I outline how an energy supply company responded to climate change by expanding its product portfolio with demand-side response technology. The fifth and final case refers to ways in which an energy supply company attempted to realign its business towards connected home technologies.

Collectively, these five cases are some of the best empirical examples for developing a more comprehensive understanding of how companies respond to climate change and to develop theory in and around the interaction and behaviour in business relationships and networks. In an attempt to show explicitly why these cases are such a good fit with the research objectives of this study, I have structured each case as follows:

At the beginning of each case, I introduce the relevant actors and describe the contextual changes that triggered the company's response to climate change. Next, I depict the key relationships as well as the interactions and behaviours within and across the business network affected by the focal company's response to climate change. I then describe the outcomes stemming from the business attempt to respond to climate change. I close each case by providing a brief conclusion.

For clarity, I provide a table containing the names and roles of all actors and their respective representatives involved in each case below (Table 8). In order to safeguard the anonymity of my participants, I have replaced actual names with pseudonyms.

Case	***Actor***	***Name***	***Job title***
Case 1: Utiliko	Utiliko	Rudy	Chief Corporate Officer
		Robert	Managing Director for Offshore
		Andrew	Head of Business Development
		Lucy	Development Manager
		Julia	Energy Policy Manager
	Exxelo UK	Sheila	Policy Manager
Case 2: Olectra	Olectra	Brian	Chief Executive Officer
		Adam	Head of Wholesale Policy
		Simon	Business Development Manager
	PlentiOil	Kevin	Carbon Capture and Storage Manager
		Anna	Analyst
	Planwey	Omar	Regional Director
Case 3: Energize	Energize	Walter	Chief Executive Officer
		John	Board of Directors
		Ben	Head of Orientation
	MDfE	Scott	Head of Energy Security
		Adam	Analyst
	Mygrid	Emma	Capacity Market Manager
Case 4: Vonergy	Vonergy	Steven	Chief Executive Officer
	Xidoa	Joe	Chief Executive Officer
		Luke	Chief Commercial Officer
	Morhaven Int.	Richard	Director of Facilities and Project Mgmt.
	Pantegis	Isaac	Chief Operating Officer
	MDfE	Connor	Head of Electricity Systems
	Gryd	Claire	Director of UK System Operator
		Claudia	Spokeswoman
Case 5: Connectica	Connectica	Hannah	Chief Executive Officer
		Alistair	Managing Director
		Grace	Commercial Director
		Tom	Head of Environment
	Ecovair	Paul	Founder
		Charlotte	Chief Executive Officer
	Qubeta	Michael	Advisor
	MDfE	Gary	Head of Regulation

Table 8: *List of actors, names and job titles*

5.1 Case 1: *Utiliko's* response to the Energy Company Obligation

The first case examines the response of *Utiliko*, an energy supply company, to the Energy Company Obligation (ECO); a supplier obligation model that mandated the company to install energy efficiency measures in domestic households in order to reduce emissions. In an attempt to achieve this representatives of *Utiliko* engaged in interactions within and across the company's business network. I concentrate on eight key actors within this business network: *Utiliko*, the energy company itself, the UK's *Ministerial Department for Energy (MDfE)*, the social housing association *Thameswide*, the administrative body of *Brixwell Council*, the insulation company *Isotec*, domestic energy *Consumers* as well as *The Energy Bjird*, an energy supply company directly competing with *Utiliko*, and the energy industry association *Exxelo UK*.

5.1.1 Introduction to the network actors

Utiliko is a British energy supply company and distribution network operator supplying electricity and gas to just over 5.2 million households and businesses across the UK. With 6,000 employees in England, Scotland and Wales, the company is one of the largest energy suppliers in the UK. Size notwithstanding, *Utiliko* represents an interesting research case because of its public commitment to reduce the company's carbon footprint by 40% by 2030 and its aim to be carbon neutral by 2050:

> *"We have set out a commitment to reduce our carbon footprint by 40% by 2030 and we aim to be carbon neutral by 2050."* [Robert, Managing Director for Offshore Business, Utiliko]

Interestingly, in its 2010 Annual Review of Corporate Social Responsibility, *Utiliko* stated total annual carbon emissions of 18.5 megatons; largely stemming from its fossil fuel-dominated energy generation portfolio. In 2010 the company generated over 90% of its energy from fossil fuels (39.1% coal and 52.2% gas) and only 8% from renewables. In an effort to increase the share of renewables, in 2012 *Utiliko* planned to invest £7 billion until 2020 to become the leading developer of wind energy generation assets. Robert, *Utiliko's* Managing Director for Offshore, was seemingly excited about the company's drive towards renewables and decarbonisation:

> *"For a utility that is a very big commitment because obviously, 25% of all carbon emissions come from the electricity sector."* [Robert, Managing Director for Offshore, Utiliko]

At the same time, however, the *MDfE* altered the design of a regulation, namely the ECO scheme. While supplier obligation models, such as the ECO scheme, had been around for more than 20 years, the latest revamp of the scheme focused particularly on reducing the emissions of low-income households and harder-to-treat properties, i.e. dwellings in which it is most difficult to fit wall insulation. Through this, the *MDfE* aimed at addressing two of the department's key performance indicators: mitigating energy-related emissions and addressing fuel poverty.

By way of contextual information, the ECO scheme required all energy supply companies with more than 250,000 customers to install energy efficiency measures to collectively generate lifetime carbon emission savings of 28 megatons. Although energy supply companies had the freedom to choose their approach to installing the energy efficiency measures, the *MDfE* had designed the regulation in a way that it would stipulate a focus on solid wall insulation in vulnerable and harder-to-treat homes. This meant that in 2013 alone, *Utiliko* was required to insulate 100,000 solid walls. Solid wall insulation, however, is a very complex task that requires skilled insulation specialists. Furthermore, specifically targeting vulnerable households made it difficult to identify eligible households. While this increased the administrative costs associated with fulfilling the ECO scheme requirements, non-compliance was no option for *Utiliko* as the *MDfE* threatened a fine of up to 10% of the company's annual turnover; based on its 2012 revenue of £5.9 billion, this meant that *Utiliko* would have faced a fine of £590 million.

In the process of responding to the ECO scheme, *Thameswide*, *Brixwell Council* and *Isotec* played a crucial role. *Thameswide* is one of the UK's oldest and largest social housing associations owning over 50,000 properties across London, *Brixwell Council* is an administrative body responsible for the strategic regional administration of London and *Isotec* is a leading British wall insulation specialist. Most pertinent to his study, however, is *Thameswide's* and *Brixwell Council's* knowledge about eligible households and *Isotec's* expertise in solid wall insulation.

Another important consideration for *Utiliko* were the consumers living in eligible households. Roughly 800,000 of *Utiliko's* consumers were living in fuel poverty and the majority of these lived in properties with an energy efficiency rating of C or below; meaning that the fuel poor live in the most energy inefficient properties and face high running costs. Many such eligible households, however, made use of their right to reject *Utiliko's* effort to implement energy efficiency measures in their houses because solid wall insulation was deemed to be too intrusive as it usually involves scaffolding and takes at least two weeks to complete.

Furthermore, *Utiliko's* competitor *The Energy Bjird*, a small energy supply company, played an important role. As a result of having less than 250,000 customers, *The Energy Bjird* was not obligated to comply with the ECO scheme and since it did not have to bear the costs of installing energy efficiency measures in vulnerable households.

Unsurprisingly, *The Energy Bjird* was able to offer its customers a 20% lower energy price than *Utiliko's* average energy price.

Lastly, the role of *Exxelo UK*, a British energy industry association, cannot be ignored. *Exxelo UK* held regular meetings with all of its 118 member companies in order to establish industry positions on the key energy regulations (such as the ECO). *Exxelo UK's* close engagement with the *MDfE* allowed them to push back on aspects of energy regulations.

Scrutinising the interactions within and across the network of actors that influenced *Utiliko's* attempt to comply with the ECO scheme in a cost-effective way, enabled me to develop a holistic understanding of the issues I sought to engage with in terms of how companies respond to climate change. Indeed, it was clear that, for *Utiliko*, the business network was a key component to install the required quantity of energy efficiency measures in order to achieve the required reduction in carbon emissions.

The remainder of this case focuses on this by outlining the contextual changes that triggered *Utiliko's* response to climate change, by describing the interactions within and across the company's business network and by reviewing the outcome stemming from *Utiliko's* interactions in response to climate change. The case closes with a brief conclusion.

5.1.2 *Utiliko's* response to the ECO scheme

In 2012, largely as a result of the *MDfE's* focus on low-income households and harder-to-treat properties, *Utiliko's* senior leadership team became more and more concerned about reaching its target of being carbon neutral by 2050. In fact, *Utiliko's* Chief Corporate Officer Rudy instigated an emergency meeting to this discuss the *"big* *increase" [Rudy, Chief Corporate Officer, Utiliko]* in costs associated with responding to the amended ECO scheme. Rudy said that the obligation's focus on solid wall insulation was *"a much more difficult, costly and time-consuming process" [Rudy, Chief Corporate Officer, Utiliko]* and hence he was worried about the cost-effectiveness of installing the energy efficiency measures required to comply with the ECO scheme.

One of the key reasons for the increased costs, so *Utiliko's* Business Development Manager, Lucy, explained, was the lengthy process of identifying eligible households and convincing them to participate in the scheme:

> *"When you have solid wall insulation installed in your house, then you always talk about scaffolding on the outside and workmen hanging around your house for two weeks.* […] *Engaging consumers to actually accept those two weeks' work and that sort of inconvenience is difficult because your front garden, your back garden and the sides of your house will have scaffolding.* […] *When you are living in blocks of flats, then you have got scaffolding on them for weeks."* [Lucy, Business Development Manager, Utiliko]

Furthermore, she found that the ECO scheme's focus on low-income households meant that *Utiliko* had to fund a larger share of the costs associated with installing the energy efficiency measures:

> *"The ECO has moved more and more towards the priority group customers. So, these customers that haven't the money to contribute, so we're having to fund up to a hundred per cent of these measures."* [Lucy, Development Manager, Utiliko]

She concluded that this was not only hindering *Utiliko* from installing the required amount of energy efficiency measures but also leading to a decrease in carbon emission savings:

> *"So, obviously it will mean that fewer measures are installed which ultimately means less carbon saved as the focus is going away from carbon more towards helping vulnerable people."* [Lucy, Development Manager, Utiliko]

As a result of the discussion during this meeting, Chief Corporate Officer Rudy decided to take parts of the £7 billion capital set aside to establish *Utiliko* as a leading developer of wind energy generation assets and instead double the spending on the ECO scheme to £134 million. This budget, as Rudy pointed out, was based on the *MDfE's* estimation that it would cost energy supply companies £50 per household per year to respond to the ECO scheme. Rudy concluded that it was of utmost importance to implement the required energy efficiency measures in the most cost-effective way to stay within this budget.

5.1.3 Interactions during *Utiliko's* response to the ECO scheme

Utiliko's attempt to implement energy efficiency measures was embedded in a network of business relationships with the actors introduced above.

Figure 11 shows this business network and the associated interactions taking place.

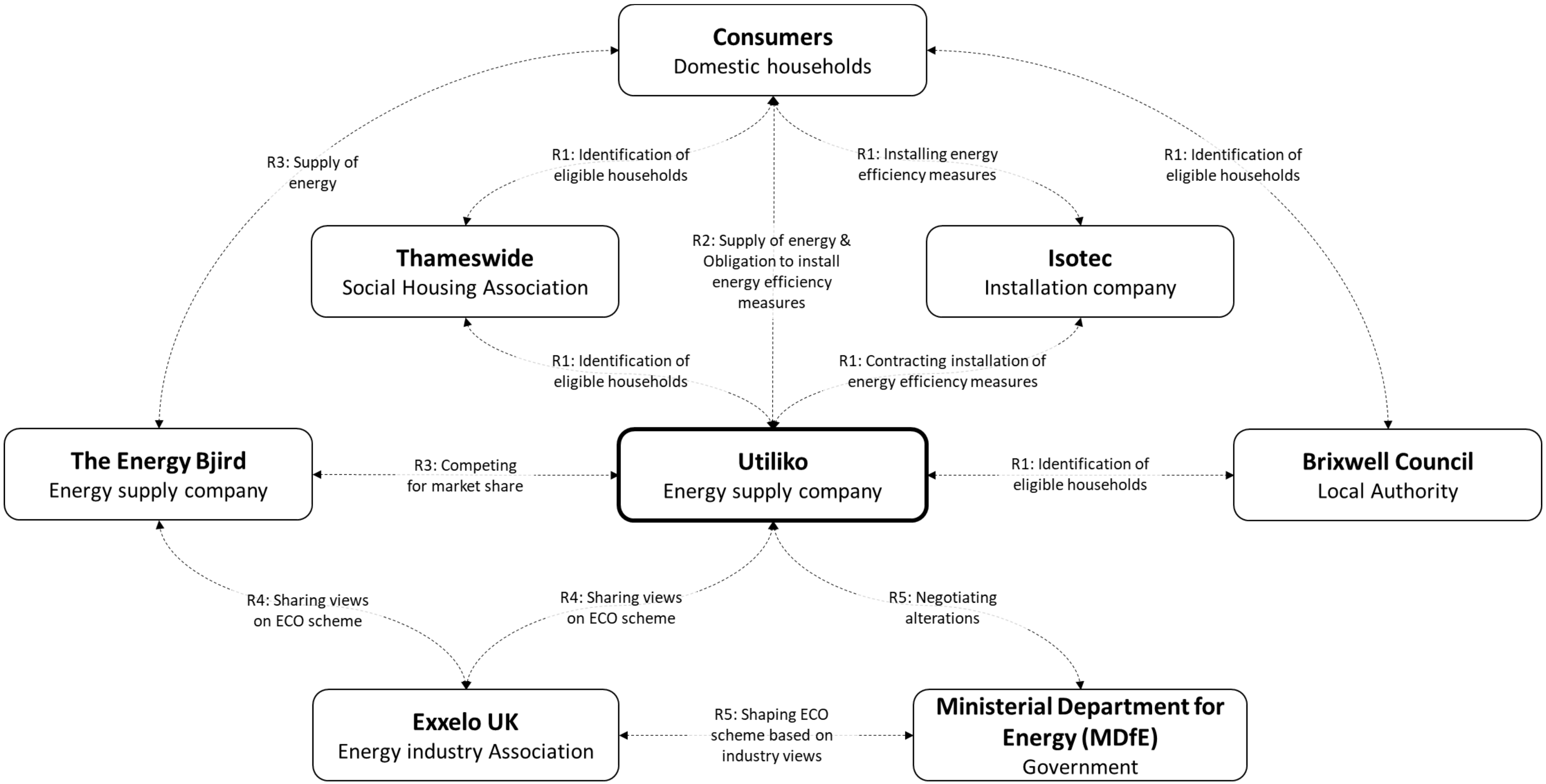

Figure 11: *The network affected by Utiliko's response to climate change*

Throughout the two years of interactions within and across this business network, I focus on five key relationships held by *Utiliko*. Delineating the interactions in and around these relationships enables the development of a holistic understanding of how companies respond to climate change.

5.1.3.1 Relationship 1 (R1): Cost-effectively installing energy efficiency measures

The first relationship that affected *Utiliko's* response to climate change was with *Thameswide*, *Brixwell Council* and *Isotec*. For these three actors, the ECO scheme was a big opportunity.

The social housing association, *Thameswide,* had recently announced its intention to put the most vulnerable people first by providing high-quality and affordable homes. What was interesting for *Utiliko,* however, was the fact that *Thameswide* had detailed information about 50,000 properties and knew the ones that were inhabited by consumers eligible for the ECO scheme. In return for sharing this knowledge on eligible households, *Utiliko* committed to getting as many of *Thameswide's* properties as possible retrofitted with energy efficiency measures.

Furthermore, *Brixwell Council*, responsible for the strategic regional administration of London, perceived the ECO scheme as an opportunity to secure additional funding to meet its climate change and energy objectives. In fact, *Brixwell Council* and *Utiliko* signed a Memorandum of Understanding that obliged *Utiliko* to maximise the number of energy efficiency measures installed within the *Brixwell Council* area in exchange for the latter providing detailed information and access to 21% of all ECO qualifying households. Lucy, *Utiliko's* Business Development Manager, was the driver behind this agreement as she perceived that *Utiliko* could gain substantial cost-benefits from collaborating with *Brixwell Council*:

> *"*[Brixwell Council] *obviously has knowledge of the properties and the areas that can help with planning measures such as solid wall insulation. It is also about their branding. It's good to have* [Brixwell Council's] *support for the project as it gives consumers confidence."* [Lucy, Business Development Manager, Utiliko]

Once *Thameswide* and *Brixwell Council* had helped *Utiliko* identify eligible households, the company's Business Develop Manager Lucy tasked the British wall insulation specialist *Isotec* with installing solid wall insulation. *Isotec* had the manpower and technical expertise needed to install wall insulation at scale because the company had invested heavily in training their staff in anticipation of the large-scale delivery of solid wall insulation required to meet the ECO.

5.1.3.2 Relationship 2 (R2): The willingness of eligible households

The role of consumers in shaping *Utiliko's* effort to implement energy efficiency measures cost-effectively cannot be ignored. While *Utiliko's* close engagement with *Thameswide* and *Brixwell Council* increased consumer confidence, getting eligible households to agree to have the energy efficiency measures installed remained a major challenge. Indeed, *Utiliko's* Business Development Manager Lucy was devastated:

> *"We can't make consumers do things to their homes. Even in social housing, the tenant has the right to say, 'I don't want those cooperies filled' despite* [Thameswide] *trying their best to have it done."* [Lucy, Business Development Manager, Utiliko]

As a result, over the first six months of the ECO scheme and despite the cost-efficiencies stemming from working closely with *Thameswide*, *Brixwell Council* and *Isotec*, *Utiliko's* costs in respect to installing energy efficiency measures added up to over £90 per household per year. *Utiliko's* Chief Corporate Officer Rudy was concerned since this was 80% more than the *MDfE's* estimate of £50 per household per year; the amount that would have allowed *Utiliko's* to stay within its ECO budget of £134 million.

Since the costs of responding to the ECO scheme had skyrocketed, *Utiliko's* profits dropped by 7.3% by the end of 2012. As a result, and effective as of January 2013, Rudy had no choice but to increase energy prices by 8.8%.

Andrew, Head of Business Development at *Utiliko*, criticised the way in which the ECO scheme was designed as it ultimately led to an increase in energy prices:

> *"ECO has got to be affordable for consumers; that is the most critical point."* [Andrew, Head of Business Development, Utiliko]

In fact, the increase in energy prices of 8.8% not only put more households into fuel poverty, but it also risked losing customers.

5.1.3.3 Relationship 3 (R3): Competing for market share

The increasing costs stemming from *Utiliko's* obligation to install energy efficiency measures in low-income homes and harder-to-treat properties put the company at a competitive disadvantage in comparison to the small energy supply company *The Energy Bjird*. As a result of having less than 250,000 customers, *The Energy Bjird* was not required to oblige with the ECO scheme and hence was soon able to offer its customer's energy prices approximately 20% below *Utiliko's* average energy price.

Although some consumers did not switch to *The Energy Bjird* due to lack of trust in smaller energy suppliers, *Utiliko's* Chief Corporate Officer Rudy believed that the ECO scheme had put its company in an unfair position as it indirectly subsidised small energy supply companies. In early 2013, he concluded that this issue had to be brought to the attention of the *MDfE*.

5.1.3.4 Relationship 4 (R4): Establishing industry-wide consensus

Utiliko interacted with *Exxelo UK*, a British energy industry association, to establish an industry-wide consensus about the challenges associated with responding to the ECO scheme.

Engaging with *Exxelo UK* was within the remit of Julia, *Utiliko's* Energy Policy Manager. She initiated a meeting with Sheila, the designated Policy Manager at *Exxelo UK*, to discuss the company's position on the ECO scheme:

> *"We work with* [Exxelo UK] *and then use that to try and establish industry positions on certain aspects of the legislation. We agree as much as we can in the industry, then those messages are going into government and to the regulator. It certainly helps when we have got all the same message!"* [Julia, Energy Policy Manager, Utiliko]

As a result, *Exxelo UK's* Policy Manager Sheila organised a workshop to which she invited the Policy Managers of the six largest energy supply companies to further discuss the issues raised by Julia. In this meeting, *Utiliko's* Business Development Manager Lucy said that they quickly reached consensus on the extensive administrative burden and costs related to responding to the ECO scheme:

> *"I mean, one of the examples was, and this was for all suppliers, when they launched ECO, the policy has totally moved towards solid wall insulation and after six month when it was launched, you know, we all said it's going to be hard because the solid wall supply chain hasn't developed efficiently to deliver the number of solid wall measures that were required."* [Lucy, Business Development Manager, Utiliko]

The demand of the Policy Managers of the six largest energy supply companies was clear: The *MDfE* had to scale back the ambition of the ECO scheme to allow energy supply companies to achieve their obligation through installing energy efficiency measures other than just solid wall insulation.

5.1.3.5 Relationship 5 (R5): Negotiating alterations to the ECO scheme

The fifth and final relationship that affected *Utiliko's* response to the ECO scheme was with the *MDfE*. Between mid- and late-2013, *Exxelo UK's* Policy Manager Sheila engaged with the *MDfE* in response to her request to revise the ECO scheme. Sheila felt that the discussions with the *MDfE* were constructive as they had a common interest in improving policies:

> *"My experience with the* [MDfE] *has been that they are extremely open to talking to us and listening to our views and trying to improve the scheme."* [Sheila, Policy Manager, Exxelo UK]

Sheila was also self-critical, however, and acknowledged that the current design of the ECO scheme was partially *Exxelo UK's* fault as they were involved in the initial design:

> *"One of the mistakes that we didn't want to make was having to change the policy retrospectively by making sure that everything is developed early, but now we have failed."* [Sheila, Policy Manager, Exxelo UK]

While *Utiliko* appreciated *Exxelo UK's* engagement, the magnitude of the issue also led Julia, Energy Policy Manager at *Utiliko*, to engage directly with a representative of the *MDfE*:

> *"In the case of ECO, there are so many aspects of how much that costs us and what the cost to the consumer is. It is not just about delivering it but the costs have to be low otherwise the government will not favour that option. You know, it has to be affordable for consumers because they are dependent on the electricity."* [Julia, Energy Policy Manager, Utiliko]

During six months of extensive negotiations, Julia repeatedly emphasised the high costs of delivering the ECO scheme and the burden that higher bills put on the consumers of energy. In support of her argument, she provided evidence for why the scheme was not working in terms of installing energy efficiency measures cost-effectively. In doing so, she highlighted that, despite collaborating with *Thameswide*, *Brixwell Council* and *Isotec*, it was impossible to comply with the ECO scheme without increasing energy prices.

In late 2013, the *MDfE* announced an alteration to the initial design of the ECO scheme. The concerns over the ECO's impact on consumer bills had caused the *MDfE* to revise down the carbon emission saving targets by 25% while also broadening its scope to include less expensive energy efficiency measures. These changes were effective as of January 2014.

5.1.4 The outcome of *Utiliko's* response to the ECO scheme

So far, this case has outlined the five key relationships relevant to *Utiliko's* response to the ECO scheme. This section now describes the outcome stemming from two years of interactions in and around these relationships.

In the months following the alteration of the ECO scheme, *Utiliko's* costs of responding to the ECO scheme fell by 50%. As a result, *Utiliko's* Chief Corporate Officer Rudy decided to pass on these savings and lower energy prices by 3.3% as well as granting its customers a £12 rebate. At the same time, Rudy advocated *Utiliko's* strong progress towards meeting the targets set under the new ECO design.

Insulation company *Isotec* and low-income *consumers*, however, were continued to be disadvantaged as an outcome of *Utiliko's* response to the ECO scheme. *Isotec* had invested in training their staff to deliver large-scale wall insulation measures. Since solid wall insulation targets were revised down from 100,000 to just over 20,000 per year, *Isotec* had no choice but to lay off half of its workforce at short notice.

Households living in fuel poverty also suffered from the amendments of the ECO scheme that were the outcome of *Utiliko's* activities. While the ECO scheme has helped to mitigate the energy bills of the fuel poor that actually had the solid wall insulation measures done, the vast majority were now facing higher bills than before the ECO scheme was set up in 2012.

Furthermore, *Utiliko's* response to the ECO scheme led to a drop in the ECO scheme's ambition to improve the energy efficiency of homes and hence to save carbon emissions. As part of the changes to the ECO scheme, the carbon emission saving targets were revised down by 25%.

5.1.5 Conclusion

This case examined an energy supply company's response to the ECO scheme; an legal/regulatory pressure emanating from climate change. I scrutinised *Utiliko's* interactions in and around implementing energy efficiency measures in domestic households as required under the ECO scheme. I concentrated on the five key relationships as well as the interactions and behaviours within and across the business network affected by *Utiliko's* response to climate change. This included *Utiliko* itself, the UK's *Ministerial Department for Energy (MDfE)*, the social housing association *Thameswide*, the administrative body of *Brixwell Council*, the insulation company *Isotec*, domestic energy consumers as well as *The Energy Bjird*, an energy supply company directly competing with *Utiliko*, and the energy industry association *Exxelo UK*.

The purpose of this case was to develop a holistic understanding of how the case company *Utiliko* responded to the legal/regulatory pressures emanating from global climatic changes. Hereby, this case links well to the second case which scrutinises how an energy supply company responded to climate change by decarbonising one of its fossil fuel energy generation assets.

5.2 Case 2: *Olectra's* efforts to decarbonise a gas-fired power plant

The second case examines the interactions when the energy supply company *Olectra* decided to decarbonise its gas-fired power plant in response to climate change. To achieve this, representatives of *Olectra* engaged in interactions within and across the company's business network in order to retrofit a gas-fired power plant with Carbon Capture and Storage (CCS) technology. I concentrate on nine key actors within *Olectra's* business network: *Olectra*, the energy supply company itself, the multinational oil and gas company *PlentiOil*, the UK's *Ministerial Department for Energy (MDfE)*, three energy services companies called *Projexon*, *Advantegis* and *Planwey*, the local authority *Ablefield Council* as well as the *Henley* CCS technology test centre and the UK government department of *House Windsor*.

5.2.1 Introduction to the network actors

Olectra is a British energy company supplying electricity and gas to 7.7 million households and businesses in the UK and Ireland. With over 20,000 employees, the company is considered to be one of the BIG 6 companies that dominate the UK energy supply sector. Size notwithstanding, *Olectra* itself represents an interesting research case because of its public commitment to drive the UK's low-carbon energy transition. In fact, in its 2012 Annual Report, *Olectra* stated the stringent target of reducing the carbon intensity of its energy generation assets by 50% by 2050. At the time, *Olectra* already perceived itself as *"a big investor in renewables" [Adam, Head of Wholesale Policy, Olectra]*. Indeed, with 3.3 GW (equivalent to 14% of the company's total energy generation) *Olectra* was operating one of UK's largest capacities of renewable generation.

Most pertinent to this study, however, is the simultaneous operation of several fossil fuel-based power plants in England and Scotland. Interestingly, in 2012 coal- and gas-fired power plants accounted for 84% of *Olectra's* total energy generation (35% coal and 49% gas). This not only resulted in annual carbon emissions of 25.3 megatons but also put the company's target to reduce its carbon intensity in jeopardy.

PlentiOil is a multinational oil and gas company and a leading player in North Sea exploration. The company produces 10% of the UK's total annual oil and gas yields and operates gas transmission pipelines as well as terminals that ensure the delivery of 20% of the UK's annual gas supply. Notwithstanding this, and important for this study, is the fact that *PlentiOil* had made the development of CCS technology the company's strategic priority in 2010. Within two years, the company had developed its very own CCS technology and was able to demonstrate its technical viability by successfully retrofitting coal-fired power plants in Australia and Canada.

By way of contextual information, CCS technology allows the capture and deep underground storage of carbon emissions from power stations and industrial plants. In the UK, CCS plays an important role because it enables the decarbonisation of gas-fired generation assets which is likely to continue to be the backbone of the UK's energy mix. The United Nations IPCC and the UK's Committee on Climate Change both classify CCS as:

> *"Very important for reducing emissions across the economy and could almost half the cost of meeting the 2050 target in the UK's Climate Change Act."* [Report, UK Committee on Climate Change]

Indeed, an analysis published by the UK's Energy Technologies Institute suggests that, without CCS technology, the costs of meeting the UK's commitments under the Climate

Change Act would be £32 billion higher. The United Nations IPCC added that a global CCS technology industry is required to reach net-zero carbon emissions globally.

In addition to *PlentiOil*, the interactions with the *MDfE*, a British ministerial department responsible for ensuring the provision of adequate, secure, affordable and environmentally friendly energy, were an important consideration for *Olectra*. Particularly because the *MDfE* was keen on encouraging private companies to develop carbon reduction technologies (such as CCS).

As a result, in April 2012, the *MDfE* announced a so-called CCS commercialisation competition. The rules were simple: The private company that was able to demonstrate the commercial and technical viability of deploying CCS technology in the UK would be awarded up to £1 billion to support the actual construction of the project. This represented a relatively low amount compared to *MDfE's* estimation that a new and world-leading British CCS industry could contribute to cutting the costs of meeting the UK's commitments under the 2008 Climate Change Act by over £32 billion and at the same time add £6.5 billion annually to the UK's gross domestic product.

The three energy services companies *Projexon*, *Advantegis* and *Planwey* played a crucial role in the process of demonstrating the commercial and technical viability of retrofitting *Olectra's* gas-fired power plant *Yankee* with CCS technology. *Projexon* is a French project support company and oil and gas infrastructure specialist, *Advantegis* is a British consulting company with expertise in the energy sector and *Planwey* is a British energy service company specialised in subsea and pipeline engineering work. *Olectra* tasked these three companies with the important role of completing the Front-End Engineering Design (FEED) phase of the *Yankee* CCS project. In fact, the quality and outcome of *Projexon's*, *Advantegis'* and *Planwey's* engineering work during the

FEED phase would ultimately decide *Olectra's* chances of securing parts of the £1 billion CCS commercialisation fund.

Besides the completion of the engineering work during the FEED phase, *Olectra* required planning permissions from *Ablefield Council;* the local authority in which the *Yankee* power station was situated. This was an important consideration for *Olectra* because if *Ablefield Council* deemed that the project would have negative impacts on the municipal district and its citizens, then it had the authority to block *Olectra's* attempt to retrofit its *Yankee* gas-fired power plant with CCS technology by not granting a planning permission.

Furthermore, *Olectra* interacted with the world's largest test centre for CCS technologies, the *Henley Centre*. The *Henley Centre*, located in a remote town in Norway, provided two post-combustion flue gas turbines required for testing, verifying and ultimately demonstrating the technical viability of *Olectra's* CCS project.

Lastly, the role of *House Windsor*, a British governmental department responsible for the UK's public finance and economic policy, cannot be ignored. Jointly with the *MDfE*, it was in the remit of *House Windsor* to make a final investment decision and award the winner(s) of the CCS commercialisation competition.

Scrutinising the interactions within and across the network of actors that were affected by *Olectra's* efforts to decarbonise its gas-fired power plant in response to climate change, enabled me to develop a holistic understanding of the issues I sought to engage with, in terms of answering how companies respond to climate change. In fact, it was evident that for *Olectra*, the business network was a key component in achieving the company's response to climate change.

The remainder of this case focuses on this by outlining the contextual changes that triggered *Olectra's* response to climate change, by describing the interactions within and across the company's business network and by reviewing the outcome stemming from *Olectra's* response to climate change. The case closes with a brief conclusion.

5.2.2 *Olectra's* response to climate change

In the quest for potential solutions to meet the company's stringent carbon intensity reduction target of 50% by 2050, *Olectra's* CEO Brian had long recognised the potential of CCS technology:

> *"If our long-term targets for reducing emissions are to be met, CCS technology must be applied as widely as possible."* [Brian, CEO, Olectra]

Nonetheless, CEO Brian was, up until now, hesitant to invest in retrofitting *Olectra's* fossil fuel-based energy generation capacity with CCS technology. This was largely because of the disproportionate costs and lack of short-term commercial viability of doing so. In fact, just like any other project, efforts to respond to climate change had to be *"fundamentally a commercial opportunity" [Simon, Business Development Manager, Olectra]*.

Simon continued by explaining that the lead time and risk associated with carbon reduction projects, as well as not being able to spend the money on other projects (opportunity costs) led to the requirement of high rates of return:

> *"We actually require quite high rates of return, because the project is quite risky and you have to expect lead times from those projects and all that, so, you know compared with other projects. So, yeah absolutely, if there is stuff that I want to do in terms of projects, then it has to achieve a certain rate of return, if it doesn't, then it won't be signed off."* [Simon, Business Development Manager, Olectra]

With the recently announced CCS commercialisation competition, however, CEO Brian perceived that retrofitting one of the company's gas-fired power plants could actually turn into a huge commercial opportunity. He, therefore, initiated a comprehensive assessment of the company's gas-fired generation assets to decide which plant might be particularly well-positioned for being retrofitted with CCS technology.

Olectra's gas-fired power plant *Yankee* soon came into the spotlight. Open since 1980, the *Yankee* gas-fired power station had played an important role in ensuring a reliable supply of gas for decades and would, at least CEO Brian hoped, continue to be an important earning's driver for *Olectra*. While the *Yankee* gas-fired power plant was a profitable asset, with one megaton of carbon emissions it contributed to *Olectra's* total annual carbon emissions. Operating the *Yankee* gas-fired power plant, therefore, stood in contradiction with *Olectra's* aim to reduce its carbon intensity.

On further analysis of the strategic options for its *Yankee* gas-fired power plant, CEO Brian recognised that 1) a significant proportion of the necessary infrastructure to transmit the carbon emitted at *Yankee* was already in place, 2) its location was in close proximity to offshore gas pipelines, and 3) a depleted gas reservoir was only 100 miles off the coast.

Simon, *Olectra's* Business Development Manager, pointed out however that the company lacked the technological expertise to retrofit its gas-fired power plant *Yankee* by itself and denied being anything but an energy supply company:

> *"We're not a technology manufacturer, we're a utility so you know we rely on others to produce things like technology and innovate."* [Simon, Business Development Manager, Olectra]

CEO Brian and his business development team, led by Simon, concluded that reducing the emissions stemming from its *Yankee* power plant was only possible through a partnership with a CCS technology provider. Indeed, Simon said that, just like the UK's low-carbon energy transition as a whole, *"it would be crazy to think that one company could do this on their own." [Simon, Business Development Manager, Olectra]*.

This triggered *Olectra's* decision to collaborate with *PlentiOil* as a strategic partner to retrofit its *Yankee* gas-fired power plant with CCS technology. If successful both *Olectra* and *PlentiOil* would not only be able to capture ten megatons of carbon emissions over ten years but also gain reputational benefits from developing the world's first large-scale gas-CCS project.

5.2.3 Interactions during *Olectra's* response to climate change

Olectra's attempt to retrofit its gas-fired power plant with CCS technology was embedded in a network of business relationships with the actors introduced above. Figure 12 shows this business network and the associated interactions taking place.

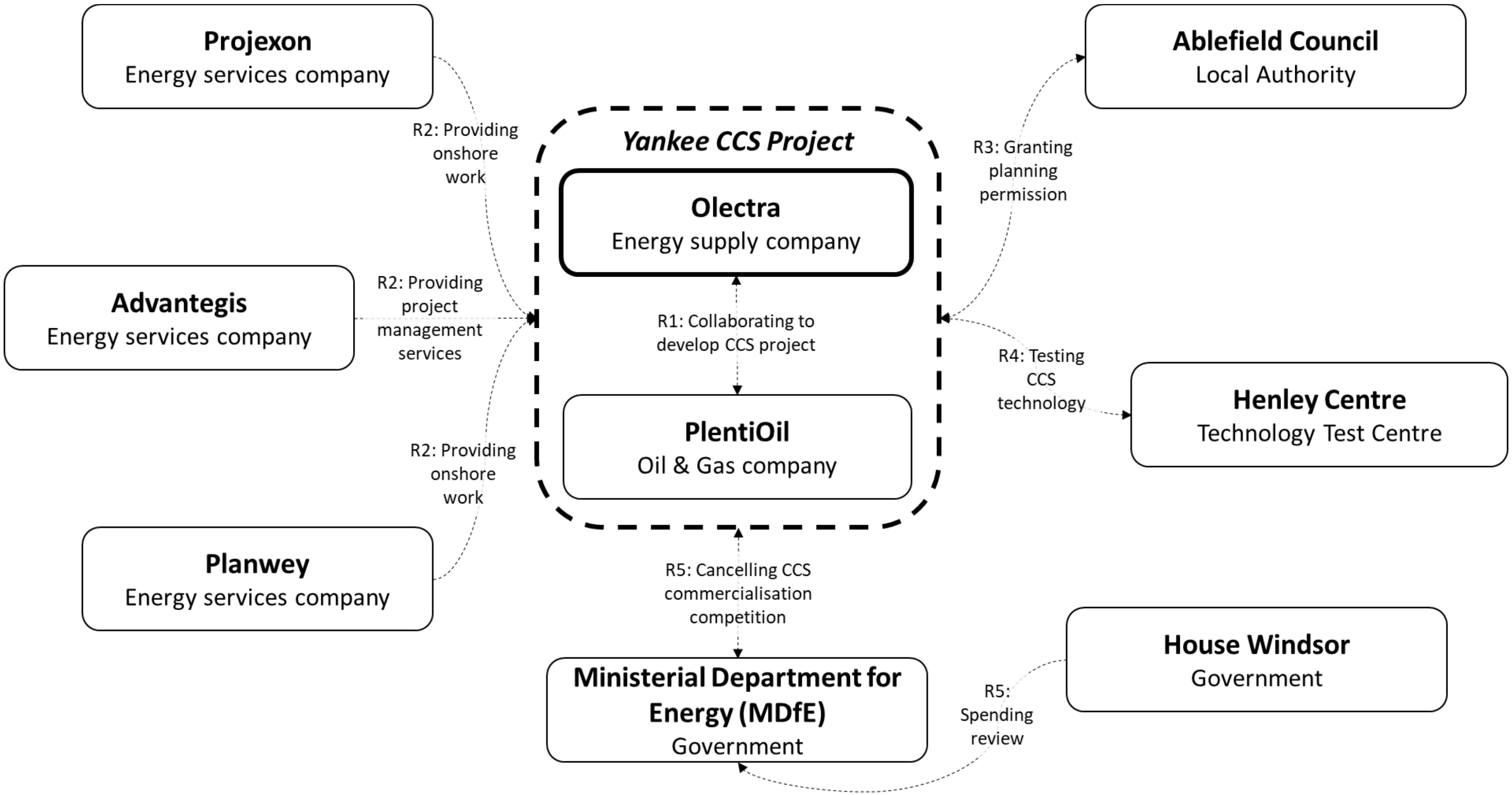

Figure 12: *The network affected by Olectra's response to climate change*

Throughout the three years of interactions within and across this business network, I focus on the five key relationships held by *Olectra*. Delineating the interactions in and around these relationships enables a holistic understanding of how companies respond to climate change.

5.2.3.1 Relationship 1 (R1): Collaborating with *PlentiOil* to develop CCS project

The first relationship that affected *Olectra's* attempt to retrofit its *Yankee* gas-fired power plant with CCS technology was with *PlentiOil*. *PlentiOil* had developed a CCS technology that allowed the mitigation of the carbon emissions stemming from coal-fired power plants. In theory, making a few minor adjustments to the CCS technology for coal-fired power plants would also allow the technology to be used to capture the emissions of gas-fired power plants. In practice, however, the technical viability had still to be proven as *PlentiOil* had not yet retrofitted its CCS technology to a gas-fired power plant.

Within *PlentiOil*, it was the company's Carbon Capture and Storage Manager, Kevin, who was the key figure in respect to *Olectra's* interest in retrofitting the *Yankee* gas-fired power plant with *PlentiOil's* CCS technology. Kevin was particularly excited about what he perceived as a major commercial opportunity:

> *"A successful scheme at* [Yankee] *could pave the way for massive investment in carbon capture and storage in the UK* [and] *with thousands of gas-fired power plants around the world, there could be a huge demand for the technology overseas."* [Kevin, Carbon Capture and Storage Manager, PlentiOil]

Following lengthy contract negotiations that precisely defined the remits and legal obligations of both companies, *Olectra* and *PlentiOil* agreed on terms to build:

> *"The first commercial-scale application of CCS technology at a gas-fired power station anywhere in the world by capturing up to one million tons of CO_2 annually."* [Annual Report, Olectra]

The contract stated that *Olectra* was responsible for making modifications to its *Yankee* gas-fired power plant so that it could be retrofitted with *PlentiOil's* CCS technology. *PlentiOil*, on the other hand, was tasked with making adjustments to its CCS technology so that it could capture the carbon emissions stemming from gas-fired power plants and ensure that these emissions could be transported and safely stored. *PlentiOil's* Carbon Capture and Storage Manager, Kevin, described that this required installing a 20 miles long transmission pipeline connecting the *Yankee* gas-fired power plant with an existing offshore pipeline between a gas terminal and one of *PlentiOil's* depleted gas reservoirs in the North Sea. Moreover, Kevin said that *PlentiOil* had to install a new compression unit to push the carbon through the transmission pipelines.

Although the *Yankee* gas-fired power plant was located in close proximity to *PlentiOil's* depleted gas reservoir and a large proportion of the necessary transmission infrastructure was already in place, Kevin, as well as his counterpart, *Olectra's* Business Development Manager, Simon, soon raised concerns over skyrocketing costs. Simon named three key reasons: 1) This kind of project bear higher risks for investors and hence requires a higher return on investment, 2) It was expensive to build new transport and storage infrastructure, and 3) *PlentiOil's* CCS technology was built using costly equipment. *Olectra's* CEO Brian concluded that it was only through government support that the costs of retrofitting gas-fired power plants with CCS technology could be lowered from the estimated of £170 per megawatt-hour (MWh) to more acceptable levels of £100 per MWh.

Olectra's Head of Wholesale Policy, Adam, however, raised concerns over relying heavily on government policies to allow progress with the project:

> *"One of the big concerns is, for investors and definitely for companies like mine, is the degree to which we make a commitment to maintain the policy that is in place. And what we actually see in the past years is a lot of flip-flopping from the government where they make an initial commitment on one hand and then suddenly things change."* [Adam, Head of Wholesale Policy, Olectra]

Nevertheless, CEO Brian and Simon's business development team, jointly with *PlentiOil*, participated in the CCS commercialisation competition by submitting a proposal to retrofit the *Yankee* gas-fired power plant with CCS technology.

In late 2013, the *MDfE* announced that *Olectra* and *PlentiOil* were one of the two preferred bidders in the CCS commercialisation competition. Representatives of the *MDfE* decided to invest £100 million of the £1 billion competition budget to take these two projects forward and award contracts to support FEED studies over a period of 18 months. The *MDfE* awarded *Olectra* and *PlentiOil* with a contract guaranteeing payments of £28 million.

This, so *Olectra's* CEO Brian estimated, would cover approximately 75% of the costs associated with the detailed engineering work during the FEED phase. *PlentiOil's* Carbon Capture and Storage Manager Kevin was seemingly excited when he described moving ahead towards the FEED phase as a *"hugely important step" [Kevin, Carbon Capture and Storage Manager, PlentiOil]* that would allow accelerating the progress of retrofitting the *Yankee* gas-fired power plant with CCS technology.

5.2.3.2 Relationship 2 (R2): Contracting the engineering work during the Front-End Engineering Design (FEED) phase of the CCS project

Olectra and *PlentiOil* appointed the three energy services companies, *Projexon*, *Advantegis* and *Planwey*, to deliver the engineering work during the FEED phase of the *Yankee* CCS project. In March 2014, *Projexon* was tasked with making modifications to the gas turbine at the *Yankee* power plant, as well as with establishing a new compression unit to push the carbon through the transmission pipelines. *Advantegis* was responsible for project management, organisation and coordination across the various engineering disciplines and project roles required to complete the FEED phase. *Planwey* used its experience of *"30 years of subsea infrastructure design" [Omar, Regional Director, Planwey]* to design the carbon transmission pipeline connecting the *Yankee* gas-fired power plant with an existing offshore pipeline between a gas terminal and a depleted gas reservoir in the North Sea. Most pertinent to this study, however, is the fact that within one year all three energy services companies delivered their assigned task within the given timeframe and budget.

5.2.3.3 Relationship 3 (R3): Obtaining planning permission from *Ablefield Council*

In addition to the completion of the engineering work during the FEED phase, *Olectra's* Business Development Manager, Simon, and *PlentiOil's* Carbon Capture and Storage Manager, Kevin, met with representatives of *Ablefield Council*. This was a crucial step in the *Yankee* CCS project because *Ablefield Council* had the authority to withhold a planning permission if they perceived that the project would harm the municipal district and its citizens. *Ablefield Council*, however, was hoping that both the construction work, as well as the guaranteed operation of the power station for at least another decade would create the desperately needed jobs for the local community. In fact, at the time *Ablefield Council* had an unemployment rate of 8.6%; significantly above the UK average of 5.5%. Unsurprisingly, *Olectra's* and *PlentiOil's* planning application was approved in June 2015.

5.2.3.4 Relationship 4 (R4): Testing the CCS technology at the *Henley Centre*

The final stage before the full-scale operation was to demonstrate the technical viability of the *Yankee* CCS project. To achieve this, the world's largest test centre for CCS technologies, the *Henley Centre*, independently tested and officially verified *PlentiOil's* CCS technology. The testing and verification process involved retrofitting the technology to two post-combustion flue gas turbines. After a month of in-depth testing, the *Henley Centre* suggested minor areas of improvement but overall confirmed the technology's readiness for full-scale operation.

After 18 months of hard work during the FEED phase, both Simon and Kevin concluded that everything was in place and stated explicitly that there were no technical barriers to retrofitting the *Yankee* gas-fired power plant with *PlentiOil's* CCS technology.

The final go-ahead for construction, however, depended on a positive outcome of the CCS commercialisation competition. As highlighted earlier in this case, Simon and Kevin had concerns over the high upfront costs required actually to build the project. The senior leadership team of both *Olectra* and *PlentiOil*, therefore, made clear that they were reluctant to commit to the project until the *MDfE* committed to guaranteeing parts of the proposed £1 billion of funding. *PlentiOil's* Carbon Capture and Storage Manager Kevin summarised:

> *"The process is such that we will take a decision on the potential project around the end of 2015, and then the government will take theirs – the timing is in their hands."* [Kevin, Carbon Capture and Storage Manager, PlentiOil]

5.2.3.5 Relationship 5 (R5): The *MDfE's* cancellation of the CCS commercialisation competition

The fifth and final relationship that affected *Olectra's* attempt to retrofit its *Yankee* gas-fired power plant with *PlentiOil's* CCS technology was with the *MDfE* and *House Windsor*. As outlined in the introduction to this case, *House Windsor*, jointly with the *MDfE*, had the authority to make the final investment decision and award the winner(s) of the £1 billion CCS commercialisation competition.

On 25th November 2015, however, the *MDfE* announced that the £1 billion budget for the CCS commercialisation competition was no longer available and that therefore the competition was cancelled. This decision was preceded by a disagreement between the *MDfE* and *House Windsor*. In fact, it became clear that a disagreement about the long-term costs of the CCS commercialisation competition led to the eventual cancellation.

Interestingly, when setting up the competition in 2012, the *MDfE* and *House Windsor* did not agree on the total financial support available. At the time, the *MDfE* estimated that the competition would cost a maximum of £6 billion over 15 years. In its 2015 spending review, however, *House Windsor* found that this figure had risen to £8.9 billion. *House Windsor* concluded that the cost for consumers would be too high, that the competition was intrinsically aimed at delivering CCS before it was cost-efficient to do so and that the competition would not guarantee the additional investments required to establish a world-leading British CCS industry. The potential cost savings of over £32 billion in meeting the UK's commitments under the 2008 Climate Change Act and the additional £6.5 billion annually to the UK's gross domestic product was not mentioned by the *MDfE* nor *House Windsor*.

5.2.4 The outcome of *Olectra's* response to climate change

So far, this case has outlined the five key relationships in relation to *Olectra's* efforts to decarbonise its gas-fired power plant *Yankee*. This section now describes the outcome stemming from three years of interactions in and around these relationships.

Following the *MDfE's* cancellation of the CCS commercialisation competition, *Olectra* and *PlentiOil* were devastated. After three years of hard work the *Yankee* CCS project was dead and could not proceed. *Olectra's* Business Development Manager Simon explained that the key problem was the high upfront capital required to build the project without having any guarantee about the future benefits:

> *"I think the problem we have at the moment is that we are trying to pretend that we can finance the expensive demonstration phase by some promise of jam tomorrow and the golden megawatt hour that is suddenly going to shower great wealth upon whoever actually gets there, but as with CCS that just doesn't work, we need to find a way of providing the upfront capital support to make that work."* [Simon, Business Development Manager, Olectra]

Simon held the *MDfE* responsible as for lacking the *"sense of urgency that is required" [Simon, Business Development Manager, Olectra]* to meet the UK's decarbonisation challenge.

Upon further reflection, *Olectra's* Head of Wholesale Policy Adam concluded that it ultimately came down to consumers who do not seem to be willing to bear some of the costs associated with transitioning towards a decarbonised energy system:

> *"One other point would be the way in which the energy sector communicates with the public and draws people along with you in terms of what needs to be done to address climate change. While a lot of people now are definitely aware of climate change in such a way that they understand that particularly in the energy sector we are in a transition and there are costs associated with transitioning into a decarbonised system."* [Adam, Head of Wholesale Policy, Olectra]

PlentiOil, although acknowledged the difficulty of *MDfE's* decision in light of *House Windsor's* spending review, *PlentiOil* simultaneously shared their disappointment via a statement on the company's website:

> *"*[PlentiOil] *is disappointed at the withdrawal of funding for the CCS Commercialisation Competition, in which our* [Yankee] *CCS project was one of the final contenders. We have worked tirelessly over the last two years to progress our plans for this project. It has the potential to bring huge value to the UK, both in terms of immediate emissions reductions and developing knowledge for the benefit of a wider industry."* [Statement on the company website, PlentiOil]

In an emergency meeting preceding these statements, *Olectra's* CEO, Brian, and his Business Development Manager, Simon, met with *PlentiOil's* Carbon Capture and Storage Manager, Kevin. It was their final attempt to somehow rack up the upfront capital required to move on to the construction stage. None of the companies, however, were willing to bear the financial risks stemming from doing so:

> *"The high cost of developing innovative, first-of-a-kind projects like* [Yankee] *CCS, need strong governmental support – as illustrated by the gradual development of other energy technologies in the past –. In the absence of the Competition and potential funding, we reluctantly concluded that there is no longer a future for the* [Yankee] *project in the near term."* [Joint statement by Olectra and PlentiOil]

As a result, *Olectra*, just like before the decision to retrofit its *Yankee* gas-fired power plant with CCS technology, continued to emit carbon emissions through the operation of their fossil fuel-fired power plant *Yankee*. In fact, *Olectra's* CEO Brian decided to operate the *Yankee* gas-fired power plant without capturing its carbon emissions. Therefore, continuing to causing one megaton of the company's carbon emissions annually.

In addition, *Olectra's* attempt to demonstrate that gas-fired power plants can be retrofitted with CCS technology in a commercially solid way may have slowed down the development of the CCS industry in the UK; an industry needed to meet the UK's 2008 Climate Change Act commitments in the most cost-effective way. Hence, the outcome stemming from *Olectra's* may have wider negative impacts on the future development of CCS as a potential solution in response to climate change.

5.2.5 Conclusion

This case examined an energy supply company's efforts to decarbonise its gas-fired power plant in response to climate change. I scrutinised *Olectra's* interactions in and around retrofitting its gas-fired power plant *Yankee* with CCS technology. I concentrated on the five key relationships in *Olectra's* business network. This included *Olectra* itself, the multinational oil and gas company *PlentiOil*, the *MDfE*, three energy services companies (*Projexon*, *Advantegis* and *Planwey*), the local authority *Ablefield Council* as well as a CCS technology test centre called *Henley* and UK government department of *House Windsor*. The purpose of this case was to develop a holistic understanding of how the case company *Olectra* responded to climate change. This case links well to the third case which scrutinises how an energy supply company attempted to establish itself as a renewables-only energy supply company.

5.3 Case 3: *Energize's* efforts to establish itself as a renewables-only energy supply company

The third case examines the interactions when the large energy supply company *Energize* decided to restructure its energy generation portfolio in response to climate change. To do so, representatives of *Energize* engaged in interactions within and across the company's business network in order to establish the company as a supplier of 100% renewable energy. Within *Energize's* business network, I concentrate on six key actors: *Energize*, the energy supply company itself, the UK's *Ministerial Department for Energy (MDfE)*, the British multinational energy distribution and transmission company *Mygrid*, both domestic and industrial *consumers*, *AMP*, an energy supply company directly competing with *Energize*, as well as the *European Union Emissions Trading System (EU ETS)*.

5.3.1 Introduction to the network actors

Energize is a multinational energy company supplying electricity, gas and heating to 6.9 million British households. With over 50,000 employees, the company is one of the largest energy suppliers in Europe. Size notwithstanding, *Energize* represents an interesting research case because of its substantial carbon emissions, exposing the company to climate change. Indeed, in its 2014 Sustainability Report, *Energize* stated that in the preceding twelve months the company's energy generation had caused 95.7 megatons of carbon emissions globally, of which approximately 42 megatons were attributable to its UK operation. At the time, *Energize's* energy generation portfolio in the UK was dominated by fossil fuels (46.7% coal and 27.1% gas). Renewables (hydro, solar and wind) accounted for 12.0%.

Interestingly, *Energize* publicly acknowledged the key role it has to play in addressing climate change globally and, particularly, in mitigating its carbon emissions in the UK. To achieve this, *Energize's* CEO, Walter, had set the target of establishing the company as a renewables-only energy supply company.

The *MDfE*, as the ministerial department responsible for ensuring that the UK is supplied with sufficient, low-carbon and affordable energy, advocated international climate change action and set up a regulatory framework to facilitate a reduction in the UK's carbon emissions by at least 80% by 2050. As a result, the *MDfE* launched a tax on carbon and designed the *Renewables Obligation*. Through this, the *MDfE* aimed at encouraging energy supply companies to increase the proportion of renewables as part of their overall energy generation portfolio to 24.4% by 2015, 29.0% by 2016 and 34.8% by 2017. Energy supply companies who do not meet these targets were legally obliged to pay a compensation fee of up to £45 per MWh. *Energize*, falling short of the 2015 target by 12.4% (and even more in the years thereafter), was pressured by this multimillion-pound fine.

In addition to the *MDfE*, the interactions with the multinational energy distribution and transmission company *Mygrid* were an important consideration for *Energize*. *Mygrid* is one of Europe's largest owners and operators of electricity and gas distribution and transmission networks. This includes more than 11,000 miles of long voltage electrical grid. Most pertinent to this study, however, is the company's responsibility to keep the balance between supply and demand within the grid. In other words, to ensure that the supply of energy to the grid never falls below the demand of British energy consumers. To do so, *Mygrid* typically kept a so-called capacity reserve margin of at least 10%, thereby, avoiding large-scale energy blackouts like the 2003 London blackout which left over 500,000 people without power for up to two hours.

The role of energy *consumers*, whether they be domestic or industrial, cannot be ignored. Indeed, after energy bills increased by 55% between 2002 and 2012, *Energize's* 6.9 million customers demanded lower energy bills. *Consumers* had become increasingly price-sensitive and frequently used energy price comparison and supplier switching services. This required *Energize's* attention because higher energy prices would be unavoidable in case the company had to pay a multimillion-pound fine for missing the targets set under the strengthened environmental regulation set up by the *MDfE*. These concerns indicate the price competition that was occurring within the UK energy supply sector.

AMP is a multinational energy supply company directly competing with *Energize*. In 2014, *AMP* supplied electricity, gas and heating to 4.3 million customers in the UK. *AMP's* energy generation portfolio (31% coal, 50% gas and 15% renewables) was similarly exposed to the vagaries of *MDfE's* increase in environmental regulation. Interestingly, *AMP* had recently announced plans to develop three large-scale wind parks in the UK. This additional source of renewable energy generation would allow *AMP* to meet the *Renewables Obligation* while continuing to benefit from the low-cost utilisation of its existing fossil fuel generation capacity.

A final important consideration for *Energize* was the emission trading scheme, *EU ETS*. Under the *EU ETS*, *Energize* was allocated emission allowances (EUAs). Each EUA permitted *Energize* to emit one ton of carbon. Emissions in excess of this allowance were to be purchased through the *EU ETS* market. In July 2008 the spot price of one EUA was around €30 and was forecasted to reach €100 by 2020. As *Energize* usually exceeded its EUAs, the *EU ETS* further threatened to increase the costs of the company's carbon-intensive generation portfolio.

Scrutinising the interactions within and across the network of actors that influenced *Energize's* attempt to restructure the company in response to climate change, enabled me to develop a holistic understanding of the issues I sought to engage with, in terms of answering how companies respond to climate change. Indeed, it was clear that, for *Energize*, the business network was a key component to achieve the company's response to climate change, namely establishing itself as a renewables-only energy supply company.

The remainder of this case focuses on this by outlining what triggered *Energize's* response to climate change, by describing the interactions within and across the company's business network and by reviewing how the outcomes stemming from *Energize's* response to climate change. The case closes with a brief conclusion.

5.3.2 *Energize's* response to climate change

With the emergence of climate change on the international political agenda, the translation into UK national legislation through the Climate Change Act in 2008 and the subsequent strengthening of environmental regulation (*Carbon tax* and *Renewables Obligation*), *Energize* became more and more exposed to these legal/regulatory pressures that were likely to increase the costs of operating a carbon-intensive energy generation portfolio. At the same time, by mid-2014, *Energize's* share price had plunged to a 20-year low. Under pressure from the company's shareholders, *Energize's* Board of Directors summoned CEO, Walter, for an emergency meeting.

Walter and the Board of Directors interpreted hitting a 20-year low share price as a ‘wakeup call’. Indeed, during the meeting, all participants agreed that it was now or never to question *Energize’s* current business activities and finally take the way in which climate change has altered the regulatory environment seriously. Walter was keen on restructuring *Energize* to enable meeting the present and future requirements of the energy market; or what he called, *“The new energy world.” [Walter, Chief Executive Officer, Energize]*.

In the same meeting, the Board of Directors tasked Walter to work closely with Ben, *Energize’s* Head of Orientation, to conduct:

> *“A comprehensive analysis of the current business activities and structure, the present and future requirements of the energy market and – on this basis – an extensive assessment of all options for strategic actions.”* [John, Board of Directors, Energize]

Exactly one month later, Walter and Ben presented their findings to *Energize’s* Board of Directors:

> *“We realised that there are now two energy worlds that an energy supply company can operate in; both, for the moment, are valid.”* [Ben, Head of Orientation, Energize]

These two energy worlds, so the team around Walter and Ben concluded, required the emission savings stemming from renewables, on the one hand, and the security, reliability and cost-effectiveness of fossil fuel generation, on the other hand. While the Board of Directors understood that these two energy worlds will co-exist, at least for the time being, Ben explained that both worlds undoubtedly will impose entirely different requirements:

> *“So when the senior leaders of* [Energize] *came together we realised that these two future worlds of energy aren’t mutually exclusive but the mindset needed to be successful in either one probably was.”* [Ben, Head of Orientation, Energize]

At the time, *Energize* itself was set up in such a way as to attempt to address the needs of both the new and the old energy world. Indeed, over the past decade, Walter had approved substantial investments in both renewables (e.g., a £10 billion investment that enabled growing its portfolio of renewables tenfold in the previous decade) and fossil fuel generation assets (e.g., a £750 million investment that extended the life of a coal-fired power plant in the previous six years). *Energize's* analysis unveiled, however, that investments focusing on the new and the old energy world simultaneously would not suffice to address the needs of either world.

As a result, in October 2014, *Energize's* Board of Directors announced that, effective as of January 2016, the company would spin off its fossil fuel generation assets and focus entirely on meeting the needs of the new energy world. To achieve this, *Energize* set itself the stringent target of supplying its customers with energy generated solely from renewable sources. Through this action, Walter believed that *Energize* is *"no longer burdened by the risks of the old energy world" [Walter, Chief Executive Officer, Energize]* such as the exposure to the pressures stemming from present and future environmental regulation aimed at mitigating global climate change.

5.3.3 Interactions during *Energize's* response to climate change

Energize's effort to establish itself as a renewables-only energy supply company was embedded in a network of business relationships with the actors introduced above. Figure 13 shows this business network and the associated interactions taking place.

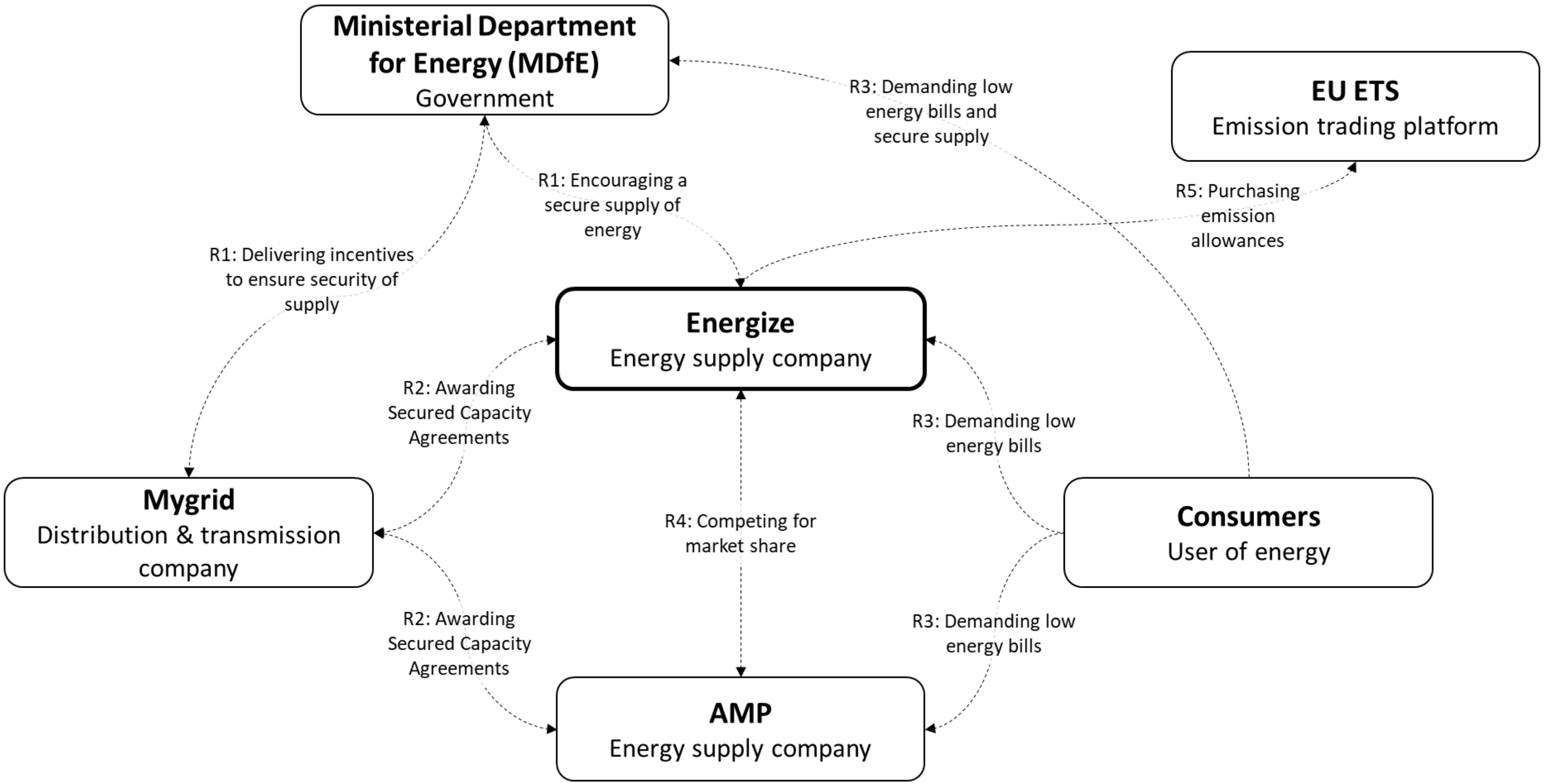

***Figure 13**: The network affected by Energize's response to climate change*

Throughout the two years of interactions within and across this business network, I focus on the five key relationships held by *Energize*. Delineating the interactions in and around these relationships enables me to develop a holistic understanding of how companies respond to climate change.

5.3.3.1 Relationship 1 (R1): The *MDfE* shifts its priority towards the security of supply

The first relationship that affected *Energize's* effort to establish itself as a renewables-only energy supply company was with the *MDfE*. The *MDfE* had responded to climate change by making it ever more costly to generate energy from fossil fuel sources. Soon, *Energize* and other energy supply companies decommissioned approximately 24 GW of fossil fuel generation capacity; equivalent to over one-third of the UK's total energy demand.

The increase in renewable generation capacity partially compensated the decline in fossil fuel generation capacity. Renewables, however, were not able to cover this shortfall in its entirety which led to tightening capacity reserve margins of around 5% in late 2014. As a result, *Mygrid* sent a *Notice of Inadequate System Margin* to the *MDfE* to highlight that the UK's total energy supply capacity would not suffice to meet peak demand, typically occurring during cold and windless days, in the upcoming winters.

The *Secretary of State* took this warning seriously as there was nothing worse for her than being responsible for a large, country-wide energy blackout. This meant that after years of encouraging energy supply companies to decarbonise their energy generation portfolio, the *MDfE* suddenly had to cope with an additional challenge: safeguarding the security of supply. Scott, Head of Energy Security at the *MDfE*, explained that in a matter of weeks the department's priority had shifted towards energy security:

"She [the Secretary of the State] *is very clear on this point, energy security is her absolute number 1 priority for the department, and that's something that the Prime Minister has reinforced as well."* [Scott, Head of Energy Security, MDfE]

Over the past years, the *MDfE* had created a regulatory framework that simply did not incentivise energy supply companies to invest in providing an energy supply capacity sufficient to meet the UK's energy demand:

"There is a significant risk that the market will no longer deliver an adequate level of security of supply as it has done historically, principally because potential revenues in the energy-only market may no longer incentivise sufficient investment in capacity." [Report, MDfE]

Energize itself is the best example of this as it indicates how and why an energy supply company would decide to invest in renewable energy generation instead of providing a large capacity of fossil fuel generation assets.

Within months, the *Capacity Market Mechanism*, a policy to attract private investment in reliable generation capacity, was designed and implemented. Under this new regulation, energy supply companies would receive payments for safeguarding energy supply during times of peak demand. In an attempt to deliver the security of supply at *"the best value for money" [Scott, Head of Energy Security, MDfE]*, the *MDfE* allowed all types of energy generation to apply for *Secured Capacity Agreements*.

Energize, still experiencing shareholder pressures due to the continuing decline of the company's share price, was keen to cash in on its £750 million investment in a coal-fired power plant. CEO Walter perceived that generating an additional revenue stream was a one-time activity that allowed the company to boost its profitability alongside transitioning towards establishing itself as a renewables-only energy supply company. *Energize* therefore prepared and submitted a competitive bid proposing one of its two GW coal-fired power plants in North England (sufficient to power two million homes annually) as an asset available for providing a secure and reliable supply of energy in return for guaranteed capacity payments.

5.3.3.2 Relationship 2 (R2): *Mygrid* awarding *Energize* a Secured Capacity Agreement

The *MDfE* appointed *Mygrid*, a multinational energy distribution and transmission company with expertise in balancing energy supply and demand in the grid, to deliver the *Capacity Market mechanism*. Within *Mygrid*, Capacity Market Manager Emma swiftly set up a process that allowed procuring sufficient capacity at the lowest possible price.

In early 2016, just after *Energize* had officially spun off its fossil fuel generation assets into a new company, Emma and her team met with Scott, *MDfE's* Head of Energy Security, to announce the energy supply companies that were successful in securing capacity agreements:

> *"We managed to secure enough capacity to meet this winter's needs. We've effectively got confidence in our capacity procured up until the end of 2020/2021 now."* [Emma, Capacity Market Manager, Mygrid]

She concluded that the *Capacity Market mechanism* was delivering the results that the *MDfE* was looking for:

> *"It gets the right results and ensures that the capacity that's coming forward will be able to deliver on the day. So I think that's been a great success."* [Emma, Capacity Market Manager, Mygrid]

In light of the inherent focus on delivering the security of supply at the lowest cost, it was largely unsurprising that coal-fired power plants were the big winners of the *Capacity Market Mechanism*. Indeed, over the next four years, energy supply companies were due to be paid a total of £453 million in secured capacity payments for operating coal-fired power plants.

Energize was successful in securing a supply contract for its two GW coal-fired power plant. Soon, *Energize's* coal-fired generation assets, now strengthened by a *Secured Capacity Agreement*, became one of the company's most essential earnings driver. As such, Ben, the Head of Orientation at *Energize*, indicated that investment in fossil fuel generation assets were back on the company's agenda as long as it was for the purpose of safeguarding the security of supply:

> *"An investment in higher carbon isn't necessarily a good idea unless it is about the security of supply."* [Ben, Head of Orientation, Energize]

5.3.3.3 Relationship 3 (R3): Consumers demanding low energy bills

The role of end *consumers* in shaping *Energize's* attempt to establish itself as a renewables-only energy supply company cannot be overlooked. As highlighted in the introduction to this case, over the past decade, *consumers* of energy had become increasingly price-sensitive and open to switching their energy suppliers. In fact, the *MDfE's* 2016 annual *Energy Consumption Survey* found that the key aspect when choosing an energy supplier was the energy price. Adam, Analyst at the *MDfE*, summarised the department's findings:

> *"Everybody's thinking about energy has become so absolutely focused on what the final bill is because the argument is that's the only bit that consumers really care about."* [Adam, Analyst, MDfE]

The *consumer* focus on energy prices posed a risk to *Energize*. It meant that if the company's strategy to focus solely on renewables increased the energy prices, then *consumers* were more likely to switch to competitors such as *AMP*. Ben, Head of Orientation at *Energize*, said that the company's challenge was to ensure that *consumer* bills do not increase while racking up the investments necessary to establish the company as a renewables-only provider of energy:

> *"Broadly speaking investing in a low carbon kind of portfolio is good* [...] *but we have to prove the benefit to consumers."* [Ben, Head of Orientation, Energize]

5.3.3.4 Relationship 4 (R4): *Energize* and *AMP* competing for market share

The increasingly price-sensitive behaviour of *consumers* outlined above led to price competition between *Energize* and the multinational energy supply company *AMP*. *Energize* and *AMP* were battling for market share, which was driven mostly by which company could offer the lowest energy price. While the senior leadership team of *Energize* was occupied with restructuring the company, *AMP* continued to focus on the security, reliability and cost-effectiveness of fossil fuel generation assets.

Simultaneously, *AMP* only grew the proportion of renewables as part of the company's overall energy mix by as much as needed to meet the quotas set in the *Renewables Obligation*. To do so, in 2014, *AMP* began with the construction of three large-scale wind parks in the UK. This additional source of renewable generation capacity allowed *AMP* to meet the renewables quotas set in the *Renewables Obligation*. By 2016, the approach taken by *AMP* turned out to be a major price advantage, particularly as the *MDfE* became increasingly concerned about the security of supply. Indeed, *AMP's* low-cost utilisation of its existing fossil fuel generation capacity translated into a major cost advantage over *Energize's* renewables-only energy generation portfolio.

5.3.3.5 Relationship 5 (R5): Purchasing emission allowances under the *EU ETS*

The fifth and final relationship that affected *Energize's* effort to establish itself as a renewables-only provider of energy was with the *EU ETS*. As outlined in the introduction, *Energize's* senior leadership team feared that the pressures stemming from environmental regulation would make it more and more costly to operate the company's carbon-intensive generation portfolio. At the time, CEO Walter perceived that the spot price for one EUA would increase far beyond its 2008 levels of around €30. Hence, he supposed that operating a carbon-intensive energy generation portfolio would unavoidably hamper

Energize's profitability. By September 2016, however, the price of one EUA had dropped to €3.91. Unsurprisingly, CEO Walter concluded that purchasing the emission allowances necessary to win further security of supply contracts under the *Capacity Market Mechanism* was permissible to ensure reliable revenue streams.

5.3.4 The outcome of *Energize's* response to climate change

So far, this case has outlined the five key relationships in relation to *Energize's* efforts to establish itself as a renewables-only energy supply company. This section now describes the outcome stemming from two years of interactions in and around these relationships.

Effective as of January 2016, CEO Walter relocated all of *Energize's* fossil fuel generation assets into a new and independently operating company. *Energize* itself was now focusing entirely on sustainable solutions, energy efficiency and, most importantly, it generated energy from 100% renewable sources. Although CEO Walter did spin-off *Energize's* fossil fuel generation assets, he did so by creating a new and independently operating energy supply company of which *Energize* – at least for a few years – continued to act as a shareholder. *Energize* perceived that thereby the company could continue to capitalise from the commercial opportunities stemming from the security, reliability and cost-effectiveness of fossil fuel generation while establishing itself as a renewables-only energy supply company.

The financial performance of *Energize's* renewables business, however, was poor. In the 2016 financial year, *Energize's* revenue had dropped by 11% and this led to a net loss of over £14 billion; the biggest loss in the company's history. CEO Walter largely blamed the £11 billion write-downs in the valuation of the fossil fuel generation assets as part of the spin-off:

> *"The conventional energy spinoff* […] *left deep marks on our balance sheet."* [Walter, Chief Executive Officer, Energize]

Controversially, the newly-created fossil fuel company was striving. The *Secured Capacity Agreements* generated predictable revenue streams from highly profitable, mostly written off, fossil fuel generation assets. Furthermore, as the spot price for emission allowances had fallen to €3.91, *Energize* only paid €164 million to purchase 42 megatons worth of emission allowances. This amount compared to €1.26 billion at the 2008 spot price of €30 and €4.2 billion at the 2020 forecasted spot price of €100.

As a result, *Energize's* CEO Walter concluded that it would be a financially reasonable decision to purchase emissions allowances rather than withholding the company from the predictable revenues stemming from running its fossil fuel generation assets. Unsurprisingly, the share value of the newly created fossil fuel company skyrocketed from €10 in 2016 to almost €28 by October 2017.

Lastly, in its 2016 annual report, *Energize* announced that spinning off its fossil fuel generation assets had reduced carbon emissions from 95.7 megatons in 2014 to just 5.0 megatons in 2016; a reduction of 94.8% within just two years. This, however, only considered *Energize's* core business. Yet, *Energize* continued to act as a shareholder of the newly created fossil fuel generation company. *Energize* did not acknowledge the emissions stemming from the operation of the fossil fuel generation assets that had been relocated to the new company.

5.3.5 Conclusion

This case examined an energy supply company's efforts to restructure itself in response to climate change. To achieve this, I scrutinised *Energize's* interactions in and around establishing the company as a renewables-only provider of energy. I concentrated on the five key relationships. This included *Energize* itself, the *MDfE*, the energy distribution and transmission company *Mygrid*, both domestic and industrial *consumers*, *Energize's* competitor *AMP* and the as the *EU ETS*. By delineating these interactions I hope to have provided empirical insight that allows a holistic understanding of how companies respond to climate change.

This case links well to the fourth case which scrutinises how an energy supply company endeavours to decarbonise its operations by establishing itself as a provider of demand-side response technology.

5.4 Case 4: *Vonergy's* efforts to establish itself as a provider of demand-side response technology

The fourth case examines the interactions when the large energy supply company *Vonergy* decided to expand its product portfolio in response to climate change. To achieve this, representatives of *Vonergy* engaged in substantial interactions within and across the company's business network in order to establish the company as a provider of demand-side response (DSR) technology. Within *Vonergy's* business network, I concentrate on seven key actors: *Vonergy*, the energy supply company itself, the DSR technology provider *Xidoa*, the multinational hospitality company *Morhaven International*, the energy supply company *Pantegis*, the British distribution network operator *Gryd*, the UK's *Ministerial Department for Energy (MDfE)* and the diesel-power generation company *Moggley*.

5.4.1 Introduction to the network actors

Vonergy is a multinational energy company supplying electricity and gas to 200,000 British commercial and industrial energy consumers. With over 17,000 employees and a total energy generation capacity of 8.2 GW, the company is one of the top 10 energy suppliers in the UK. Size notwithstanding, *Vonergy* represents an interesting research case because, despite the fact that the company emitted substantial carbon emissions (13.1 megatons in 2014), at the same time, their CEO publicly committed to playing a leading role in the UK's transition towards a low-carbon energy supply system:

> *"*[We are] *committed to the responsible growth of* [our] *businesses in response to the central challenges of the energy transition, combating climate change and making responsible use of natural resources."* [Steven, Chief Executive Officer, Vonergy]

Interestingly, *Vonergy* intended to achieve this by expanding its product portfolio with a technology that offers a considerable emission reduction potential, so-called DSR technology. Through this, *Vonergy's* CEO Steven hoped to enable its commercial and industrial consumers to mitigate their carbon emissions while also providing them with an opportunity to generate a new revenue stream.

By way of contextual information, DSR technology refers to a broad range of technological processes aimed at reducing the consumption of energy when demand is at its peak. One such process involves installing grid balancing devices at large commercial and industrial energy consumers. In times of peak demand, providers of such devices can remotely reduce the energy demand in exchange for a compensation fee paid by the grid operator. Grid operators are willing to make these payments because of savings stemming from not having to maintain costly reserve energy capacities (e.g., fossil fuel power plants). This type of DSR technology enables considerable emission reductions and generates a commercial opportunity for large commercial and industrial energy consumers.

Xidoa is one of the UK's leading DSR aggregators and technology innovators. Founded in 2009, the company's hardware- and software permits to remotely turn down the energy consumption of large commercial and industrial energy consumers (e.g., hospitals, hotels, manufacturing sites, schools, shopping centres, etc.) by a degree that remains unnoticeable. *Xidoa's* Co-Founder and Chief Executive Officer, Joe, had developed the DSR technology with the vision to provide a cleaner, cheaper and more efficient way to balance the electricity grid. Thereby, releasing some of the grid congestion pressures created by the intermittency related to the steep increase of renewables as part of the UK's energy mix.

In addition to *Xidoa*, the interactions with the multinational hospitality company *Morhaven International* were an important consideration for *Vonergy*. With over 6,000 properties around the world, *Morhaven International* is not only one of the world's largest hospitality companies, but it also aims at protecting the planet's natural resources. For example, in 2014, *Morhaven International's* senior leadership team announced the target of reducing the energy consumption of its 40 hotels across the UK by 20% by 2020. Through this initiative, *Morhaven International* sought to mitigate its £60 million annual spendings on energy while also contributing to the company's drive for emission savings. Following the successful implementation of DSR technologies in its hotels located in the USA, *Morhaven International* was keen on trialling DSR technology at four hotels in London.

Pantegis is a subsidiary of one of the largest British energy supply companies that have specialised in supplying energy to large commercial and industrial energy consumers. *Pantegis* offered its customers reliable and cost-effective energy generated from renewable energy sources, as well as services to enable more efficient use of energy and control over their energy spending. Most pertinent to this study, however, is the fact that *Pantegis* did not want to take the financial risks associated with developing the innovative technologies that would enable delivering such services by itself, and was therefore keen on partnering with a DSR technology provider.

The role of *Gryd*, a British multinational company managing a part of the UK's energy transmission and distribution network, cannot be ignored. *Gryd* was responsible for ensuring that the balance between energy supply and demand is maintained every minute of the year. DSR technologies were seen as a cost-effective and less carbon-intensive way of balancing grid congestion in times of peak demand; typically occurring around 5 pm on a winter weekday. In fact, *Gryd* estimated that DSR technologies could contribute to meeting 5% of peak demand by 2025 which would generate network investment savings of approximately £500 million per year. Unsurprisingly, *Gryd* was keen on promoting DSR technologies in the UK.

Another important consideration for *Vonergy* were the interactions with the *MDfE*; the UK's ministerial department responsible for ensuring a reliable, affordable and low-carbon supply of energy to British consumers. The *MDfE* perceived DSR technologies as a promising low-carbon solution to address the concerns over the security of supply emerging in the winter of 2014. The *MDfE*, therefore, decided to set up a range of initiatives aimed at encouraging the development of innovative energy technologies, such as DSR.

Lastly, the role of *Moggley*, a developer of fast-ramping small-scale flexible energy generation assets, cannot be overlooked. *Moggley* was directly competing with *Xidoa's* DSR technology for contracts under the *Capacity Market Mechanism*. Most pertinent to this study, however, is the fact that *Moggley* was able to offer its capacity of 700 MW of diesel-fired power plants as a measure to meet peak demand at a much lower price than *Xidoa's* DSR technology.

Scrutinising the interactions within and across the network of actors that affected *Vonergy's* efforts to expand its product portfolio in response to climate change, enabled me to develop a holistic understanding of the issues I sought to engage with, in terms of answering how companies respond to climate change. Indeed, it was clear to see that, for *Vonergy*, the business network was a key component to achieve the company's goal of establishing itself as a provider of DSR technology.

The remainder of this case focuses on this by outlining what triggered *Vonergy's* response to climate change, by describing the interactions within and across the company's business network and by reviewing the outcomes stemming from *Vonergy's* interactions in response to climate change. The case closes with a brief conclusion.

5.4.2 *Vonergy's* response to climate change

Vonergy's CEO Steven perceived the contextual changes emanating from climate change (e.g., the UK national legislation through the Climate Change Act in 2008, the increasing need for innovative technologies that enable the UK's low-carbon energy transition) as an opportunity for responsible growth of *Vonergy*. In the quest for potential products that enabled growing the company while at the same time contributing to the UK's low-carbon energy transition, he soon realised the potential of DSR technologies.

Vonergy's CEO, Steven, viewed DSR technology as a reliable, low-cost and low-carbon solution to the increasing concerns over the security of supply. Furthermore, it also represented a new revenue stream for *Vonergy's* commercial and industrial customers as they would receive payments from the distribution network operator *Gryd* in return for reducing their energy demand for short-periods. In addition, it was a promising new business stream for *Vonergy* as DSR technology providers keep a margin of 30-50% of the payments received from the network operator.

On further analysis, *Vonergy's* CEO Steven concluded that the UK market for DSR technologies was the most promising DSR market in Europe, forecasted to have a potential size of up to 9.8 GW by 2020 and, at least so far, it remained almost untapped. In early 2014, therefore, *Vonergy* announced its decision to establish itself as a provider of DSR technology.

5.4.3 Interactions during *Vonergy's* response to climate change

Vonergy's attempt to establish itself as a provider of DSR technology was embedded in a network of business relationships with the actors introduced above. Figure 14 shows this business network and the associated interactions taking place.

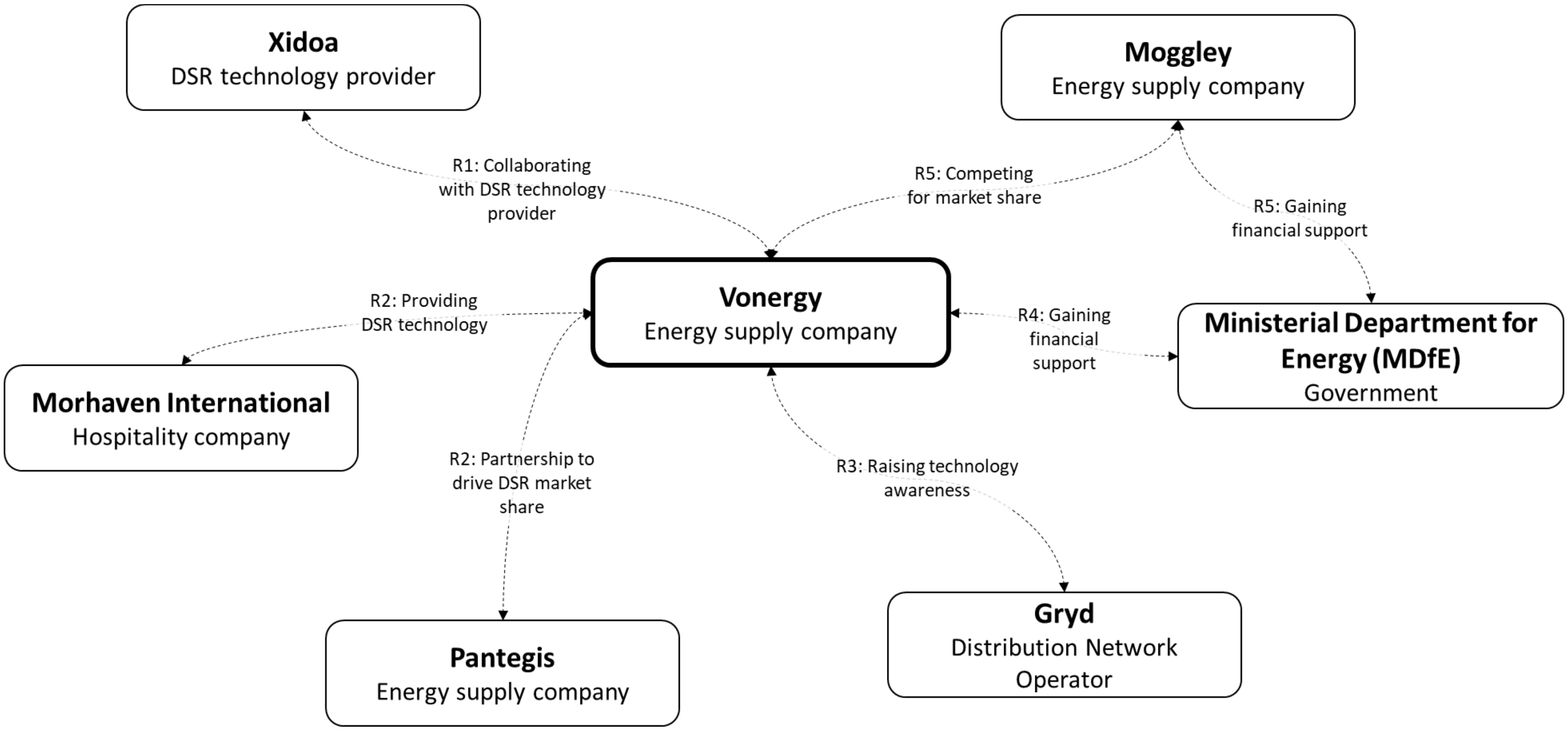

Figure 14: *The network affected by Vonergy's response to climate change*

Throughout the two years of interactions within and across this business network, I focus on the five key relationships held by *Vonergy*. Delineating the interactions in and around these relationships enables a holistic understanding of how companies respond to climate change.

5.4.3.1 Relationship 1 (R1): Collaborating with the DSR technology provider *Xidoa*

The first relationship that affected *Vonergy's* attempt to establish itself as a provider of DSR technology was with *Xidoa*. Joe, the Co-Founder and CEO of *Xidoa*, had developed the hardware- and software that enables the energy consumption of large commercial and industrial energy consumers to be turned down remotely. This type of DSR technology provides not only a reliable, low-cost and low-carbon way to manage the balance between supply and demand, it also represents a commercial opportunity for large industrial energy consumers:

> *"We are in an amazing position where our end clients get paid for being more efficient, and it's great to be able to do that. Each time we pay a customer it means we've reduced the use of highly polluting peak power stations."* [Joe, Chief Executive Officer, Xidoa]

Xidoa was struggling to market its DSR technology, however. *Xidoa's* CEO Joe said that this was largely due to a lack of customer awareness as *"no one was doing it" [Joe, Chief Executive Officer, Xidoa]* as well as the conservative nature of the UK energy sector:

> *"People in the world of energy tend to be quite conservative and slow at making decisions.* […] *They are worried about what it will do to their processes, they are worried about the loss of control. We show them that it doesn't impact their process and we show them that they always maintain control."* [Joe, Chief Executive Officer, Xidoa]

Furthermore, Joe supposed issues regarding the prioritisation of large commercial and industrial energy consumers while also viewing their often relatively low energy costs as a barrier to market its DSR technology:

> *"Beyond that, it is mostly prioritisation. I have a lot of things to do, is this really the one that I'm going to dedicate the time to? The best way to convince them is to pay them enough money to do it. Now, if*

we were obtaining the kind of prices that power stations are getting, then it would be no question that we can pay them enough money." [Joe, Chief Executive Officer, Xidoa]

As a result of these challenges, it took *Xidoa* over four years (from founding the company in 2009 until 2013) to install its DSR technology at 100 large commercial and industrial energy consumers. In an effort to access a larger share of the 9.8 GW DSR market in the UK, and drive *Xidoa's* extensive growth strategy. CEO Joe decided to collaborate with a large energy supply company.

At the same time, *Vonergy's* CEO Steven was evaluating strategies to establish *Vonergy* as a provider of DSR technology. His conclusion was to collaborate with an established DSR technology provider rather than to develop the technology by itself. Interestingly, Steven and Luke, *Xidoa* Chief Commercial Officer, knew each other as they both frequently attended energy industry conferences. Both shared their commitment to playing a key role in the UK's low carbon energy transition:

"[We] *share our commitment to providing flexible and sustainable solutions to the challenges facing System Operators."* [Luke, Chief Commercial Officer, Xidoa]

The potential synergies between the two companies were large. Indeed, *Vonergy's* CEO Steven understood that *Xidoa's* DSR technology was a perfect fit since it would not only help its large commercial and industrial consumers to save carbon emissions, it also represented a financial opportunity for them. In a follow-up discussion, *Xidoa's* CEO Joe explained exactly this:

"Our customers are commercial industrials. They, you know, they care about reducing their emissions but at the end of the day they're doing it because there's a direct financial benefit; they get paid to do it." [Joe, Chief Executive Officer, Xidoa]

Xidoa's CEO Joe was excited about *Vonergy's* interest in working with the company. He hoped that this would enable *Xidoa* to gain market access to *Vonergy's* 200,000 British commercial and industrial customers; a huge amount compared to *Xidoa's* current customer base of 100 large commercial and industrial customers. At the same time, he understood that large energy supply companies, such as *Vonergy*, are not willing to take the financial risks associated with developing innovative DSR technologies by themselves:

> *"You don't necessarily want utilities to be mad risk takers. You need crazy people like us to invest and utilities eventually to buy them."* [Joe, Chief Executive Officer, Xidoa]

In July 2015, Steven, Joe and Luke jointly announced that *Vonergy* acquired a share of *Xidoa* in an effort to expand their DSR technology business. *Vonergy's* CEO Steven summarises:

> *"*[Xidoa's] *customer-friendly solution, real-time metering, technology and automated processes have a lot to offer to commercial customers in this respect. We want to be able to continue to offer to our customers a wide variety of commercial solutions that work for almost every company under every set of circumstances."* [Steven, Chief Executive Officer, Vonergy]

Luke, *Xidoa's* Chief Commercial Officer was similarly excited that the deal had gone through:

> *"We are very excited to have* [Vonergy] *on board. We have been working with* [Vonergy] *over the last year to expand our demand response offering across their vast international customer base. We are excited to be strengthening our relationship with a global, forward-thinking utility."* [Luke, Chief Commercial Officer, Xidoa]

5.4.3.2 Relationship 2 (R2): Partnerships to drive DSR technology business

Jointly, *Vonergy* and *Xidoa* worked closely with the multinational hospitality company *Morhaven International* to establish a case for the commercial and environmental benefits stemming from utilising DSR technologies. Specifically, *Morhaven International* was trialling *Xidoa's* DSR technology at four hotels in London. Upon successful completion of this trial, *Morhaven International* would expand its engagement by implementing the DSR technology in over 40 hotels across the UK.

For *Morhaven International's* Director of Facilities and Project Management Richard, implementing *Xidoa's* DSR technology was an opportunity to generate a risk-free revenue stream while gaining detailed information about the company's energy use and contributing to its carbon emission reduction goals. What was crucial for Richard, however, was the fact that the DSR technology, under no circumstances, has a negative impact on hotel guests:

> *"No amount of payment from DSR is going to be of value if it has a negative impact on our guests."* [Richard, Director Facilities and Project Management, Morhaven International]

Xidoa's CEO Joe guaranteed Richard that its DSR technology would, temporarily and unnoticeably for hotel guests, turn down non-essential services (e.g., air conditioning systems, fridges and ice coolers by no more than 1 °C) when energy demand is at its peak. After agreeing to these terms, *Xidoa* installed its DSR technology at four of *Morhaven International's* hotels in London.

In return for trimming the hotels' energy demand, *Xidoa* received payments from distribution and network operator *Gryd* and then passed on 70% to *Morhaven International*. Upon completion of a two-month trial period, Richard *Morhaven International's* Director Facilities and Project Management concluded:

> *"We have successfully been able to turn down some of our non-essential systems for up to an hour without any negative impact on business operations or customer comfort levels."* [Richard, Director Facilities and Project Management, Morhaven International]

As a result of the successful trial, *Vonergy*, *Xidoa* and *Morhaven International* extended their engagement and installed *Xidoa's* DSR technology in over 40 hotels across the UK.

> *"We can control a large part a lot of their* [Morhaven International's] *air conditioning systems across multiple hotels. Literally, we're talking about a change in air temperature of a couple of degrees for half an hour to an hour across the 40 hotels in the UK, and it adds up to quite a lot."* [Joe, Chief Executive Officer, Xidoa]

Indeed, *Morhaven International's* Director of Facilities and Project Management Richard determined that installing *Xidoa's* DSR technology has not only reduced the company's carbon emissions but also generated additional revenue of £100,000. Most importantly for Richard, however, was the fact that he achieved all this almost effortlessly and without affecting operations or having any negative impact on the comfort of its hotel guests:

> *"We've had a number of* [DSR] *calls, but had no negative comments from our guests."* [Richard, Director Facilities and Project Management, Morhaven International]

Morhaven International was not the only large commercial and industrial energy consumer that *Vonergy* and *Xidoa* interacted with in order to grow its customer base. In fact, *Vonergy's* CEO Steven suggested partnering with *Pantegis*, a subsidiary of one of the largest British energy supply companies, primarily supplying energy to commercial and industrial energy consumers. *Pantegis'* Chief Operating Officer, Isaac, was keen on working with *Vonergy* and *Xidoa* since the company aimed to offer its commercial and industrial customers services that enable more efficient use of energy and provide more control over their energy spending:

> *"We are committed to working in partnership with customers to make energy work for them. We believe that a lower carbon UK and being more sustainable are both good for the world and good for business."* [Isaac, Chief Operating Officer, Pantegis]

As Isaac did not want to take the financial risks associated with developing the innovative technologies that would enable delivering such services, he decided to work with *Vonergy* and *Xidoa*. Isaac summarises the benefits of utilising *Xidoa's* DSR technology:

> *"Our customers will now have the opportunity to financially benefit from changing how they use energy, simply and seamlessly.* [Xidoa's] *technology is best in class and drives innovation. Together we will generate real, additional value for* [our] *customers and help them to operate more sustainably."* [Isaac, Chief Operating Officer, Pantegis]

While *Vonergy's* CEO Steven was satisfied with the successful project with *Morhaven International* and the collaboration with *Pantegis*, when offering *Xidoa's* DSR technology to many of his 200,000 large commercial and industrial consumers, they repeatedly raised concerns about the ways in which the DSR technology may impact their current processes while also highlighting some financial constraints.

Indeed, a report on DSR for commercial and industrial energy consumers found that exactly this leads to low prioritisation of implementing DSR technologies:

> *"Organisations require a financial incentive to change their patterns of electricity consumption and/or provide services to the grid.* […] *Issues include uncertain benefits and the relative smallness of potential savings/revenue. For some organisations energy spend is a relatively low overhead and small electricity bill savings are therefore unlikely to warrant the time required to engage with DSR."* [Report on DSR for industrial energy consumers, Element Energy]

In an effort to counteract this, Vonergy's CEO Steven engaged with the distribution and network operator *Gryd* to raise customer awareness about the benefits associated with installing DSR technologies.

5.4.3.3 Relationship 3 (R3): Raising customer awareness through the Power Responsive Initiative

The role of the distribution and network operator *Gryd* in shaping *Vonergy's* efforts to establish itself as a provider of DSR technology cannot be ignored. *Gryd's* Director of UK System Operator, Claire, regarded DSR technology as an opportunity to save approximately £500 million in annual network investments. In fact, a study conducted by Imperial College London and the University of Cambridge Energy Policy Research Group estimated that such savings could be as high as £8.1bn a year by 2030. A key barrier to unlocking these savings potential, however, was the lack of customer awareness. Claire had therefore set herself the task of raising awareness about the benefits of DSR technologies for large commercial and industrial energy consumers. To achieve this, Claire started the *Power Responsive Initiative*:

> *"So the evolution of demand-side response, something that we've been working hard on* […] *through our campaign called Power Responsive, a collaboration across the industry to really start to create the*

narrative and the conditions for change around demand-side response." [Claire, Director of UK System Operator, Gryd]

The *Power Responsive Initiative* triggered interactions with large commercial and industrial energy consumers. This included offering training and running workshops. Moreover, *Gryd* engaged with the Major Energy Users Council, an organisation representing industrial, commercial and public energy consumers. Collectively, the members of the Major Energy Users Council account for approximately one-quarter of the total industrial energy consumption in the UK:

"This week we launched our collaboration with the Major Energy Users Council where we've actually issued a guide and a set of educational materials about how businesses can get involved." [Claire, Director of UK System Operator, Gryd]

Vonergy's CEO Steven and *Xidoa's* CEO Joe welcomed *Gryd's* efforts to raise awareness. Through this, Joe hoped that they would be able to overcome the lack of awareness that acts as a barrier and prevents larger commercial and industrial energy consumers from participating in DSR technology programmes:

"[Gryd] *has really stepped up the mark with this as well. They've launched their power responsive campaign to educate and to really make people aware of the opportunities which we think is terrific."* [Joe, Chief Executive Officer, Xidoa]

Furthermore, *Vonergy's* CEO Steven was keen on optimising the cost-effectiveness of *Xidoa's* DSR technology and hence attempted to gain financial support through a range of initiatives set up by the *MDfE* in order to encourage the development of innovative energy technologies.

5.4.3.4 Relationship 4 (R4): Gaining financial support from the *MDfE*

The *MDfE* had designed and implemented a set of supportive regulatory mechanisms in order to enable further growth of the DSR market in the UK. This included the *Energy Entrepreneurship Fund (EEF)* and the *Capacity Market Mechanism*.

The *MDfE* set up the *EEF* to support the development of innovative energy technologies. As part of this competitive scheme, *Xidoa* was awarded a share of the £21 million grant. The *MDfE's* Head of Electricity Systems Connor perceived that this would help the company to make its DSR technology more affordable for large commercial and industrial energy consumers. While *Vonergy* welcomed the financial support, the company's CEO Steven pointed out that drastically reducing costs would only be possible when the *MDfE* would allow DSR technology providers to participate in the *Capacity Market Mechanism*.

The *MDfE* had designed the *Capacity Market Mechanism* with the aim of guaranteeing that a sufficient supply of energy is provided in order to meet the future demand. To achieve this, the *MDfE* offered contracts to energy supply companies in exchange for guaranteeing the required energy capacity. DSR technologies, however, were not included in the initial design of the *Capacity Market Mechanism*. Connor, Head of Electricity Systems at the *MDfE*, explains:

> *"Our view is that in the industrial and commercial sector a lot of the enablers that Government or the regulator might put in place are already there."* [Connor, Head of Electricity Systems, MDfE]

In late 2014, however, the *MDfE* understood that DSR technologies are a promising low-carbon solution to address the emerging concerns over the security of supply. The *MDfE*, therefore, agreed to include DSR technologies in the *Capacity Market Mechanism*; albeit under slightly different rules.

These rules included that DSR technology providers were only allowed to bid for one-year contracts, compared to three- or 15-year-long contracts for providers of other forms of generation capacity (e.g., new construction of fossil fuel-fired power plants). The *MDfE's* Head of Electricity Systems Connor estimated that they would award at least one

GW worth of *Capacity Market Mechanism* contracts to DSR technology providers. *Xidoa's* CEO Joe welcomed the *MDfE's* decision to include DSR technologies in the *Capacity Market Mechanism*:

> *"*[The MDfE] *seems to understand that successful deployment of DSR technology, in a fair market, has the potential to deliver hundreds of millions of pounds to both large and small businesses across the country."* [Joe, Chief Executive Officer, Xidoa]

However, he also pointed out the inflexibility of the scheme and highlighted the need to continue to ensure that DSR technologies can compete in an enduring market:

> *"The rules of how the Capacity Market works are very, very inflexible. And so we had to do an awful a lot of work and still have to do an awful a lot of work to get demand response to be able to participate in the market that is really being built for generators."* [Joe, Chief Executive Officer, Xidoa]

He perceived that there were peculiar issues related to the design of the *Capacity Market Mechanism*:

> *"The Capacity Market is still biased towards traditional generation.* [...] *I would also point out that* [the Capacity Market Mechanism] *is currently not a 'level playing field', and simply subsidises existing fossil fuel generation."* [Joe, Chief Executive Officer, Xidoa]

Indeed, while the *MDfE's* Head of Electricity Systems, Connor, claimed that the *Capacity Market Mechanism* is technology-neutral, the unequal contract length puts DSR technology providers at a disadvantage compared to conventional energy generation providers. Such one-year contracts mean that *Vonergy* and *Xidoa* had to make investment decisions on a year-to-year basis, preventing the company from medium/long term investment security.

Interestingly, it was the distribution and network operator *Gryd* who, on the one hand, supported DSR technology providers through the *Power Responsive Initiative*, but on the other hand awarded a majority of contracts to fossil fuel-fired power plants as an outcome of its role as the delivery body of the *Capacity Market Mechanism*. *Gryd's* spokeswoman, Claudia, explained that while they awarded 450 MW of *Capacity Market Mechanism* contracts to DSR technology provider (550 MW less than the *MDfE's* forecast of 1 GW), *Gryd* did not have the authority to prioritise low-carbon technologies:

> *"Contracts are awarded based on capability and price. We cannot discriminate against fuel types offered."* [Claudia, Spokeswoman, Gryd]

As a result, *Vonergy's* CEO Steven and *Xidoa's* CEO Joe were frustrated and unhappy about the large number of subsidies awarded to fossil fuel-fired power station; an energy generation technology competing with its low-carbon solution to balance supply and demand in the electricity grid:

> *"At the same time,* [Gryd] *has also panicked because their job is to keep the lights on and they have been spending hundreds of millions of pounds in subsidising coal-fired power stations.* […] *But completely neglecting more environmentally friendly and more sustainable options."* [Joe, Chief Executive Officer, Xidoa]

The decision of *Gryd's* Director of UK System Operator Claire, however, was bound to the regulatory methodology set by the *MDfE*. Hence, Claire had no choice but to award the contracts in the way she did. Interestingly, in line with the efforts as part of the *Power Responsive Initiative*, Claire seemed implicit in favour of DSR technologies:

> *"Well, first of all, we need a toolkit to balance the system* […]*, that system is changing radically, and we need to balance that system efficiently and keep costs low for consumers. We are seeing this growth in intermittent renewable generation and that means there's a growing need for flexibility, agility and the need to embrace innovation around that future toolkit."* [Claire, Director of UK System Operator, Gryd]

Nevertheless, providers of fossil fuel-based solutions to meet peak demand, such as *Moggley*, had a major advantage by being able to secure 15-year-long guaranteed payments as part of the *Capacity Market Mechanism*.

5.4.3.5 Relationship 5 (R5): Competing with fossil fuel-based energy generation companies

The fifth and final relationship that affected *Vonergy's* efforts to establish itself as a DSR technology provider was with *Moggley*, a provider of 700 MW fast-ramping small-scale flexible diesel-fired energy generation assets. Just like *Vonergy* and *Xidoa*, *Moggley* participated in the *Capacity Market Mechanism*. Indeed, as a result of the increasingly tight capacity reserve margins in the winter of 2014, the *MDfE* had allowed diesel-power generators of under 50 MW to bid for contracts under the *Capacity Market Mechanism*.

Moggley secured 15-year-long subsidy contracts to build 22 new diesel-fired power plants with a total capacity of 450 MW. *Xidoa's* CEO Joe, directly competing with *Moggley* over Capacity Market subsidy contracts, was frustrated:

> *"We are not building gas, we are not building clean coal, we are building diesel. It's a fiasco and the government won't even admit that this is a mistake. They are more than happy to let these diesel power stations get built. We are talking about the most polluting form of power, not the least polluting form of power. Diesel is getting build in the UK because of these policy decisions."* [Joe, Chief Executive Officer, Xidoa]

He concluded that the *Capacity Market Mechanism* is a necessary tool but inherently misaligned with the long-term objective of driving the UK's low-carbon energy transition.

5.4.4 The outcome of *Vonergy's* response to climate change

So far, this case has outlined the five key relationships in relation to *Vonergy's* efforts to establish itself as a provider of DSR technology in response to climate change. This section now describes the outcome stemming from two years of interactions in and around these relationships.

As a result of *Vonergy's* and *Xidoa's* efforts to grow its DSR business in the UK, the company has managed to install DSR technology devices at 700 out of the 200,000 large commercial and industrial energy consumers that *Vonergy's* supplies. This meant that 200 MW of energy demand were equipped with *Xidoa's* DSR technology. While both *Vonergy's* CEO Steven and *Xidoa's* CEO Joe evaluated this as having achieved some success, the 200 MW represented only 2% of the total DSR market potential of 9.8 GW in the UK.

Xidoa's CEO Joe said that this was partially due to being slowed down by regulation and policy. Particularly the *MDfE's* decision to award 15-year-long contracts to diesel-fired power plants while only one-year contracts to DSR technology providers had disappointed him:

> *"We realised that actually, the UK may never work because the government seems to make persistent mistakes and then potentially will end up with failing to meet its climate change targets. The contracts they give to power stations can be up to 15 years in length. So, once they make the mistake, it could be a closed market for 15 years, and so it may never be solved."* [Joe, Chief Executive Officer, Xidoa]

Therefore, *Vonergy* and *Xidoa* made the decision to focus on other countries in order to grow its DSR technology business:

> *"We are expanding much faster internationally now. America in general, France, Belgium, Ireland, Germany,* […] *Australia, Korea. There is no shortage of countries where demand response can work, but very few countries need it as much as the UK. You know, we don't have many countries that have an island running a negative reserve margin. The UK just seems to have made these horrible policy decisions, it's not just us saying that it's pretty much across the board, everybody is saying that the government messed up."* [Joe, Chief Executive Officer, Xidoa]

Interestingly, *Vonergy* and *Xidoa* were able to market its DSR technology in France in record time. Within only eight months of focusing on the French market, they had managed to implement its DSR technology in 70 large commercial and industrial consumers; controlling over 75 MW of energy demand.

Furthermore, in discussions with *Xidoa's* CEO Joe, it quickly became clear how disappointed he was that his company was only able to mitigate a vanishingly small amount of carbon emissions stemming from the consumption of *Vonergy's* large commercial and industrial energy consumers. In fact, *Vonergy's* efforts to establish itself as a provider of DSR technology has contributed to decarbonising 200 MW of the UK's total energy demand of 75.3 GW. To put this into perspective, *Vonergy* has contributed to decarbonise one-tenth of a two GW gas-fired power plant. On average, a two GW gas-fired power plant generates one megaton of emissions annually; meaning that *Vonergy's* efforts to establish itself as a provider of DSR technology has decarbonised 0.1 megatons.

5.4.5 Conclusion

This case examined an energy supply company's efforts to expand its product portfolio in response to climate change. To achieve this, I scrutinised *Vonergy's* interactions in and around establishing the company as a provider of DSR technology. I concentrated on the five key relationships. This included *Vonergy* itself, the connected home technology provider *Xidoa*, the multinational hospitality company *Morhaven International*, the energy supply company *Pantegis*, the British distribution network operator *Gryd*, the *MDfE* and the diesel-power generation company *Moggley*.

The purpose of this case was to develop a holistic understanding of how companies respond to climate change. This case, in fact, links well to the fifth case which scrutinises how an energy supply company aimed at decarbonising its operation by establishing itself as a provider of connected home technologies.

5.5 Case 5: *Connectica's* efforts to establish itself as a provider of connected home technologies

The fifth and final case examines the interactions when the large energy supply company *Connectica* decided to expand its product portfolio in response to climate change. To achieve this, representatives of *Connectica* engaged in interactions within and across the company's business network in order to establish the company as a provider of connected home technologies. Within *Connectica's* business network, I concentrate on six key actors: *Connectica*, the energy supply company itself, the connected home technology provider *Ecovair*, the independent research organisation *Qubeta*, domestic energy *consumers*, the advertising agency *Advotis* and the UK's *Ministerial Department for Energy (MDfE)*.

5.5.1 Introduction to the network actors

Connectica is a British energy company supplying electricity and gas to twelve million households in the UK. With over 31,000 employees and a total energy generation capacity of 8.6 GW, the company is one of the UK's biggest energy suppliers. Size notwithstanding, *Connectica* represents an interesting research case because the company's senior leadership team has publicly committed to mitigate the annual carbon emissions of 4.4 megatons stemming from its own operation in 2015 as well as help its customers to reduce their emissions.

Interestingly, 90% of *Connectica's* carbon emissions were not caused directly by the company but when its customers consumed energy. These, so-called Scope 3 carbon emissions can be mitigated by reducing the total carbon intensity by revenue (tCO_2e/£). In 2015, *Connectica's* total carbon intensity by revenue was 157 tCO_2e/£. What is most pertinent to this study, however, is that *Connectica* intended to mitigate its carbon intensity by revenue by expanding its product portfolio with a technology that offers considerable emission reduction potential, so-called connected home technologies. In doing so, *Connectica's* Head of Environment, Tom, hoped to enable its customers to reduce their carbon emissions while also providing them with an opportunity to lower their energy bills.

By way of contextual information, connected home technology refers to a broad range of technologies aimed at reducing the consumption of energy through the automation of lighting, heating, ventilation and home appliances (e.g., refrigerators, washers, dryers, ovens). The connected home technology that *Connectica* focused on falls into the category of smart thermostats. Such devices can be used to control a home's heating by scheduling different room temperatures throughout the day, thereby allowing a reduction of carbon emissions and lowers the energy bills of consumers.

Ecovair is one of the UK's leading connected home technology innovators. Founded in 2006, the company's hardware- and software permits the remote monitoring and controlling of the energy consumption of household appliances. *Ecovair's* Founder, Paul, had developed the technology to help consumers to run their homes more energy efficient and through this enable energy savings:

> "[Our smart thermostat] *can sit around and say, 'This person always gets up at half past six in the morning, so I need to make sure the house is comfortable then, and they leave the house about 9 am so I can start to let the temperature tail off'."* [Paul, Founder, Ecovair]

What is most pertinent to this study, however, is the fact that *Ecovair* managed to install around 200,000 devices within the first five years of operation (launch of the product in 2009 until 2014) but its relatively low engineering manpower hindered a steeper growth trajectory. As a result, *Ecovair's* Founder Paul was keen to engage with a strategic investor.

In addition to *Ecovair*, the interactions with the independent research organisation *Qubeta* were an important consideration for *Connectica*. Mostly commissioned by government departments and private companies, *Qubeta* has established itself as the UK's leading hub for knowledge in and around household's energy consumption. Nevertheless, *Qubeta's* Advisor Michael acknowledged that there is a persistent lack of robust evidence about connected home technologies:

> *"There is a lack of evidence about whether connected home technologies actually do work and save energy, especially in the UK context. There is a bit of evidence in the US, but most of the evidence is from the manufacturers themselves. That, of course, is unreliable."* [Michael, Advisor, Qubeta]

Furthermore, the role of *Connectica's consumers*, whether existing or new ones, cannot be ignored. In fact, *Connectica's* CEO, Hannah, believed that connected home technologies could help to reduce the emissions stemming from domestic heating, which is responsible for over 15% of the total energy consumption in the UK. She also understood, however, that *consumers* would only purchase connected home technology products when they offered other benefits such as lower energy bills and/or increased comfort. Following a comprehensive market analysis, she concluded that by installing connected home technologies the average energy *consumer* could save up to £150 annually on their energy bills.

Another important consideration for *Connectica* were the interactions with the British advertising agency *Advotis*. In 2014, a survey conducted by *Advotis* suggested that only 35% of British energy *consumers* are aware of connected home technologies. *Connectica* and *Advotis* were keen on counteracting this lack of awareness.

Lastly, the role of the *MDfE*, the UK's ministerial department responsible for the provision of adequate, secure, affordable and environmentally friendly energy, cannot be overlooked. In fact, the *MDfE's* Head of Regulation, Gary, supposed that the department's goals can be achieved most effectively by improving the energy efficiency of domestic households. Therefore, the *MDfE* established a list of certified technologies and designed a set of policies to support energy efficiency technologies (e.g., the Boiler+ programme). Connected home technologies, however, were not on the list and hence did not receive government support.

Scrutinising the interactions within and across the network of actors that affected *Connectica's* efforts to expand its product portfolio in response to climate change, enabled me to develop a holistic understanding of the issues I sought to engage with, in terms of answering how companies respond to climate change. Indeed, it was clear that, for *Connectica*, the business network was a key component to achieve the company's goal of establishing itself as a provider of connected home technologies.

The remainder of this case focuses on this by outlining what triggered *Connectica's* response to climate change, by describing the interactions within and across the company's business network and by reviewing the outcome stemming from *Connectica's* interactions in response to climate change. The case closes with a brief conclusion.

5.5.2 *Connectica's* response to climate change

Connectica's conventional energy generation assets had diminished in value following the emergence of climate change on the international political agenda, the UK government's efforts to meet its carbon emission reduction targets set in the 2008 Climate Change Act and the resulting UK legal/regulatory framework in favour of low-carbon sources of energy.

These contextual changes emanating from climate change had partially caused a drop in *Connectica's* profits from £1.6 billion to just £81 million. To mitigate the company's exposure to strengthened environmental regulation and the diminishing value of its conventional generation, *Connectica's* Head of Environment, Tom, decided to conduct an assessment of the company's carbon emissions. Interestingly, this assessment showed that 90% of the company's emissions were not produced directly by the company but when its customers consumed energy. Tom, therefore believed that *Connectica's* biggest contribution to mitigating emissions would be to offer its customers the tools to reduce their energy consumption:

> *"With around 90% of our carbon emissions arising from customer energy consumption, the greatest role we can play is to give our customers the products and services they need to reduce their energy use and carbon footprint."* [Tom, Head of Environment, Connectica]

On further analysis on the strategic options to do so, he concluded that connected home technologies could enable substantial energy savings and hence not only mitigate carbon emissions but also lead to lower energy bills and increased consumer control. Indeed, a report published by the *MDfE* suggested that connected home technologies could create a rare win-win situation for energy companies, its customers and the UK as a whole:

> *"Improving home energy efficiency is a 'win-win' for households and the UK as a whole. It enhances the UK's energy security, cuts the carbon emissions from our building stock, and reduces costs–the cheapest energy is the energy that we don't use. From the consumer perspective, the benefits include lower energy bills, warmer homes that are more comfortable to live in, and improved wellbeing."* [Report on Home energy efficiency and demand reduction, MDfE]

Connectica's Commercial Director, Grace, supposed that smart thermostats could be particularly important for enabling such a win-win situation:

> *"For years we've put up with thermostats we can't programme, heating empty homes, and paying for gas and electricity based on estimates. But technology is changing this. At* [Connectica]*, we're focused on making our customers' lives a little easier by offering* […] *smart energy products that*

help our customers on the things that matter the most to them: control, comfort, convenience and costs." [Grace, Commercial Director, Connectica]

This triggered *Connectica's* senior leadership team's decision to invest £500 million to expand its product portfolio by establishing the company as a provider of connected home technologies.

5.5.3 Interactions during *Connectica's* response to climate change

Connectica's efforts to establish itself as a provider of connected home technologies was embedded in a network of business relationships with the actors introduced above. Figure 15 shows this business network and the associated interactions taking place.

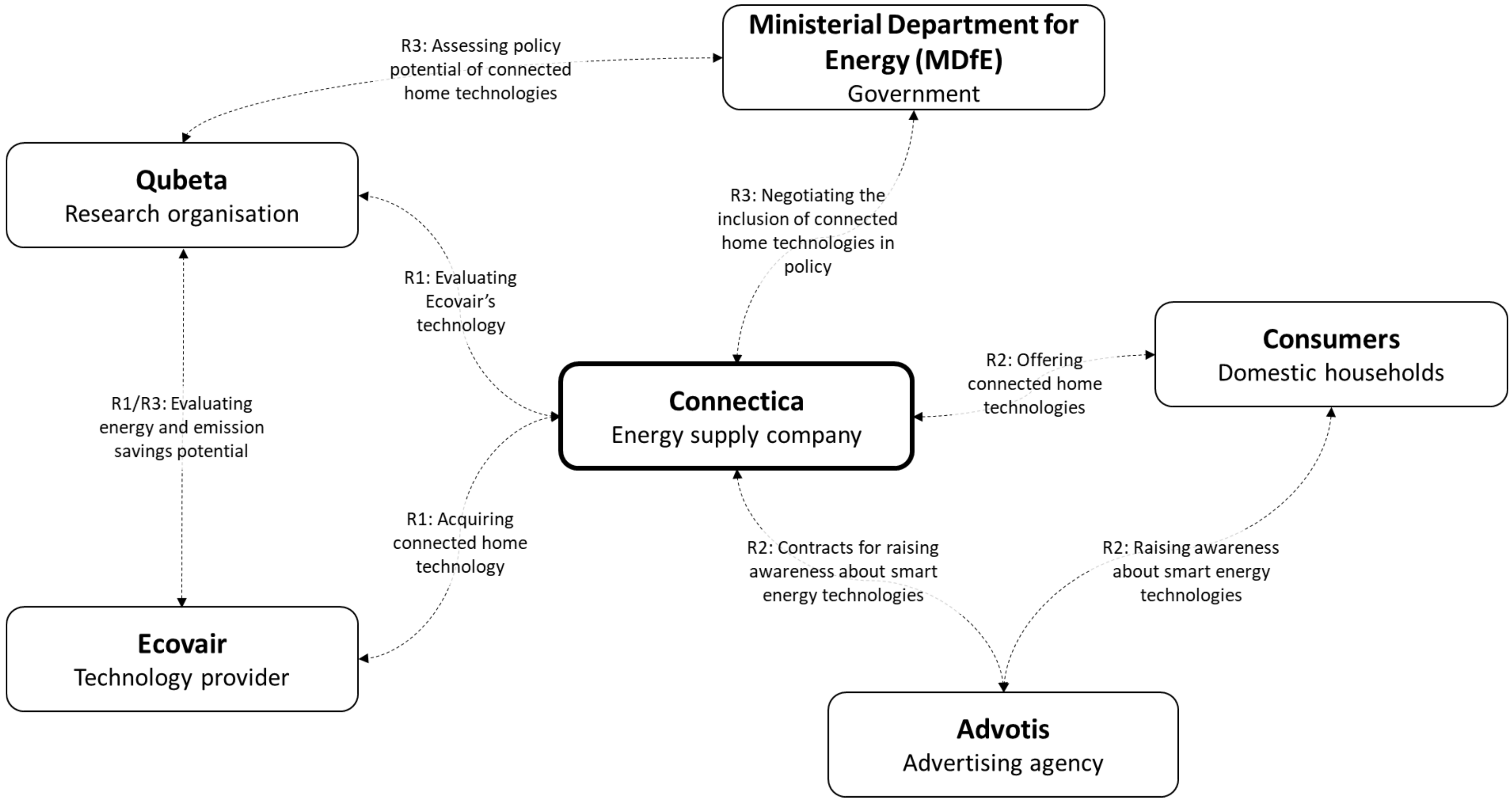

Figure 15: *The network affected by Connectica's response to climate change*

Throughout the two years of interactions within and across this business network, I focus on the three key relationships held by *Connectica*. Delineating the interactions in and around these relationships enables a holistic understanding of how companies respond to climate change.

5.5.3.1 Relationship 1 (R1): Acquiring the connected home technology provider *Ecovair*

The first relationship that affected *Connectica's* efforts to establish itself as a provider of connected home technologies was with *Ecovair*. Paul, the Founder of *Ecovair*, had developed smart plugs and a platform (both a mobile app and a physical device) that allowed users to remotely monitor and control the energy consumption of household appliances. Seeking a steeper growth trajectory than the 40,000 devices they had been able to manufacture and install annually in the first five years since the product was launched in 2009, *Ecovair's* Founder Paul and CEO Charlotte were keen to engage with a strategic investor that would not only bring cash but has the infrastructure in place to install over one thousand connected home devices daily.

At the same time, *Connectica's* CEO Hannah, Commercial Director Grace and Head of Environment Tom were evaluating strategies for expanding their product portfolio with connected home technologies. In fact, *Connectica's* senior leadership team had both the financial resources (the £500 million investment capital set aside for expanding its product portfolio) and the infrastructure established through its traditional energy business (10,000 well-trained installation engineers).

Before the team was ready to make a final investment decision, however, they wanted to be certain that *Ecovair's* connected home technology was actually saving electricity. *Connectica*, therefore, carried out trials with households that already had *Ecovair's* connected home technology installed, and hired *Qubeta* to provide an independent assessment of the energy-saving potential of *Ecovair's* connected home technology.

Michael, an Advisor at *Qubeta*, was tasked with establishing in-depth knowledge, providing robust evidence and evaluating the energy-saving potential of *Ecovair's* connected home technology:

> *"We are basically running an independent and robust evaluation of the energy savings borne through the device.* […] *We were basically drawing upon existing data, so gas consumption readings from the energy supplier from homes both with and without this device, and running a bunch of energy modelling and trying to see if it's true and how much energy the device was saving."* [Michael, Advisor, Qubeta]

Interestingly, after three-months of analysing this data, Michael concluded that *Ecovair's* connected home technology has the ability to generate energy savings of up to 68%. Simultaneously, *Connectica's* own trials indicated a similarly promising energy-saving potential of around 60%.

As a result of these findings, *Connectica's* senior leadership team perceived that the energy-saving potential of *Ecovair's* connected home technology, combined with the synergies stemming from *Connectica's* market access and infrastructure, would turbocharge the company's connected home technology business.

In February 2015, *Connectica's* CEO Hannah confirmed that the company had acquired *Ecovair* for £65 million. *Ecovair's* CEO Charlotte was excited about the opportunity to work with *Connectica* and described it as an opportunity to contribute to the UK's low carbon energy transition:

> *"We are delighted to welcome* [Connectica] *as a strategic investor and key commercial partner. This is a massive opportunity to contribute towards transforming the energy sector by providing easy to use, personalised services to customers, enabling them to manage their energy use, save money and reduce carbon emissions."* [Charlotte, Chief Executive Officer, Ecovair]

5.5.3.2 Relationship 2 (R2): Marketing connected home technology products

Jointly, *Connectica* and *Ecovair* worked closely on marketing the connected home technology products. To achieve this, *Connectica's* Managing Director Alistair engaged with the company's existing and new customers as well as the advertising agency *Advotis*. These interactions were an important consideration for *Connectica* because they would allow installing connected home technology at the scale necessary to establish the company as a leading provider of connected home technologies, thereby not only recovering the losses stemming from the decreasing value of its conventional generation business but also enabling substantial emission reductions.

In fact, since 90% of *Connectica's* emissions are generated when its customers consume energy, the role of *consumers* cannot be overlooked. For its twelve million current customers, however, mitigating emissions alone was not sufficient to justify purchasing connected home technology for £199 (including installation).

As a result, *Connectica's* Managing Director Alistair quickly altered his marketing pitch and focused on the other benefits (e.g., lower energy bills, increased comfort) rather than merely the reduction of emissions:

> *"We want to make energy-saving as easy as possible for our customers. This is why we continue to offer new, smarter ways to help customers take control of their energy usage.* [Ecovair]*'s innovative product portfolio is a great addition to* [our] *current service offering, and will provide our customers with a new range of affordable, easy to use tools to reduce their energy consumption and cut their fuel bills."* [Alistair, Managing Director, Connectica]

Interestingly, while it sounds counterintuitive that an energy supply company would be interested in reducing its customer's energy consumption (as this would lead to less revenue from energy sales), *Connectica's* Commercial Director Grace pointed out that the profit margins on pure energy sales are typically very low. Selling connected home technologies, on the other hand, was a much more lucrative business.

At the same time, *Connectica* received positive feedback from the consumers that had purchased its connected home technology: 88% of consumers using the technology felt more in control over their energy consumption, 70% believed that they had saved energy and 58% used the app to monitor their energy consumption on a daily basis. Nevertheless, *Connectica's* Commercial Director Grace supposed that many consumers are too disengaged with their energy consumption and hence do not purchase connected home technologies:

> *"Consumers are disengaged with energy. This lack of engagement between people and energy suppliers and their energy bills is a big problem.* […] *I am recruiting software engineers, user experience designers and data scientists from NASA. They are motivated by changing customers' engagement with energy."* [Grace, Commercial Director, Connectica]

In an attempt to encourage consumers to become more engaged with their energy consumption, she tasked the British advertising agency *Advotis* to design and implement an extensive marketing campaign. Amongst other measures, *Advotis* created a TV commercial aimed at raising awareness and improving consumer acceptance of connected home technologies.

5.5.3.3 Relationship 3 (R3): Including connected home technologies in domestic energy efficiency policies

The third and final relationship that affected *Connectica's* efforts to establish itself as a provider of connected home technologies was in and around the company's attempt to include connected home technologies in domestic energy efficiency policies. To do so, *Connectica's* senior leadership team engaged with the *MDfE* and *Qubeta*. In fact, the *MDfE* had established a list of certified technologies and designed a set of policies to support these energy efficiency technologies (e.g., the Boiler+ programme). Connected home technologies, however, were not on this list:

> *"So, for this kind of heating control technology because the technology is new it doesn't currently exist in regulation and testing standards."* [Michael, Advisor, Qubeta]

The *MDfE's* Head of Regulation Gary explained that this was due to a shortage of robust evidence that proves the energy-savings stemming from connected home technologies.

Connectica's senior leadership, however, had just received exactly this evidence from *Qubeta's* Advisor Michael and happily shared the results with the *MDfE*. While the *MDfE's* Head of Regulation Gary was interested and acknowledged that the evidence was of a quality and format that could feed into policy discussions, he decided to task *Qubeta* with a study that was explicitly designed to evaluate how connected home technologies can be best encouraged through regulation:

> *"We want to try and understand how* [connected home technologies] *are best encouraged through regulation as well as protecting the interests of consumers."* [Gary, Head of Regulation, MDfE]

After lengthy discussions about what kind of evidence the *MDfE* needs and *how* this evidence then may improve policies, *Qubeta's* Advisor Michael began with its evaluation.

Surprisingly, although the initial stages of *Qubeta's* analysis suggested that connected home technologies can reduce energy consumption, it quickly became clear that the technology cannot be computed by the methodology underpinning the governments Standard Assessment Procedure (SAP).

By way of contextual information, the SAP is a British computer tool designed to assess the energy and environmental performance of houses. Michael, Advisor at *Qubeta*, provided further insights into the SAP:

> *"So, that is basically a very complex and long-standing energy efficiency model which models and predicts building energy efficiency. If you put all the data you know into this model, things like the building type, the construction and the type of boiler, etc., then you get out of the model some energy efficiency rating. This model basically underpins not quite all government energy policy, but it is a huge amount of it."* [Michael, Advisor, Qubeta]

This implied, however, that when a technology cannot be computed by the methodology underpinning the SAP, then the chances are high that this technology is not going to be supported by the *MDfE*. In fact, Michael found that the SAP cannot compute the energy efficiency stemming from connected home technologies:

> *"So, one of the problems with* [connected home technologies] *is that they change the consumption based on what the home should be heated to and when.* [Connected home technologies] *actually turn the heating off automatically when people are out of the house. It can also incrementally reduce your temperature trying to save energy. And the problem is that the SAP model just cannot compute that, sort of like the computer says no."* [Michael, Advisor, Qubeta]

While the *MDfE*, at least theoretically, could support a technology without being included in the SAP, *Qubeta's* Advisor Michael pointed out that this is a complex process:

> *"That is a multi-year process, involving a huge amount of testing which is what we are currently doing as part of this trial but it is proving to be very difficult."* [Michael, Advisor, Qubeta]

As a result of the insights stemming from *Qubeta's* analysis, the *MDfE's* Head of Regulation Gary concluded that connected home technologies were not to be included in the *MDfE's* list of certified technologies and hence was not supported through domestic energy efficiency policies.

5.5.4 The outcome of *Connectica's* response to climate change

So far, this case has outlined the three key relationships in relation to *Connectica's* efforts to establish itself as a provider of connected home technologies. This section now describes the outcome stemming from two years of interactions in and around these relationships.

In discussions with *Connectica's* senior leadership team, it quickly became clear that the decision to expand its product portfolio with connected home technologies was dominated by concerns over the ways in which climate change had caused its conventional energy generation assets to diminish in value; leading to a drop in profit from £1.6 billion to just £81 million in 2014.

As a result of *Connectica's* efforts to grow its connected home technology business, the company has managed to install 660,000 in 2015. In fact, by combining *Ecovair's* technological expertise with *Connectica's* market access and infrastructure, *Connectica's* senior leadership team established itself as a leading provider of connected home technologies in the UK. By selling 660,000 connected home technology products, *Connectica* has enabled considerable emission reductions over the products' lifetimes.

5.5.5 Conclusion

This case examined an energy supply company's efforts to expand its product portfolio in response to climate change. To achieve this, I scrutinised *Connectica's* interactions in and around establishing the company as a provider of connected home technologies. I concentrated on three key relationships *Connectica's*, including the connected home technology provider *Ecovair,* the independent research organisation *Qubeta*, domestic energy *Consumers*, the advertising agency *Advotis* and the UK's *Ministerial Department for Energy (MDfE)*. The purpose of this case was to develop a holistic understanding of how the case company *Connectica* responded to climate change.

5.6 Conclusion

In this chapter, I have presented the empirical findings stemming from five in-depth case studies of business responses to climate change. The first case provided insights into an energy supply company's efforts to respond to a regulation aimed at mitigating carbon emissions. In the second case, I described how another energy supply company aimed at decarbonising its gas-fired energy generation assets. The third case described a multinational energy supply company's efforts to establish itself as a renewables-only energy supply company. In the fourth case, I outlined how an energy supply company responded to climate change by expanding its product portfolio with demand-side response technology. The fifth and final case referred to ways in which an energy supply company attempted to realign its business towards connected home technologies.

In the following chapter, I analyse these five cases based on the initial theoretical structure (see Figure 2 on page 45) and the relevant contextual changes outlined in the *Context and Industry Definition* chapter. In this way, I analyse the empirical findings and outline the ways in which the insights stemming from these cases contribute to extending the current understanding of how companies respond to climate change.

6 Analysis and discussion

In this chapter, I analyse and discuss the empirical findings in light of the initial theoretical structure for the study of business responses to climate change (see Figure 2 on page 45). In doing so, I employ the intellectual lenses established through the literature review to explain the empirical findings. Specifically, I provide detailed insights that advance our understanding of the theoretically derived cause and effect links to answer how companies respond to climate change.

I begin this chapter with a review of the initial theoretical structure and the research questions to remind the reader of the key aspects relevant to the analysis and discussion. I then provide an overview of the empirical findings and highlight that all five case studies have the commonality of leading to three observed network outcomes. Through an iterative systematic combining of the literature, the theory and the juxtaposition of theory and empirical findings, I proceed to the development of a novel conceptual framework of business responses to climate change.

To do so, I analyse the empirical findings by dissecting the five empirical cases and running them through the initial theoretical structure (see Figure 2 on page 45). Thereby, I analyse the interaction and behaviour within and across the five cases. This involves examining the contextual changes that triggered the network tensions and resulted in interaction and behaviour within and across business relationships and networks.

In the subsequent section, I then elucidate how the empirical findings drive the theoretical work on organisation and management studies, corporate social responsibility, business networks and behavioural science together, in order to build a novel conceptual framework (see Figure 16 on page 246) through which I seek to explain how companies respond to climate change. I conclude this chapter with a brief summary.

6.1 Review of initial theoretical structure and research questions

The aim of analysing the empirical findings is to explain how and why this study provides more detailed insights that advance the theoretically derived cause and effect links of how companies respond to climate change. In fact, by setting the empirical findings presented in the previous chapter against the organisation and management literature on business responses to externally generated pressures in general and to climate change specifically as well as the interactional and behavioural insights stemming from the network approach and the behavioural science literature, I established an initial theoretical structure for the study of business responses to climate change. This initial structure was driven from, not just the theoretical understanding of the previous literature but also from the case studies themselves. This systematic combining, iterative and logical research process allowed me to establish an initial theoretical structure that consists of three pillars: 1) *Network tensions*, 2) *Network interactions*, and 3) *Network outcomes*.

Indeed, when analysing what was happening in each of the empirical cases, I realised that the socio-cultural, legal/regulatory and economic pressures emanating from global climatic changes had caused network tensions. As a result, the companies initiated activities and hence interacted within and across their business networks in order to access the necessary resources which were not available in concentrated form but rather located within the company's business relationships and networks. These successive interactions commonly resulted in three network outcomes.

By utilising the initial theoretical structure of *network tensions*, *network interactions* and *network outcomes*, I was able to answer the two research questions underpinning this study:

1. *How* do companies respond to climate change?
2. *How* do companies interact and behave within and across their business relationships and networks when responding to climate change?

The first research question focuses on identifying the causal mechanisms that explain how companies respond to climate change. The second research question ensures that a full view of the interaction behaviour within and across business relationships and networks is established. As outlined in the previous section, one of the key arguments put forward in this thesis is that the sources that explain how companies respond to climate change may be located within the interaction and behaviour in *business relationships and networks*. Collectively, answering these two research questions permits the development of a more comprehensive understanding of how companies respond to climate change.

Driven by the research questions reviewed above, I set the empirical findings stemming from the five cases presented in the previous chapter against the initial theoretical structure for the study of business responses to climate change (Figure 2 on page 45). In doing so, I analyse and discuss the five case studies with regards to 1) the actors involved in the focal company's response to climate change; 2) the *outcome* stemming from the response to climate change; 3) the *tension* created through the socio-cultural, legal/regulatory and economic changes emanating from global climatic changes; and 4) the *interaction and behaviour* in and around the company's business relationships and networks. Within and across these four sections of the analysis and discussion, I focus on providing more detailed insights that advance the theoretically derived cause and effect links that explain how companies respond to climate change.

Below, I begin the analysis and discussion of my empirical findings by providing an overview of the contextual changes that triggered the companies' responses to climate change.

6.2 Overview of business responses to climate change

In this section, I analyse and discuss the contextual changes that triggered the business responses to climate change in the empirical cases. Interestingly, in each of the five case studies, prior to the focal companies' response to climate change, all were characterised by emitting a considerable amount of carbon (between 4.4 and 42.0 megatons annually), which was mostly because of a large proportion of fuel-based energy generation assets. What came through when analysing the empirical findings is that the emergence of climate change had brought about a variation in socio-cultural (i.e., a shift towards more sustainable forms of living, working and consuming), legal/regulatory (i.e., policies and regulations to promote decarbonisation of the economy) and economic (i.e., more costly to run a carbon-intensive business) values, norms and rules, which acted as a stimulus for the case companies to respond to climate change.

In the third case, for example, this is vividly illustrated by the case company *Energize* commitment to restructuring its energy generation portfolio with the aim of establishing itself as a renewables-only energy supply company. Similarly, in the second, fourth and fifth case, the focal companies decided to implement changes to mitigate carbon emissions. Conversely, in the first case, the response to climate change seemed to be purely triggered by a legal/regulatory pressure that required the company to install energy efficiency measures in domestic households.

Collectively, the five empirical cases indicate that the case companies responded to climate change as a result of either socio-cultural, legal/regulatory or economic pressures which were generated externally to the company. Interestingly, while, on the one hand, the empirical findings suggest that the socio-cultural, legal/regulatory and economic pressures drive companies towards responding to climate change, on the other hand, simultaneously operating pressures are demanding companies to operate as cost-effectively as possible. In fact, Shevchenko et al. (2016) would term this a paradox ingrained in the behaviour of external stakeholders (in this study evident through the socio-cultural, legal/regulatory and economic pressures) who are pressuring companies to respond to climate change but, at the same time, allowing these companies to delay doing so by demanding a cost-effective approach. Indeed, a similar congruence of behaviour appears to be underpinning the empirical findings of this study.

In an attempt to highlight how this paradox occurred in each of the five cases underpinning this study, I provide broadly representative quotes and examples in Table 9 below. Collectively, these quotes and examples show how the socio-cultural, legal/regulatory and economic pressures triggered the business responses to climate change in the most effective manner.

	Socio-cultural	*Legal/regulatory*	*Economic*
Case 1: Utiliko	"It has to be affordable for consumers because they are dependent on the electricity." [Julia, Energy Policy Manager, Utiliko]	The ECO scheme was introduced; requiring all energy supply companies with more than 250,000 customers to install energy efficiency measures in low-income and harder-to-treat properties. Collectively, these measures were to generate carbon emission lifetime savings of 28 megatons.	Energy supply companies with less than 250,000 customers were not obliged to comply with the ECO scheme. Soon, they were able to offer 20% lower energy prices than Utiliko.
Case 2: Olectra	"While a lot of people now are definitely aware of climate change in such a way that they understand that particularly in the energy sector we are in a transition and there are costs associated with transitioning into a decarbonised system." [Adam, Head of Wholesale Policy, Olectra]	The MDfE announced the CCS commercialisation competition. The private company that was able to demonstrate the commercial and technical viability of deploying CCS technology in the UK would be awarded up to £1 billion to support the actual construction of the project.	Competing energy supply companies do not attempt to decarbonise its fossil fuel-fired power plants.
Case 3: Energize	"Everybody's thinking about energy has become so absolutely focused on what the final bill is because the argument is that's the only bit that consumers really care about." [Adam, Analyst, MDfE]	"She [The Secretary of the State] is very clear on this point, energy security is her absolute number 1 priority for the department, and that's something that the Prime Minister has reinforced as well." [Scott, Head of Energy Security, MDfE]	"There is a significant risk that the market will no longer deliver an adequate level of security of supply as it has done historically, principally because potential revenues in the energy-only market may no longer incentivise sufficient investment in capacity." [Report, MDfE]
Case 4: Vonergy	Increasing pressures on companies to act "in response to the central challenges of the energy transition, combating climate change and making responsible use of natural resources." [Steven, CEO, Vonergy]	The Energy Entrepreneurship Fund (EEF) and the Capacity Market Mechanism as a set of supportive regulatory mechanisms in order to enable further growth of the DSR market in the UK.	Grid operators are willing to make these payments because of savings stemming from not having to maintain costly reserve energy capacities (e.g., fossil fuel power plants).
Case 5: Connectica	"At [Connectica], we're focused on making our customers' lives a little easier by offering […] smart energy products that help our customers on the things that matter the most to them: control, comfort, convenience and costs." [Grace, Commercial Director, Connectica]	Connected home technology cannot be computed by the methodology underpinning the governments Standard Assessment Procedure (SAP). Hence, connected home technologies did not receive regulatory support.	The decision to establish itself as a provider of connected home technologies was dominated by concerns over the ways in which climate change had caused its conventional energy generation assets to diminish in value; leading to a drop in profit from £1.6 billion to just £81 million in 2014.

Table 9: *Socio-cultural, legal/regulatory and economic pressures in response to climate change*

As illustrated by the quotes and examples in Table 9 above, the contextual changes at the socio-cultural level triggered the case companies to decarbonise their energy generation portfolio as cost-effectively as possible. In fact, while the values, norms and rules of the society (which are ultimately the case companies' customers) appeared to be more aware of climate change and that decarbonising the economy and particularly the energy supply system is required, at the same time, the socio-cultural pressures demanded affordable energy prices and did not seem to be willing to bear the costs associated with transitioning towards a low-carbon energy supply system.

These empirical findings are in line with previous research on socio-cultural pressures which were found to act as both drivers of and barriers to business responses to climate change (e.g., Adger et al., 2009; Leiserowitz, 2006; Shevchenko et al., 2016). The present research shows that socio-cultural pressures are a double-edged sword in the sense that they trigger business responses to climate change but, at the same time, pose a financial constraint on doing so as the socio-cultural actors (i.e., customers, taxpayers) are not willing to bear the costs associated with moving towards a low-carbon energy supply system. What appears to underpin this behaviour of society is the so-called attitude-behaviour gap (e.g., Öberseder et al., 2011; Caruana et al., 2016). In other words, very few consumers are actually translating their concerns about environmental problems such as climate change into actual purchasing behaviours. As a result, this study concludes that business responses to climate change are triggered by socio-cultural pressures but, at the same time, limited by the extent to which consumer's value and financially reward such activities.

Furthermore, the previous literature claims that the emerging legal/regulatory pressures encourage businesses to decarbonise their operations (e.g., Bansal and Roth, 2000;

Banerjee et al., 2003; Veal and Mouzas, 2010). While the empirical findings of this study confirm this, it seems that the legal/regulatory pressures on companies are relative to other concerns of policymakers. In the context of the energy sector, this is exemplified by the government priority of safeguarding the security of supply and maintaining the affordability of energy. For example, in case three, it is evident that the changes in the legal/regulatory pressures have driven the company to establish itself as a provider of 100% renewable energy, but at the same time, the legal/regulatory pressures focused on the need to maintain a secure supply of electricity, which was challenged by decommissioning the stable supply inherent in fossil fuel-based energy generation assets. As a result, the legal/regulatory pressures were altered. The present research, therefore, suggests that the legal/regulatory pressures act as a driver of business responses to climate change but are constrained by the priority on the security of supply and/or energy affordability. This, in turn, explains why the legal/regulatory demands to mitigate emissions may often be patchy and inconsistent. A similar congruence of thinking was put forward in earlier research by Wittneben (2009), Keohane and Victor (2011) and Okereke et al. (2012).

Moreover, the empirical findings of this study show that climate change has, indeed, brought about a variety of economic pressures and opportunities. Commercialising such opportunities, however, frequently requires high upfront capital investments that may hamper short-term profitability. As illustrated in the first and second case, companies that are not making these investments today obtain a competitive advantage in the short-term. These insights advance the established thinking that economic pressures are a key driver of business responses to climate change (e.g., Cordano, 1993; Bansal and Roth, 2000; Kolk and Levy, 2001). In fact, this confirms that addressing climate change competes with the business focus on short-term profitability as identified in the literature review (e.g., Wright and Nyberg, 2017). This behaviour, as demonstrated in Hardin's (1968) tragedy of the commons, may explain why emissions in the atmosphere continue to rise. In other words, in the short-term, for each individual company, it is in their own best interest to grow their business and neglect the need to decarbonise as it will weaken the company's competitiveness.

The overview of the contextual changes that triggered the case companies' responses to climate change, however, does not fully explain how the case companies interacted and behaved in response to climate change. To shed light on this question, in the next section, I dissect the five empirical cases and analyse them along with the initial theoretical structure as established in the literature review (Figure 2 on page 45). In doing so, I integrate all sections of the theory, the empirical findings and the contextual changes for the analysis of the interaction and behaviour in business relationships and networks when responding to climate change.

6.3 Analysis of interaction and behaviour in business networks when responding to climate change

This section analyses and discusses the interaction and behaviour within and across the networks of business relationships that were formed in each of the five empirical cases. I employ the initial theoretical structure in and around the *network tensions*, *network interactions* and *network outcomes*. Interestingly, what came through when analysing the data is that network tensions, as the first pillar of the initial theoretical structure, are brought about by socio-cultural, legal/regulatory and economic pressures introduced above.

Interestingly, what was evident in the five empirical cases is that the contextual changes emanating from climate change triggered network level activities because in the short-term these contextual changes caused some kind of discontinuity in the business networks. In fact, the source of network tensions appeared to be a mismatch between current operations and the emerging socio-cultural, legal/regulatory and economic pressures. Therefore, I begin with analysing and discussing these network tensions.

6.3.1 Network tensions

This section discusses the network tensions that the socio-cultural, legal/regulatory and economic pressures have brought about. More specifically, network tensions refer to the discontinuity in the business network originating from the misalignment of business operations and the need for change stemming from the contextual changes. In other words, the tensions between what the previous literature describes as the focus on short-term profitability and the emerging need to respond to change (Okereke et al., 2012; Wright and Nyberg, 2017). Analysing the network tensions that the contextual changes emanating from climate change (socio-cultural, legal/regulatory and economic) is important to understand how companies interact and ultimately respond to climate change.

Demonstrated across all five cases of business responses to climate change, the present study identifies a tension between the established activities and resources that a network actor possesses (current operations) and the activities and resources required to address climate change (need for change). Current operations refers to assessing the validity and value of business resources in light of the emerging contextual changes. In the second case, for example, the case company explicitly stated that their core business is in and around the supply of energy and that the company is *not* a manufacturer of carbon reduction technologies. Nonetheless, it was an innovative carbon reduction technology (Carbon Capture and Storage) that the company required in order to achieve their chosen strategy in response to the contextual changes, i.e. retrofitting one of the company's gas-fired power plants with CCS technology.

The need for change, on the other hand, refers to the ways in which the socio-cultural, legal/regulatory and economic pressures demand companies to decarbonise their operations. In each of the five empirical cases, the companies seemed committed as long as they perceived that a decarbonised energy supply system is beneficial for their business. As illustrated in the third case, for example, investing in carbon-intensive projects was not permissible, unless when it was about safeguarding the security of supply.

In an effort to further illuminate how the tension between current operations and the need for change played out across the five empirical cases, I provide broadly representative quotes from each case in Table 10 below. Collectively, these quotes show how the network tensions were manifested in the empirical cases.

Case	*Current operations*	*Need for change*
Case 1: Utiliko	"The ECO has moved more and more towards the priority group customers. So, these customers that haven't the money to contribute, so we're having to fund up to a hundred per cent of these measures." [Lucy, Development Manager, Utiliko]	"[Brixwell Council] obviously has knowledge of the properties and the areas that can help with planning measures such as solid wall insulation." [Lucy, Business Development Manager, Utiliko]
Case 2: Olectra	"A successful scheme at [Yankee] could pave the way for massive investment in carbon capture and storage in the UK [and] with thousands of gas-fired power plants around the world, there could be a huge demand for the technology overseas." [Kevin, Carbon Capture and Storage Manager, PlentiOil]	"We're not a technology manufacturer, we're a utility so you know we rely on others to produce things like technology and innovate." [Simon, Business Development Manager, Olectra]
Case 3: Energize	[John, Board of Directors, Energize] "An investment in higher carbon isn't necessarily a good idea unless it is about the security of supply." [Ben, Head of Orientation, Energize]	"A comprehensive analysis of the current business activities and structure, the present and future requirements of the energy market and – on this basis – an extensive assessment of all options for strategic actions."
Case 4: Vonergy	"We are committed to working in partnership with customers to make energy work for them. We believe that a lower carbon UK and being more sustainable are both good for the world and good for business." [Isaac, Chief Operating Officer, Pantegis]	"We want to be able to continue to offer to our customers a wide variety of commercial solutions that work for almost every company under every set of circumstances." [Steven, Chief Executive Officer, Vonergy]
Case 5: Connectica	"With around 90% of our carbon emissions arising from customer energy consumption, the greatest role we can play is to give our customers the products and services they need to reduce their energy use and carbon footprint." [Tom, Head of Environment, Connectica]	"At [Connectica], we're focused on making our customers' lives a little easier by offering […] smart energy products that help our customers on the things that matter the most to them: control, comfort, convenience and costs." [Grace, Commercial Director, Connectica]

Table 10: *Network tensions in response to climate change*

Interestingly, previous research suggests that the business tension brought about by climate change is between short-term profitability and meaningfully mitigating carbon emissions (Okereke et al., 2012; Wright and Nyberg, 2017). The empirical findings of this study, however, suggest that it is rather between meaningfully mitigating emissions and the established activities as well as resources that a company possesses.

What is most pertinent to this study, however, is that despite the lack of resources, all five case companies attempted to change their business operations profoundly. In the third case, for example, the case company, historically driven by fossil fuel-based energy generation, devoted itself to become a provider of renewables-only energy. As identified earlier in this chapter, however, the socio-cultural, legal/regulatory and economic pressures required this to be done in the most effective manner. Interestingly, what came through when analysing the five empirical cases is that the case companies attempted to achieve effectiveness by engaging within and across their business relationships and networks.

In fact, all of the case companies interacted within and across their business relationships and networks in order to access the resources and mobilise the activities that were not aligned with their current operations but were required to respond to climate change.

6.3.2 Network interactions

This section identifies the network interactions between network actors, their resources and activities. In other words, network interactions capture the network-level activities aimed at accessing resources to address the network tensions. To do so, actors interact within and across their business relationships and networks. Scrutinising the ways in which actors initiate activities to access the resources required to respond to climate change is important as it may reveal the mechanisms ingrained in the process of interaction that may enhance the understanding of business responses to climate change.

Prior to dissecting the specific network interaction, it is essential to identify the network actors involved in five empirical cases. This becomes particularly pertinent when recalling the network approach that is underpinning the present research. Indeed, the network approach required going beyond the conventional thought of island-like businesses and take entire business networks as the unit of analysis. This approach seemed particularly relevant to the study of business responses to climate change as the sheer scale of mounting a response to climate change is likely to go far beyond the capacity of an individual company (Veal and Mouzas, 2010; Ferraro et al., 2015).

Largely unsurprisingly, and endorsing the utilisation of the network approach, in each of the five empirical cases, the focal company engaged with a multitude of network actors (on average more than seven actors per response to climate change). In the first case, for example, the network of actors involved in the business response to climate change comprised eight key actors. Similarly, the second, third, fourth and fifth case involved nine, six, seven and six network actors respectively. These included energy supply companies, energy services/technology providers, energy consumers, national governments, local authorities, industry associations and others.

Table 11 below summarises the types of actors that were identified in each of the five case studies.

Type of actor	*Case studies covered* 1	2	3	4	5	*Network actors*
Energy supply companies	2	2	2	3	1	AMP; Connectica; Energize; Moggley; Olectra; Pantegis; PlentiOil; The Energy Bjird; Utiliko; Vonergy
Energy services/technology providers	1	4	1	2	1	Advantegis; Ecovair; Gryd; Henley Test Centre; Isotec; Mygrid; Planwey; Projexon; Xidoa
Energy consumers	1		1		1	Commercial and industrial consumers; domestic consumers
National governments	1	2	1	1	1	House Windsor; Ministerial department for Energy (MDfE)
Local authorities	1	1				Ablefield Council; Brixwell Council
Industry associations	1					Exxelo UK;
Others	1		1	1	2	Advotis; EU ETS; Morhaven International; Thameswide; Qubeta
Total network actors	**8**	**9**	**6**	**7**	**6**	

Table 11: *Network actors involved in business responses to climate change*

As highlighted in Table 11 above, the present research provides empirical evidence that shows the variety of actors involved in business responses to climate change. In this study, this included seven different types of actors.

The first type of actor involved are energy supply companies and their competitors. In all five cases, this included the energy supply companies that initiated the efforts to address the contextual changes (*Connectica*, *Energize*, *Olectra*, *Utiliko*, *Vonergy*). In case one to four, at least one additional energy supply company was either collaborating or competing with the focal company (*AMP*, *Moggley*, *Pantegis*, *PlentiOil*, *The Energy Bjird*). For example, in the second case, the multinational oil and gas company *PlentiOil* was closely collaborating with the energy supply company *Olectra* in order to retrofit a gas-fired power plant located with Carbon Capture and Storage (CCS) technology. On the other hand, in the third case, the multinational energy supply company *AMP* was directly competing for customers with the case company *Energize*.

The second type of actor were energy services and technology providers. On the one hand, these included energy services providers like the French project support company as well as oil and gas infrastructure specialist *Projexon*, the British energy consulting company *Advantegis*, or the British energy service company specialised in subsea and pipeline engineering work *Planwey*. On the other hand, this included energy technology providers such as the DSR technology provider *Xidoa* or the connected home technology provider *Ecovair*. In fact, the present research indicates that energy supply companies engage with energy services and technology providers to respond to climate change as effectively as possible. This was vividly illustrated in the fourth and fifth case, as the focal companies opted to acquire a low-carbon energy technology provider instead of investing in costly R&D to develop the technology by themselves, thereby, outsourcing the initial risks to other network actors.

The third type of actor identified in this study are *consumers*. *Consumers* seem to play an important role in business responses to climate change since they demand a low-carbon energy supply system but are not willing to bear much of the costs associated with this transition. Here, the empirical evidence presented in cases one, three and five suggests that either *domestic* and/or *commercial/industrial consumers* affected the way in which the focal company responded to climate change.

The fourth type of actor involved in all five cases of business responses to climate change are departments of national governments. In fact, the UK's *Ministerial*

Department for Energy (MDfE) directly shaped the business responses to climate change by designing and implementing a legal/regulatory framework to which the companies had to react. In the second case, this also included *House Windsor*, a British governmental department responsible for the UK's public finance and economic policy.

Additionally, the five cases suggest that local authorities are the fifth type of actor involved in business responses to climate change. Particularly in case one and two, the local authorities of *Ablefield Council* and *Brixwell Council* impacted the way in which the focal company responded to climate change. In these cases, the local authorities possessed vital insights that would permit achieving the focal companies' response to climate change more effectively (e.g., information about households eligible for the ECO scheme). Furthermore, local authorities were responsible for issuing planning permissions required for large-scale construction work such as retrofitting a gas-fired power plant with CCS technology (Case 2).

The sixth type of actor involved in the business responses to climate change were industry associations. In the first case, the energy industry associations *Exxelo UK* played an important role in establishing industry positions on the key energy policies (such as the ECO).

The seventh and final type of actor involved in the five business responses to climate change are other actors such as an international hospitality company, a research organisation, an advertising agency and a social housing association. These actors had a large variety of roles such as providing robust data about households' energy consumption, trialling the commercial benefits of low-carbon technologies as well as designing and implementing marketing campaigns to raise awareness.

Collectively, these seven types of actors comprised the network actors involved in business responses to climate change. This study, therefore, shows that business responses to externally generated involve a multitude of network actors. As such, the present research raises doubts about the existing organisation and management research on business responses to climate change because such efforts are commonly conceptualised as atomistic and isolated activities of individual companies (e.g., Kolk and Levy, 2001; Banerjee et al., 2003; Kolk and Pinkse, 2004; Margolick and Russell, 2004; Jones and Levy, 2007; Slawinski and Bansal, 2012; Shevchenko et al., 2016; Wright and Nyberg, 2017).

Throughout the literature review, I have pointed out that the organisation and management literature of touching upon business responses to climate change commonly disregard that companies are embedded in wider networks of continuous business and non-business exchange relationships (Easton and Håkansson, 1996; Gnyawali and Madhavan, 2001; Håkansson and Ford, 2002; Ritter et al., 2004). As this study shows, the contrary appears to be the case: Companies interact with other actors to access the resources necessary to respond to climate change in the most effective manner (as demanded by socio-cultural, legal/regulatory and economic pressures). This is largely because the respective network actors possess at least one resource required to achieve the strategy in response to climate change. This has been evident across all of the five cases underpinning this study.

The finding that companies interact in response to climate change is valuable but invites a deeper exploration of the specific network interactions. I argue that it is only through this vital step that the observed network outcomes can be explained.

What came through when analysing the specific network interactions, was that such interactions appeared to be driven by activities aimed at resource rationalisation and resource expansion. Resource rationalisation refers to the ways in which network actors attempt to safeguard the established network position, assets, profitability and other valuable possessions. Unsurprisingly, responding to climate change had brought about was driven by effectiveness as network actors had to ensure that their activities were beneficial to the company's customers. Although this underpinned the network interaction across all cases, it was particularly strong in the third case. Here, the company was very clear that investing in a low-carbon energy generation portfolio was the preferred option as long as it bore benefits to the customers (e.g., maintaining low energy prices).

Resource expansion, on the other hand, refers to the ways in which network actors attempt to mobilise network resources and activities to alter their network position. All of the case companies interacted comprehensively with other network actors in order to expand their resource pool. These efforts seemed to be driven by cost-effectiveness since the focal actors perceived that they could achieve their response to climate change at the smallest cost when mobilising network resources. This argument, claiming that businesses engage in network interaction when they perceive that value can be created, either directly or indirectly, is in line with the extent IMP literature (e.g., Ritter et al., 2004; Mouzas and Ford, 2009).

In fact, a key cause of this appeared to be the case that companies were concerned about the uncertain future benefits and the large upfront capital investments necessary to respond to climate change. Across all five empirical cases, it is evident that the companies had to make a considerable investment in order to achieve the response strategies.

Table 12 below illustrates the network interaction based upon activities aimed at resource rationalisation and resource expansion by providing broadly representative quotes for each of the five cases.

Case	*Resource rationalisation*	*Resource expansion*
Case 1: Utiliko	"We are just always driven to deliver as cost-effectively as possible." [Lucy, Business Development Manager, Utiliko]	Thameswide, Brixwell Council and Isotec viewed the ECO scheme as a big opportunity and were seeking to benefit from Utiliko's obligation to retrofit low-income homes and harder-to-treat properties with solid wall insulation.
Case 2: Olectra	"The high cost of developing innovative, first-of-a-kind projects like [Yankee] CCS, need strong governmental support – as illustrated by the gradual development of other energy technologies in the past –. In the absence of the Competition and potential funding, we reluctantly concluded that there is no longer a future for the [Yankee] project in the near term." [Joint statement by Olectra and PlentiOil]	"I think the problem we have at the moment is that we are trying to pretend that we can finance the expensive demonstration phase by some promise of jam tomorrow and the golden megawatt hour that is suddenly going to shower great wealth upon whoever actually gets there, but as with CCS that just doesn't work, we need to find a way of providing the upfront capital support to make that work." [Simon, Business Development Manager, Olectra]
Case 3: Energize	"Broadly speaking investing in a low carbon kind of portfolio is good [...] but we have to prove the benefit to consumers." [Ben, Head of Orientation, Energize]	"The conventional energy spinoff […] left deep marks on our balance sheet." [Walter, CEO, Energize]
Case 4: Vonergy	"Contracts are awarded based on capability and price. We cannot discriminate against fuel type's offered." [Claudia, Spokeswoman, Gryd]	"Our customers are commercial industrials. They, you know, they care about reducing their emissions but at the end of the day they're doing it because there's a direct financial benefit; they get paid to do it." [Joe, Chief Executive Officer, Xidoa]
Case 5: Connectica	"This is a massive opportunity to contribute towards transforming the energy sector by providing easy to use, personalised services to customers, enabling them to manage their energy use, save money and reduce carbon emissions." [Charlotte, Chief Executive Officer, Ecovair]	"That is a multi-year process, involving a huge amount of testing which is what we are currently doing as part of this trial but it is proving to be very difficult." [Michael, Advisor, Qubeta]

Table 12: *Network interactions in response to climate change*

Interestingly, when analysing the case data on the network interaction in light of the behavioural sciences literature, it became clear that a set of behaviours may underpin the resource rationalisation and resource expansion activities. This includes 1) Frames and reference points, 2) Loss aversion and the fixed-resource pie, and 3) Herd behaviour. I now turn my attention to analysing and discussing each of the behaviours evident in this study.

6.3.2.1 Frames and reference points

The first set of behaviours identified when analysing the network interaction across all five cases is related to frames and reference points. Frames and reference points refer to the risk-averse behaviour of actors and the tendency to weigh responses to climate change against reference points.

In all five cases, it was either the legal/regulatory pressures (Case 1, 2 and 3) or the economic opportunity (Case 4 and 5) that acted as a frame for the activities made by the network actors. These frames were presented in a loss- or gain-oriented manner. In the first and third case, the respective legal/regulatory pressures (*ECO scheme* and *Renewables Obligation*) were framed in a loss-oriented manner (a fine for non-compliance). In the second, fourth and fifth case, the legal/regulatory pressures (*CCS Commercialisation Competition*) and the economic opportunities (high margins and new revenue streams) were framed in a gain-oriented manner (financial benefits from compliance or proactivity).

Interestingly, whether or not a decision was framed in a loss- or gain-oriented manner did not seem to impact the ways in which companies behaved. In fact, in all five cases, the network interaction was characterised and driven by risk-aversion. Astonishingly, this finding contradicts the seminal work of Kahneman and Tversky (1979) who suggested that only positively framed decisions, i.e. the gains that can be obtained when addressing a problem, prompt risk-averse behaviour. Negatively framed decisions, i.e. what can be lost when not addressing a problem, on the other hand, would prompt risk-seeking behaviour (Kahneman and Tversky, 1979).

Furthermore, the legal/regulatory pressures or economic opportunities acted as reference points for the network interaction. In fact, in all five cases, the case company's responses to climate change were relative to these reference points. In the first case, for example, this meant that the business response to climate change was relative to the ECO scheme. Similar behaviour occurred in the fourth and fifth case where the companies' efforts in response to climate change were relative to the economic opportunity. As a result of these diverging reference points held by network actors rather than just the single aim of reducing carbon emissions may explain the differing behaviour of actors within the respective networks. This finding advances previous research conducted by Veal and Mouzas (2010) who, based on the prior work of Kahneman and Tversky (1979) and Tenbrunsel et al. (2000), found that companies take the emerging rules and regulations as a frame for thinking about their action in response to climate change.

In summary, this study finds that network interactions in response to climate change are based upon diverging frames and reference points held by the network actors. Table 13 provides illustrative examples of how the network interactions were based on differing frames and reference points in each of the five cases.

Case	Frames	Reference points
Case 1: Utiliko	The ECO scheme presented a choice framed in a loss-oriented manner (a fine of up to £590 million). Even compliance with the ECO was a loss for Utiliko, however, at lower costs. This prompted risk-averse network behaviour.	The ECO scheme acted as a reference point for network behaviour. The efforts to mitigate the carbon emissions stemming from its consumers were relative to the ECO scheme (e.g., focus on addressing fuel poverty and reducing carbon emissions) and not based upon absolute effectiveness.
Case 2: Olectra	The CCS commercialisation competition represented a choice framed in a gain-oriented manner (a potential support of up to £1 billion for demonstrating the commercial and technical viability of CCS retrofit). This prompted risk-seeking network behaviour at first but transitioned back to risk-averse network behaviour once the opportunity for gain vanished.	The CCS Commercialisation Competition and EU ETS acted as reference points. The network behaviour was relative to the requirements set under the CCS competition. The price of purchasing the potentially saved emissions allowances acted as a reference point for capital investments.
Case 3: Energize	The Renewables Obligation represented a choice framed in a loss-oriented manner (a fine of up to £45 per MWh for non-compliance). This prompted risk-averse network behaviour.	The Renewables Obligation and EU ETS acted as reference points for network behaviour. Energize's response to climate change was relative to regulation.
Case 4: Vonergy	The commercial opportunity of DSR technology presented a choice framed in a gain-oriented manner (high margins and new revenue stream). This prompted risk-averse network behaviour.	The commercial opportunity of DSR technology acted as a reference point for network behaviour. The efforts to mitigate carbon emissions stemming from the application of DSR technology was relative to the commercial opportunity (e.g., focus on new revenues for current customers).
Case 5: Connectica	The commercial opportunity of connected home technologies represented a choice framed in a gain-oriented manner (high margins and new revenue stream). This promoted risk-averse network behaviour.	The commercial opportunity of connected home technologies acted as a reference point for network behaviour. The efforts to mitigate carbon emissions stemming from the application of connected home technologies was relative to the commercial opportunity (e.g., focus on new revenues from customers).

Table 13: *Frames and reference points in network interactions*

Based on the empirical insights in and around these illustrative examples and in light of the previous literature I conclude that the wide range of frames and reference points of network actors brings about diverging network interactions when responding to climate change. In fact, what became evident when analysing the empirical findings is that in each of the cases the network interactions were characterised by risk-aversion and the tendency to weigh responses to climate change against frames and reference points. Furthermore, the network interactions seemed to be driven by loss aversion and the belief in a fixed-resource pie.

6.3.2.2 Loss aversion and the fixed-resource pie

The second set of behaviours identified when analysing the network interactions across all five cases is related to loss aversion and the fixed-resource pie. These refer to the loss-averse network interaction of actors and the belief in a fixed-resource pie.

In all five cases, the network interaction seemed to be characterised by loss-aversion. In fact, as soon as the focal actors realised that the loss of resources was a possibility, the company adjusted its response to climate change as such that activities aimed at mitigating carbon emissions were reduced. This played out similarly in all five cases. In the first case, for example, as soon as the actors realised that it was impossible to comply with the ECO scheme within the allocated costs, their interaction turned towards requesting an alteration of the policy. Thereby, attempting to safeguard profitability by minimising the costs of responding to legal/regulatory changes resulting from the emergence of global climatic changes. In the same way, in the third case, the network interaction was rooted in not missing a commercial opportunity along with the transition towards a renewables-only energy supply, or in other words, maximising profitability by running a two GW coal-fired power plant. The network interaction of actors, therefore, appeared to be characterised by loss aversion since the network actors had the tendency to prefer avoiding a loss by keeping their current resources rather than bearing the risk of losing resources in the process of responding to climate change. As suggested by previous research (Kahneman and Tversky, 1979; Tversky and

Kahneman, 1991; Kahneman et al., 1991) this behaviour is rooted in the belief that the competitiveness nature of the business environment will eventually eliminate actors that operate inefficiently.

This is further amplified by the behavioural bias of perceiving the world and its resources as limited (e.g., Bazerman et al., 2000). In fact, this congruence of thinking, evident across all cases, prompted network interactions based upon a lose-lose or win-lose frames. As a result, the network actors opted for protecting their resources and rationalising activities rather than putting the company at risk when responding to climate change. Interestingly, it did not seem to matter whether a decision was based upon a lose-lose or a win-lose frame. The default always appeared to be to protect the company from losing their current network position and customer base rather than exposing the company to the risks associated with responding to climate change. In the third case, for example, the commercial benefits related to the case company's move towards renewables were incremental and put the company at risk of losing their current network position. This prompted network interactions based on a win-lose frame in which defending the current resources and rationalising activities were the preferred actions.

As a result of the network interaction in and around loss aversion and the fixed-resource pie, actors opted for defending their existing resources and rationalising their activities when responding to climate change rather than striving for the incremental benefits stemming from a radical alteration of resources as required for an immediate response to climate change. Table 14 provides broadly illustrative examples of the network interaction based on loss aversion and the fixed-resource pie in each of the five cases.

Case	*Loss aversion*	*Fixed-resource pie*
Case 1: Utiliko	*Utiliko's* response suggests that network behaviour was driven by loss-aversion. As soon as the actors realised that it was impossible to respond to the ECO scheme within the set cost-structure, they requested an alteration of the policy. Profitability was thereby safeguarded and the costs of responding to regulation were reduced.	The benefits of responding to the ECO scheme were incremental and did not outweigh the associated costs. This prompted network behaviour based on a lose-lose frame. Here, *Utiliko* chose to opt for the lesser evil (responding at lowest-possible costs) and thereby protecting their network position rather than exposing the company to the risks associated with extensive spending on responding to climate change.
Case 2: Olectra	*Olectra's* response suggests that network behaviour was driven by loss-aversion. As soon as the loss of resources was a possibility (e.g., loss of financial support when the *MDfE* cancelled the CCS competition), the company rendered its response to climate change.	The benefits of decarbonising its *Yankee* gas-fired power plant (one megaton fewer carbon emissions) were incremental and did not outweigh the upfront investment. This prompted network behaviour based on a win-lose frame. *Olectra* chose to protect themselves rather than putting the company at risk by safeguarding natural resources.
Case 3: Energize	*Energize's* response was driven by ensuring profitability (e.g., running a two GW coal-fired power plant). The network behaviour was rooted in loss-aversion (not missing a commercial opportunity along with the transition towards a renewables-only energy supply).	The commercial benefits stemming from *Energize's* move towards renewables were incremental and put the company at risk of losing customers. This prompted network behaviour based on a win-lose frame in which resource rationalisation was the preferred action.
Case 4: Vonergy	*Vonergy's* response suggests that network behaviour was driven by loss-aversion. As soon as the actors realised that it was costly to gain a significant traction for DSR in the UK, they decided to focus on other countries (e.g., France).	The benefits of establishing itself as a provider of DSR technology were incremental (low carbon emissions reduction and low commercial benefits). This prompted network behaviour based on a win-lose frame and individuals choose to protect the company rather than putting it at risk.
Case 5: Connectica	*Connectica's* response was driven by ensuring profitability (e.g., a revenue of £660 million). The network behaviour appeared to be rooted in loss-aversion (not missing the commercial opportunities stemming from its traditional carbon-intensive business).	The benefits of establishing itself as a provider of connected home technologies were considerable (a zero-carbon intensity revenue of £660 million in 2015) but the carbon-intensive business remained profitable. This prompted network behaviour based on a win-lose frame and individuals choose to protect the company rather than putting it at risk.

Table 14: *Loss aversion and the fixed-resource pie in network interactions*

6.3.2.3 Herd behaviour

The third and final set of behaviours identified when analysing the network interactions across all five cases is related to herd behaviour. These refer to the ways in which actors engage in response to climate change that are akin to other actors in their business network rather than opting for isolated action.

In all five cases, the network interactions were characterised by forming and acting as a herd. In other words, the network actors made their decisions relative to how other network actors behaved. In the first case, for example, the case company decided to request a revision of the ECO scheme because compliance was costly and some of the other network actors were not exposed to the external legal/regulatory pressure. The network actors that were required to respond to the ECO scheme jumped on the bandwagon and also requested an alteration. Similarly, in the fourth case, the case company may have taken the decision to reduce their effort to establish itself as a provider of DSR technology in the UK because other network actors continued to make profits with diesel-fired power plants.

As suggested by previous research (e.g., Kindleberger, 1978; Banerjee, 1992; Shiller, 1995, 2000; Mouzas and Ford, 2011) in these herd-like network interactions, the network actors acted akin when their intrinsic values and beliefs were similar. Collectively, such herds of actors had the chance to alter the contextual changes resulting from the emergence of climate change, such as legal/regulatory decarbonisation targets. In the second case, for example, the two focal companies acted like as a collective when withdrawing their commitment to retrofit a gas-fired power plant with CCS technology. In line with this, and predominantly a result of similar intrinsic values and beliefs, the network actors in the first case requested alterations to the ECO scheme. This led to a revision of the carbon emission saving targets. The herd behaviour has thereby been able to render the contextual changes resulting from global climatic changes.

Interestingly, while the network actors intrinsically seemed to strive to control the interactions in their business relationships and networks, in practice, this rarely happened. As a result the networks in each of the cases appeared to operate as a *"self-organizing system"* (Ritter et al., 2004, p.175) in which no individual actor could choose, develop, manage and control networks with the purpose of enhancing their own performance because this was always dependent on the respective activities and resources of counterparts. This does not imply, however, that herd behaviour always reduces the magnitude of the socio-cultural, legal/regulatory and economic changes resulting from climate change. Interestingly, in the fourth and fifth case, the network actors acted as a collective when attempting to raise awareness about DSR technologies in the UK. This brought about network interactions that encouraged legal/regulatory changes.

Interestingly, these empirical findings in and around herd behaviour provide evidence that individual actors in business relationships and networks have the tendency to act as a collective and akin to other network actors. As previously found by Mouzas and Ford (2011) network actors may act alike and form herds based on joint understandings of a problem. This study enhances Mouzas and Ford's (2011) finding as such that herding behaviour appears to underpin business responses to climate change.

Table 15 provides broadly illustrative examples of network interactions based on herd behaviour in each of the five cases.

Case	*Herd behaviour*
Case 1: Utiliko	*Utiliko* decided to request a revision of the ECO scheme because their response was costlier than anticipated and other network actors, such as small energy supply companies, were not required to comply. The other BIG 6 energy supply companies jumped on the bandwagon and also requested an alteration. This led to a 25% lower carbon emission saving targets. Thereby, the herd behaviour has altered the legal/regulatory pressure at the contextual level.
Case 2: Olectra	*Olectra* and *PlentiOil* acted as a collective when cancelling their efforts to retrofit the Yankee gas-fired power plant with CCS technology. *Olectra* and *PlentiOil* have taken the decision to halt their effort to retrofit the Yankee gas-fired power plant with CCS technology because another network actor has terminated their financial support.
Case 3: Energize	The network welcomed the *Capacity Market Mechanisms* as a commercial opportunity along with the transition towards a low-carbon energy supply system. One of the reasons that explain *Energize's* decision to participate in the *Capacity Market Mechanism* was that its competitor *AMP* participated as well. Combined with the competitiveness, drive for lower prices and the risk of losing their network position this prompted herd-like network behaviour.
Case 4: Vonergy	*Vonergy* may have taken the decision to reduce their effort to establish itself as a provider of DSR technology in the UK because *Moggley* continued to make profits with diesel-fired power plants. This suggests herd-like network behaviour.
Case 5: Connectica	One of the reasons that may explain *Connectica's* decision to continue operating its fossil fuel-based generation assets is that its competitors continued to make profits despite their carbon intensity. This suggests herd-like network behaviour.

Table 15: *Herd behaviour in network interactions*

Based on the empirical insights in and around these illustrative examples and in light of the previous literature I conclude that herd behaviour was a considerable determinant of network interactions. What became evident when analysing the behaviour in networks in each of the cases is that actors engaged in responses to climate change that were akin to other network actors rather than opting for isolated action.

Interestingly, I observed three network outcomes that appeared to stem from the business responses to climate change. In fact, what became evident when dissecting the five case studies is that the explanations of how companies respond to climate change are to be found at the network level; the unit of analysis that has received little attention by previous research on how companies respond to climate change. In an attempt to illuminate this further, I commence by describing the observed network outcomes.

6.3.3 Discharging, protecting and herding as outcomes of business responses to climate change

What came through when analysing the five empirical cases in light of the previous literature on business responses to externally generated pressures in general and to climate change specifically, the network approach and the behavioural science literature is that the interaction and behaviour in business relationships and networks seem to bring about three network outcomes. In fact, I observed three broad categories of network outcomes: 1) companies were *discharging* their responsibility by passing the impact to others, 2) companies were *protecting* their resources and rationalising activities rather than bearing risks of change, and 3) companies were forming herds, i.e. acting akin to other actors with similar intrinsic values and beliefs rather than operating in isolation *(herding)*. I now pay closer attention to each of these three network outcomes.

6.3.3.1 Network outcome I: Discharging

The first network outcome *discharging* relates to individual actors' discharging their responsibility by passing the impact to others. In the empirical findings of this study, the network outcome *discharging* was observed and illustrated by the risk-aversion of actors and the tendency to weigh responses to climate change against reference points. In the first case, for example, the ECO scheme presented a choice framed in a loss-oriented manner (a fine of up to £590 million). Even compliance with the ECO was a loss for the case company *Utiliko*, although at lower costs. As a result, the ECO scheme acted as a reference point for the company's response to the legal/regulatory pressure emanating from climate change. The efforts to mitigate the carbon emissions stemming from its consumers were, therefore, relative to the ECO scheme (e.g., focus on addressing fuel poverty and reducing carbon emissions) and not based upon absolute effectiveness. Similarly, in the fifth case, the case company *Connectica* responded to climate change as they supposed a commercial opportunity in connected home technologies. Doing so, however, was relative to the commercial opportunity (e.g., focus on new revenues from customers). Interestingly, across all five cases, the network outcome stemming from the responses to climate change was manifested in the discharging of the business effects on the natural environment rather than entirely eliminating it. In other words, the network outcome of discharging is based on actors' incrementally offsetting emissions (through compliance and relative effectiveness) rather than radically eliminating them (through proactivity and absolute effectiveness).

6.3.3.2 Network outcome II: Protecting

The second network outcome *protecting* relates to individual actors defending their resources and rationalising activities rather than bearing risks of change. Here, the analysis of the five cases of business responses to climate change suggests that the loss-aversion of actors and the belief of a fixed-resource pie caused actors to safeguard their existing resources in response to climate change (limiting risk of losing customers and the current network position) rather than opting for the incremental benefits stemming from a profound alteration of resources as required for an immediate response to climate change (uncertainty of future benefits). In the third case, for example, the response to climate change was driven by maximising profitability (e.g., running a two GW coal-fired power plant) owing to loss-aversion (not missing a commercial opportunity along the transition towards a renewables-only energy supply), whereas the commercial benefits from *Energize's* radical move towards renewables were incremental and put the company at risk of losing customers and their established network position. Similarly, in the fifth case, the benefits of establishing the company as a provider of connected home technologies and completely neglecting the established fossil fuel-based business were not attractive. In other words, all five cases companies opted for protecting the resources and rationalising activities rather than bearing risks of change.

6.3.3.3 Network outcome III: Herding

The third network outcome *herding* relates to individual actors acting akin to other actors with similar intrinsic values and beliefs rather than operating in isolation. In fact, the empirical findings of this study show that actors form herds to engage in responses to climate change that are akin to other actors in their business network rather than opting for isolated action. Furthermore, it appears that the decisions being taken by other actors in the network may impact on the ability to respond to climate change.

Collectively, network actors have the potential to block or lobby against or encourage national environmental regulation. For example, in the fourth case, the case company *Vonergy* may have taken the decision to halt their effort to establish itself as a provider of DSR technology in the UK because the competing energy supply company *Moggley* continued to make profits with diesel-fired power plants. Similarly, in the first case, *Utiliko* decided to request a revision of the ECO scheme because compliance was costly and small energy supply companies were not required to comply. As a collective, the network actors requested an alteration to the legal/regulatory pressure.

Table 16 below summaries the finding related to the three network outcomes by explaining and illustrating my observations in each of the five case studies.

Network outcomes	*Observation*	*Explanation*
Discharging	Network actors tend to discharge their responsibility by passing the impact to others.	The risk-aversion of actors and the tendency to weigh responses to climate change against reference points seems to cause actors to opt for offsetting carbon emissions incrementally (through compliance and relative effectiveness) rather than radically eliminating them (through proactivity and absolute effectiveness).
Protecting	Network actors tend to defend their resources and rationalising activities rather than bearing risks of change.	The loss-aversion of actors and the belief of a fixed-resource pie appear to cause actors to safeguard their existing resources in response to climate change (limiting risk of losing customers and network positions) rather than opting for the incremental benefits stemming from a profound alteration of resources as required for a radical response strategy (uncertainty of future benefits).
Herding	Network actors tend to form herds and act akin to other actors with similar intrinsic values and beliefs rather than operating in isolation.	Actors seem to engage in responses to climate change that are akin to other actors in their business network rather than opting for isolated action. Collectively, network actors have the potential to block or lobby against or encourage legal/regulatory pressures.

Table 16: *Discharging, protecting and herding as network outcomes*

Collectively, the insights stemming from setting the five empirical cases against the initial theoretical structure in and around the network tensions, network interactions and network outcomes *discharging*, *protecting* and *herding* provided a more fine-grained explanation of why these three network outcomes emerged. Based on the understanding established in this section (i.e., contextual changes triggered network tensions and network interactions which lead to specific network outcomes), in the next section, I propose a novel conceptual framework of business responses to climate change.

6.4 A conceptual framework of business responses to climate change

In the final section of the analysis chapter, I bring together the insights stemming from the preceding discussion and in light of the previous literature on externally generated pressures in general and to climate change specifically, business networks and behavioural science, I build a novel conceptual framework through which I seek to explain how companies respond to climate change.

In the subsequent discussion, I pursue to explain how the findings illustrated through the key components of the conceptual framework translate into theoretical contributions. By referring to the empirical findings in and around the five cases of business responses to climate change, I elucidate 1) the contribution to the literature when taking a network view of a focal company's response to climate change and 2) the contribution to understanding of how actors interact and behave in business relationships and networks. These theoretical contributions emerged from and are guided by the proposed conceptual framework of business responses to climate change illustrated in Figure 16 on page 246.

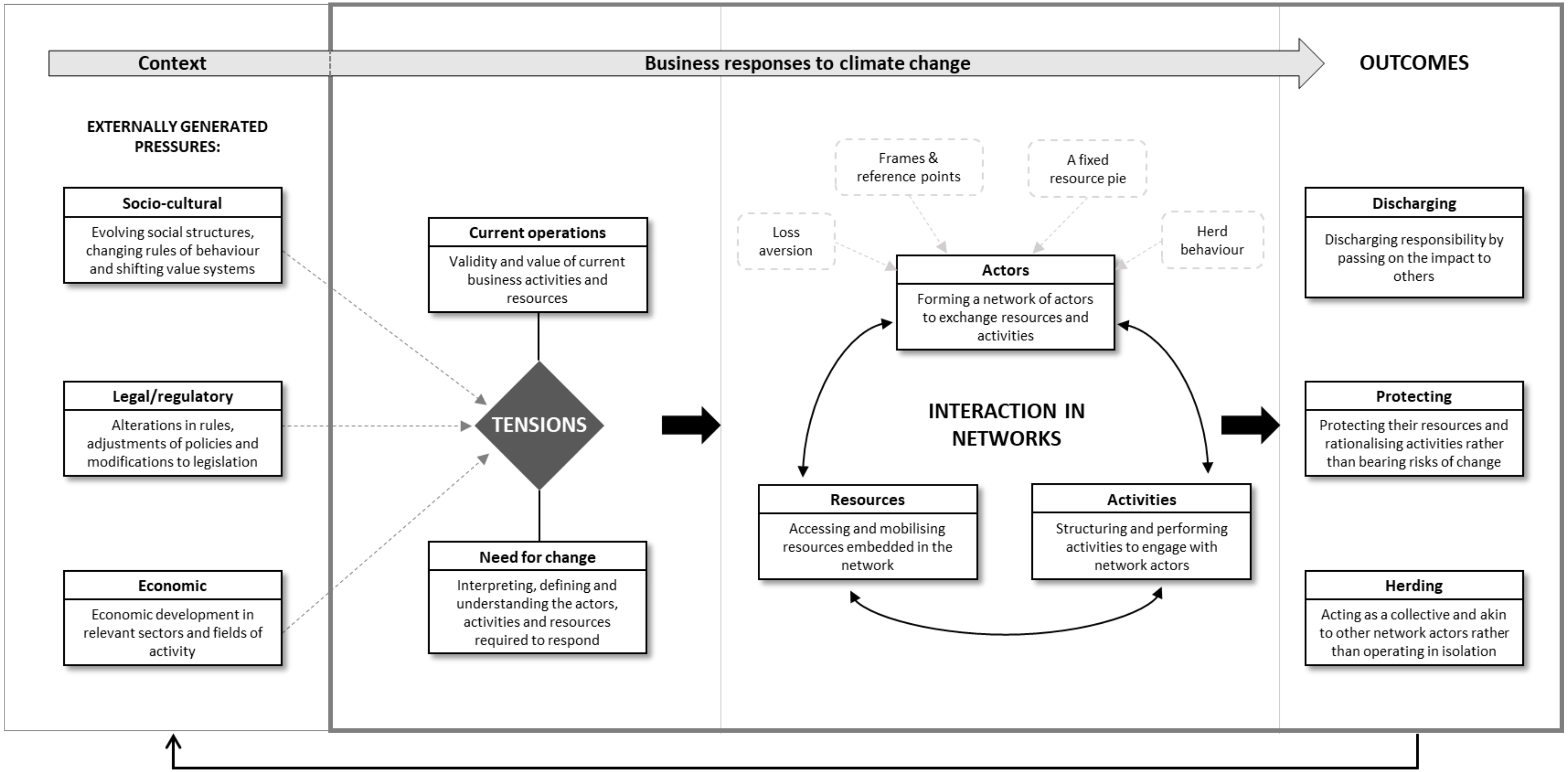

Figure 16: *A conceptual framework of business responses to climate change*

6.4.1 A network approach to business responses to climate change

The empirical findings of this study provide illustrations and evidence that the explanation of business responses to climate change may be found within the business relationships and networks. In fact, based on the empirical findings of this study it seems likely that the process of responding to climate change almost always triggers interactions within and across business networks. While some of the literature has implicitly acknowledged degrees of interaction (e.g., Kolk and Pinkse, 2005), scholars have not determined such interactions as an explanatory variable of responses to climate change.

Adopting a network approach in this study, therefore, has shown that business responses to climate change are not isolated activities of individual actors, but instead are the outcome of a complex process that involves multiple actors, their activities and resources. By depicting such interactions and behaviours within and across business networks, the present research seeks to make a contribution to the study of business responses to climate change.

In the following four sections, I elucidate how the findings stemming from each stage of the conceptual framework (illustrated in Figure 16 on page 246) have allowed me to make theoretical contributions.

6.4.1.1 Contextual changes

The first theoretical contribution stemming from this study refers to the contextual changes that generate pressures in response to global climatic changes. This study finds that three types of pressures are dominant: 1) socio-cultural, 2) legal/regulatory, and 3) economic. In fact, the socio-cultural pressures originating from evolving social structures, changing rules of behaviour and shifting value systems, the legal/regulatory pressures emanating from alterations in rules, adjustments of policies and modifications to legislation and the economic pressures due to economic developments in relevant sectors and fields of activity, have demanded the case companies to change their current pattern of behaviour. This finding is largely in line with previous research conducted by Cordano (1993), Bansal and Roth (2000), Kolk and Levy (2001), Banerjee et al. (2003), Leiserowitz (2006), Adger et al. (2009), Wittneben (2009), Veal and Mouzas (2010), Keohane and Victor (2011), Okereke et al. (2012) and Shevchenko et al. (2016). Indeed, similarly to the existing literature, this study finds that these contextual changes may act as a stimulus for change.

As illustrated by the three arrows going from the externally generated pressures on the left to the tensions within the network (Figure 16 on page 246), the socio-cultural, legal/regulatory and economic pressures seem to bring about a disparity between current operations and the need to change. In the next section, I review the network tension related findings in light of the previous literature.

6.4.1.2 Network tensions

This study finds that network tensions are brought about through change stimuli related to the socio-cultural, legal/regulatory and economic pressures. More specifically, network tensions may result from the misalignment of current operations and the need for change. In the literature on climate change, this tension has been described as one between short-term profitability and the emerging need to do something meaningful about climate change (Okereke et al., 2012; Wright and Nyberg, 2017).

Richly demonstrated across all five empirical cases of business responses to climate change, this study finds that it is rather a tension between the established activities and resources that an actor possesses (current business operations) and the activities and resources required to address the emerging contextual changes (need for change). In other words, companies tended to re-assess the validity and value of current operations in light of the evolving socio-cultural, legal/regulatory and economic pressures. In the second case, for example, the case company explicitly stated that their core business is in and around the supply of energy and that responding to the contextual changes would require the skills and expertise of a carbon reduction technology manufacturer. Such needs for change meant that the case companies had to interpret, define and understand the actors, activities and resources necessary to respond to climate change.

This study suggests that these network tensions, triggered by the contextual changes, acted as a stimulus for network interactions. As highlighted by the arrow between the network tension and network interaction in the conceptual framework (Figure 16 on page 246), the tension between current operations and the need for change causes actors to interact within and across their business relationships and networks. In fact, all of the case companies interacted within and across their business relationships and networks in order to mobilise the activities and access the resources that were not aligned with their current operations but were required to mitigate the socio-cultural, legal/regulatory and economic pressures.

In the next section, I seek to demonstrate how this study's insights on network interactions contribute to the literature.

6.4.1.3 Network interactions

This study finds that the network interactions are a key determinant of the outcomes stemming from business responses to climate change. Hereby, this study enhances the current literature on response strategies to climate change (e.g., Levy and Kolk, 2002;

Kolk and Pinkse, 2004; Hoffman, 2005; Jones and Levy, 2007; Ihlen, 2009; Wittneben and Kiyar, 2009; Okereke and Russel, 2010; Slawinski and Bansal, 2012; Shevchenko et al., 2016; Wright and Nyberg, 2017). In fact, taking the network into account when analysing the business responses to climate change showed that actors form a network, structure and perform activities in order to exchange, access and mobilise resources embedded in the network. In other words, companies interact with other actors because they depend on the resources of other companies to respond to climate change. Across all five empirical cases, this study has highlighted that other network actors possessed at least one resource required to respond. This finding is in line with the established thinking of business network scholars such as Ritter et al. (2004), Mouzas and Ford (2009), Veal and Mouzas (2010) and Finke et al. (2016).

The empirical findings suggest that through the network interactions companies aim at rationalising and expanding their resource pool. Resource rationalisation refers to the ways in which network actors attempt to safeguard and defend the established resources. For example, in this study actors' initiated efforts to minimise the risk of hampering short-term profitability arising from responding to climate change aimed at carbon emission reduction. In fact, responding to climate change was almost always driven by cost-effectiveness since network actors had to ensure that their activities were beneficial to the company's customers. Although this was underpinning the network interaction across all cases, it was particularly strong in the third case. Here, the company was very clear that investing in a low-carbon energy generation portfolio is the preferred option as long as it bore benefits to the customers (e.g., maintaining low energy prices).

Resource expansion, on the other hand, refers to the ways in which network actors attempt to mobilise network resources and activities to extend their resource pool. In fact, all of the case companies interacted heavily with other network actors in order to expand their resource pool. These efforts were driven by cost-effectiveness since the focal actors perceived that they could achieve their response to climate change at the smallest cost when interacting to mobilise network resources. This finding is in line with the argument that businesses engage in network interaction when they perceive that value can be created, either directly or indirectly, as established by Ritter et al. (2004) as well as Mouzas and Ford (2009).

Interestingly, what came through when analysing the empirical findings is that the network interactions may be related to specific behavioural patterns. Due to the significance of this finding, I have dedicated a section on the behavioural underpinning of network interactions towards the end of this chapter.

In the next section, I highlight how the three observed network outcomes contribute to our understanding of business responses to climate change.

6.4.1.4 Network outcomes

This study advances the literature on network outcomes by identifying three outcomes stemming from business responses to climate change. Previous research on network outcomes is rare, vividly illustrated by Ford and Mouzas (2007, p.8) stating that there is *"sheer unknowability of effects and outcomes in a network"*. By depicting the observed network outcomes this study contribution opening the 'black box' of unknown effects and outcomes in a network. Indeed, this study finds that the outcomes stemming from business responses to climate change are companies 1) *discharging* their responsibility by passing the impact to others, 2) *protecting* their resources and rationalising activities rather than bearing risks of change, and 3) *forming herds* and acting as a collective and akin to other actors with similar intrinsic values and beliefs rather than operating in isolation.

The network outcome, *discharging*, relates to firms discharging to their responsibility by passing the impact to others. Evident across all five cases, the network outcome *discharging* seemed to be driven by the risk-aversion of actors (frames) and the tendency to weigh responses to climate change against reference points that guided the network interactions. In the fifth case, for example, the case company *Connectica* responded to climate change because they perceived a commercial opportunity in connected home technologies. The efforts to mitigate carbon emissions stemming from the application of connected home technologies, however, was relative to the commercial opportunity (e.g., focus on new revenues from customers) and not based upon absolute effectiveness.

Interestingly, across all five cases, the network outcome *discharging* stemming from the responses to climate change was manifested in the compensation of the business effects rather than entirely eliminating it.

The network outcome, *protecting*, relates to defending resources and rationalising activities rather than bearing risks of change. As vividly illustrated in all five cases, the network outcome, *protecting*, appeared to be driven by the loss-aversion of actors and the actors' belief in a fixed-resource pie. In the third case, for example, the response to climate change was driven by maximising profitability (e.g., running a two GW coal-fired power plant) due in loss-aversion (not missing a commercial opportunity along with the transition towards a renewables-only energy supply). The commercial benefits from *Energize's* radical move towards renewables were incremental, however, and put the company at risk of losing its established position. Interestingly, as a result, the actors tended to safeguard their existing resources in response to climate change (limiting the risk of losing its established position) rather than opting for the incremental benefits stemming from a profound alteration of resources.

The network outcome, *herding*, relates to actors forming herds, acting as a collective and akin to other actors with similar intrinsic values and beliefs rather than operating in isolation. Evident across all five cases, the network outcome, *herding*, seemed to be driven by the herd behaviour of actors in network interactions. In the first case, for example, the case company *Utiliko* decided to request a revision of the ECO scheme because compliance was costly and small energy supply companies were not required to comply. The other BIG 6 energy supply companies 'jumped on the bandwagon' and also requested an alteration. As a result of similar intrinsic values and beliefs, *Utiliko*, *Exxelo UK* and other energy supply companies requested alterations to the ECO scheme.

In turn, these network outcomes may act as a stimulus for changes at the contextual level. In fact, as highlighted by the arrow in the bottom right corner of the conceptual framework (Figure 16 on page 246), the socio-cultural, legal/regulatory and economic pressures may be altered by the network outcomes that stem from the initial response to climate change. The stages of the proposed conceptual framework (contextual changes, network tensions, network interactions and network outcomes) are therefore not linear but mutually reinforce one another across the entire framework.

I have attempted to illustrate how this circular, non-linear flow appeared in each of the five empirical cases and along with the conceptual framework in Figure 17 on page 254. In doing so, I seek to demonstrate how the business responses to climate change played out and occurred over time.

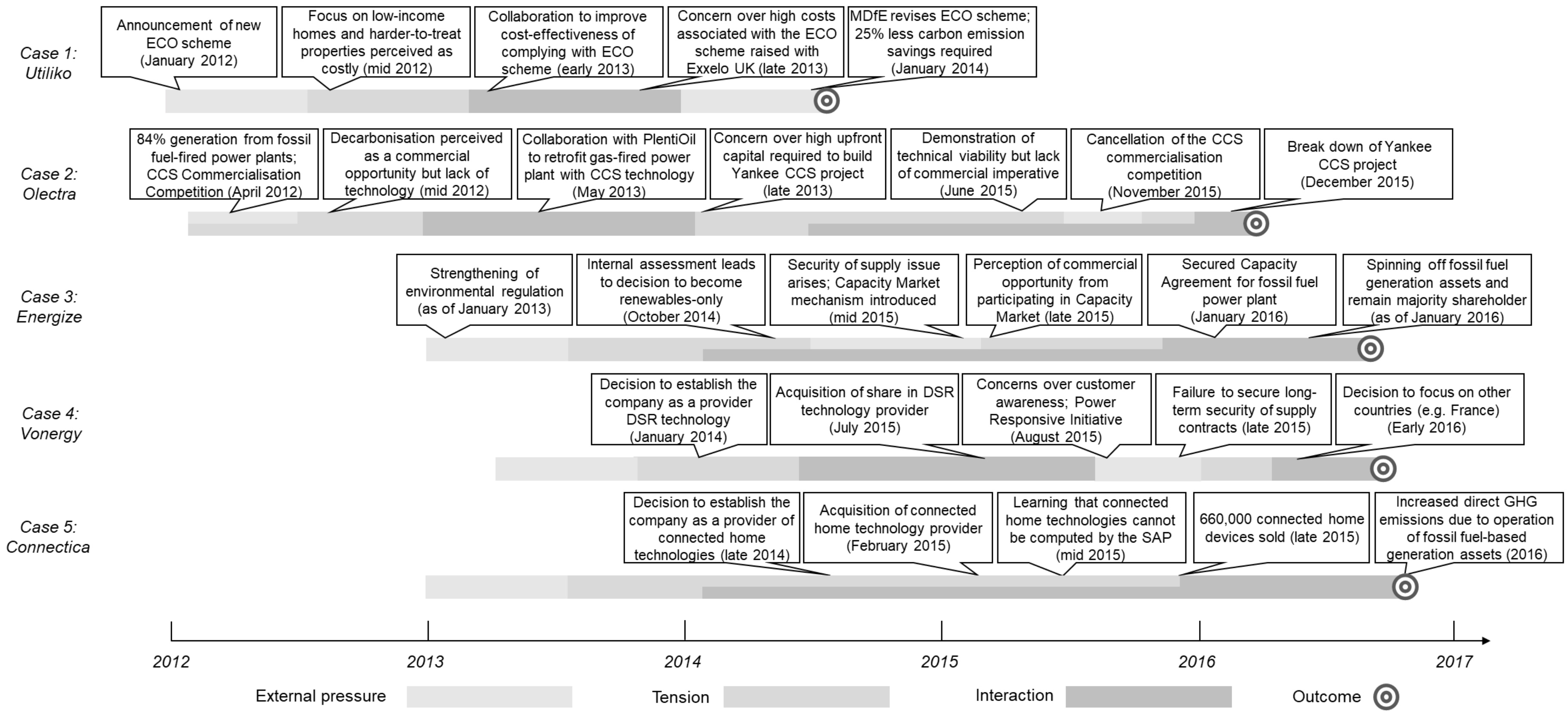

Figure 17: *Business responses to climate change over time*

Based on the insights stemming from the five empirical cases and in light of the previous literature on business responses to climate change, business networks and behavioural science, it is plausible to infer that the three observed network outcomes of *discharging*, *protecting* and *herding*, and the mechanism that enables them to emerge (i.e., the externally generated pressures that triggered network tensions and the behaviour within and across the network interactions) explains business responses to climate change more fully. In fact, these findings have shown that through adopting a network approach a lot can be learnt about a focal company's response to climate change.

In the next section, I specifically highlight how the findings of this study advance our understanding of how actors interact and behave in business relationships and networks.

6.4.2 Interaction and behaviour in business networks

The empirical findings of this study provide new evidence of interaction and behaviour in business networks. On the one hand, this study shows that the contextual changes in response to climate change may cause a considerable amount of change within a business network. Hereby, contradicting previous business marketing research suggesting that business networks are relatively stable due to deep processes and pattern across actors, activities and resources (e.g., Harrison and Easton, 2002). On the other hand, the present research highlights the behavioural underpinnings of network interactions which confirms and advances previous work done by Veal and Mouzas (2010). In the next two sections, I focus on how this study contributes to our understanding of how actors interact and behave in business relationships and networks. To do so, I refer to the dynamics between stability and change in business networks as well as the behavioural underpinnings of network interactions.

6.4.2.1 Dynamics between stability and change in business networks

The dynamics between stability and change represents a prominent stream of research within the business marketing literature. It is commonly argued that business networks are comparably stable due to a deep process and pattern *"that drives actors to minimise the impact of externally imposed changes"* (Harrison and Easton, 2002, p.551). Interestingly, the findings of this study contradict this claim. Across all of the five empirical cases of business responses to climate change, a considerable amount of change occurred. It seemed that as a result of the contextual changes (socio-cultural, legal/regulatory and economic pressures), previous activities proven to successfully operate and survive (Håkansson, 1992) were no longer perceived as guaranteeing such success and survival.

Interestingly, DiMaggio and Powell (1983), two scholars outside the business marketing domain, have previously claimed that alterations to a regulatory framework frequently leads to companies changing their current pattern of behaviour. Similarly, the present study finds that the contextual changes (socio-cultural, legal/regulatory and economic pressures) may cause a change of network processes and patterns. In other words, contextual changes threaten the network "*pattern that represents the perceived best way of operating at the current time"* (Harrison and Easton, 2002, p.551). Hence, network actors are required to adjust existing and develop new patterns of behaviour in response to contextual changes. However, as the success of new ways of working remains unknown, business networks appear to undergo a process of trial and error through interactions between actors, activities and resources. Ultimately leading to a considerable amount of change in business networks. As such, this study contradicts the notion that business networks are relatively stable (e.g., Håkansson, 1992; Harrison and Easton, 2002). At least when responding to climate change the contrary appears to be the case.

In the next section, I focus on the specific behavioural underpinnings that seem to drive much of the network interactions.

6.4.2.2 Behavioural underpinnings of network interactions

When analysing the case data on the network interactions, it appeared that a set of behaviours underpins the network interactions. In fact, in congruence with previous theoretical developments in the behavioural sciences literature (e.g., Kahneman and Tversky, 1979; Sebenius, 1983, 1995; Lax and Sebenius, 1991; Tversky and Kahneman, 1991; Kahneman et al., 1991; Hampson, 1995; Tenbrunsel et al., 2000), in the present study a set of behaviours seemed to guide the network interactions. These are 1) Frames and reference points; 2) Loss aversion and the belief in a fixed-resource pie, and 3) Herd behaviour.

The first set of business behaviours identified when analysing the network interactions across all five cases is related to frames and reference points. Frames and reference points refer to the risk-averse behaviour of actors and the tendency to weigh responses to climate change against reference points. Interestingly, in all five cases, it was either the legal/regulatory pressures (Case 1, 2 and 3) or the economic pressure (Case 4 and 5) that acted as a frame for the decisions made by the network actors. These frames were presented in a loss- or gain-oriented manner. In the first and third case, the respective legal/regulatory pressures (ECO scheme and Renewables Obligation) were framed in a loss-oriented manner (a fine for non-compliance). In the second, fourth and fifth case, the legal/regulatory pressures (CCS commercialisation competition) and the economic pressures (high margins and new revenue streams) were framed in a gain-oriented manner (financial benefits from compliance or proactivity).

These legal/regulatory or economic pressures acted as reference points for the network interactions. In fact, in all five cases, the case company's efforts to respond to climate change were relative to these reference points. In the first case, for example, this meant that the emission reductions were relative to the ECO scheme. Similar behaviour occurred in the fourth and fifth case since the case companies' efforts to mitigate carbon emissions were relative to economic opportunities. Hereby, this study supports previous work of Veal and Mouzas (2010) who, based on the prior work of Kahneman and Tversky (1979) and Tenbrunsel et al. (2000), found that companies take the emerging rules and regulations as a frame for thinking about their action in response to climate change.

The second set of behaviours identified when analysing the network interactions across all five cases is related to loss aversion and the belief in a fixed-resource pie. In all five cases, the network interactions were characterised by loss-aversion. In fact, as soon as the focal actors realised that the loss of resources was a possibility, the company altered its activities aimed at responding to climate change. This played out similarly in all five cases and was further amplified by the behavioural bias of perceiving the world and its resources as limited. In fact, this congruence of thinking, evident across all cases, prompted network interactions based upon a lose-lose or win-lose frame. As a result, the network actors opted for protecting their resources and rationalising activities rather than bearing risks of change. Hereby, this study confirms previous findings on behaviour in response to climate change being driven by concerns over the scarcity of resources and the basic human belief of a fixed-resource pool (e.g., Bazerman et al., 2000).

The third set of behaviours identified when analysing the network interactions across all five cases is related to herd behaviour. These refer to the ways in which actors engage in responses to climate change that are akin to other actors in their business network rather than opting for isolated action. Interestingly, across all five cases, the network interactions seemed to be characterised by acting as a herd. In other words, the network actors made their decisions relative to how other network actors behaved. In line with previous research (e.g., Sebenius, 1983; Veal and Mouzas, 2010), these herd-like network interactions led to coalitional behaviour. Across all five empirical cases, the network actors acted as a coalition when their intrinsic values and beliefs were similar. Therefore, this study confirms Mouzas and Ford's (2011) finding that herd behaviour may characterise activities when addressing a business problem.

Having analysed, discussed and highlighted the theoretical contributions stemming from the empirical findings, I have provided a more comprehensive understanding of business responses to climate change as well as the enhanced the business marketing literature on how actors interact and behave in business relationships and networks.

In the subsequent section, I close this chapter with a brief summary.

6.5 Conclusion

In this chapter, I used the theoretical underpinnings (see Chapter 2) to analyse the empirical evidence presented in the five cases (see Chapter 5) on how companies respond to climate change. In doing so, I have provided detailed insights that advance our understanding of how companies interacting in business networks responded to climate change.

In the next chapter, I draw conclusions from the analysis and discussions chapter in particular, and my thesis as a whole. As such, I provide a summary of the findings and outline the specific theoretical contributions and implications. Furthermore, I elucidate the implications that my thesis has for managers and policymakers and the limitations. I close the chapter with outlining promising directions for future research.

7 Conclusions, contributions and implications

This chapter outlines the conclusions, contributions and implications that can be drawn from this study. I begin by providing a summary of the findings that ultimately serve as an explanation of how companies respond to climate change. I then discuss the theoretical implications stemming from the original insights in relation to adopting a network approach to the study of business responses to climate change as well as the interaction and behaviour in business relationships and networks. Furthermore, I highlight the implications for managers and policymakers and acknowledge some limitations of this study. I close this chapter by suggesting promising paths for future research in this area.

7.1 Summary of findings: How companies respond to climate change

The findings of this study offer some original insights in relation to the interaction and behaviour in business relationships and networks that provide a more comprehensive understanding of how companies respond to climate change.

In fact, the present study suggests that interactions in business relationships and networks are stimulated by contextual changes, driven by sets of behaviours and cause a considerable amount of change within and across a business network. Moreover, what came through when analysing the empirical evidence in light of the previous literature is that business responses to climate change can only be explained adequately when taking a network approach (as established in Figure 16: A conceptual framework of business responses to climate change on page 246).

In an attempt to synthesise the findings stemming from this study, I make and discuss five findings (F_1, F_2, F_3, F_4 and F_5), which can broadly be described as the conclusions of this study.

The first finding relates to the socio-cultural, legal/regulatory and economic pressures at the contextual level and their effects on companies:

> F_1. Socio-cultural, legal/regulatory and economic pressures at the contextual level trigger business responses to climate change by creating a tension between the current business resources and activities (current operations) and the business resources and activities required to react to the contextual changes (need for change).

This study identified that the variation in contextual level values, norms and rules (socio-cultural, legal/regulatory and economic pressures) acts as the primary stimulus for businesses to respond to climate change. It appears that business responses to climate change are triggered by the tension brought about by the combination of 1) socio-cultural (e.g., increasing consumer demand for environmentally-friendly products and sustainable business operations), 2) legal/regulatory (e.g., strengthened environmental regulation and standards) and 3) economic (e.g., increasing demand for low-carbon products and services) pressures that have emerged as a result of global climatic changes.

The contextual changes, therefore, create a dissonance between the needs emanating from the socio-cultural, legal/regulatory and economic pressures, and the existing business patterns. Interestingly, while the findings presented in this study show that the emerging socio-cultural, legal/regulatory and economic pressures prompt business responses to climate change, the present research also suggests that these very same aspects demand companies do so as effectively as possible.

It seems that the socio-cultural demands, for example, are a double-edged sword in the sense that they pressure companies to alter their current resources and activities but, at the same time, pose a constraint on business responses to climate change as the socio-cultural actors (i.e., customers, taxpayers) do not seem to be willing to bear the costs associated with responding to climate change. This leads to the conclusion that business responses to climate change are triggered by socio-cultural pressures but, at the same time, limited by the extent to which consumer's value and financially reward such responses.

Although the legal/regulatory pressures may act as a driver of business responses to climate change, they also appear to be constrained by the other competing priorities of national governments. In this study, this was vividly exemplified in an alteration of the legal/regulatory pressures when concerns about the affordability and/or the security of energy supply were raised. In fact, other priorities of national governments may interfere with business responses to climate change. In the first case, for example, the government's focus on addressing fuel poverty may have been flawed, since it was forcing companies into focusing on harder-to-treat properties, which may not have been the ideal strategy in response to climate change.

Collectively, this suggests that the socio-cultural, legal/regulatory and economic pressures require companies to respond to climate change as effectively as possible. In an attempt to do so, companies interact within and across their business relationships and networks. Indeed, this would seem to link well with the second finding.

The second finding relates to the business responses to addressing the tensions brought about by the socio-cultural, legal/regulatory and economic pressures at the contextual level:

> F_2. Business responses to climate change involve a multitude of network actors that interact with one another in order to access the resources and activities required to respond to climate change.

The findings of this study show that business responses to climate change involve a multitude of network actors (on average more than seven actors per response to climate change). It appears that the network actors interact with other actors to access the resources and activities necessary to respond to climate change.

This is because the network actors (such as energy supply companies, energy services/technology providers, energy consumers, national governments, local authorities, industry associations and others) possess *at least one resource* required to respond to climate change. This leads to the conclusion that network actors interact with one another to address the tensions brought about by the socio-cultural, legal/regulatory and economic pressures. In turn, this links well with the third finding.

The third finding relates to the interactions in business relationships and networks that are aimed at addressing the tension brought about by the socio-cultural, legal/regulatory and economic pressures at the contextual level:

F_3. The network interactions in response to climate change are based upon activities aimed at resource rationalisation and resource expansion.

This study identified that the network interactions in response to climate change are based upon activities aimed at resource rationalisation and resource expansion. Resource rationalisation refers to the ways in which network actors attempt to defend and safeguard the established network position, assets, profitability and other valuable possessions. Unsurprisingly, responding to the contextual level pressures that climate change had brought about was driven by cost-effectiveness since network actors had to ensure that their activities were beneficial to the company's customers. Although this underpinned the network interaction across all cases, it was particularly strong in the third case. Here, the company was very clear that investing in a low-carbon energy generation portfolio was the preferred option as long as it bore benefits to the customers (e.g., maintaining low energy prices).

Resource expansion, on the other hand, refers to the ways in which network actors attempt to mobilise network resources and activities to alter their network position. All of the case companies interacted heavily with other network actors in order to expand their resource pool. These efforts were driven by effectiveness since the focal actors perceived that they could achieve their response to climate change most effectively when interacting to mobilise network resources. The argument that businesses engage in network interaction when they perceive that value can be created, either directly or indirectly, is in line with the established business marketing literature (e.g., Ritter et al., 2004; Mouzas and Ford, 2009).

Interestingly, such behaviour in and around network interactions seemed to be driven by three sets of business behaviours that may explain the observed network outcomes of *discharging*, *protecting* and *herding* and, hence, ultimately explain business responses to climate change. This links well to the fourth finding.

The fourth finding relates to three sets of business behaviours that appear to guide the interaction in business relationships and networks and their effects on business responses to climate change:

> F_4. The network interactions are guided by three sets of business behaviours – 1) Frames and reference points; 2) Loss aversion and a fixed-resource pie; and 3) Herd behaviour – that may bring about the observed network outcomes.

The first set of business behaviours identified in this study are frames and reference points. Frames and reference points refer to the risk-averse behaviour of actors and the tendency to weigh responses to climate change against reference points. In all five cases, it was either the legal/regulatory demand (Case 1, 2 and 3) or the economic opportunity (Case 4 and 5) that acted as a frame for the decisions made by the network actors. These frames were presented in a loss- or gain-oriented manner. In the first and third case, the respective legal/regulatory demands (ECO scheme and Renewables Obligation) were framed in a loss-oriented manner (a fine for non-compliance). In the second, fourth and fifth case, the legal/regulatory demand (CCS commercialisation competition) and the economic opportunities (high margins and new revenue streams) were framed in a *gain-oriented manner* (financial benefits from compliance or proactivity).

Interestingly, this study shows that whether or not a decision is framed in a loss- or gain-oriented manner does not seem to affect the ways in which companies behave. In all five cases, the network interaction was characterised and driven by risk-aversion. Astonishingly, this finding contradicts the seminal work of Kahneman and Tversky (1979) who suggested that only positively framed decisions, i.e. the gains that can be obtained when addressing a problem, prompt risk-averse behaviour. Negatively framed decisions, i.e. what can be lost when not addressing a problem, on the other hand, would prompt risk-seeking behaviour (Kahneman and Tversky, 1979).

Furthermore, the legal/regulatory or economic pressures acted as reference points for the network interactions. This study shows that companies' efforts in response to climate change are relative to these reference points. In the first case, for example, the company's response was relative to the ECO scheme. Similar behaviour occurred in the fourth and fifth cases since the case companies' efforts to respond to climate change were relative to the economic opportunity. This finding confirms the previous research of Veal and Mouzas (2010) who, based on the prior work of Kahneman and Tversky (1979) and Tenbrunsel et al. (2000), found that companies take the emerging rules and regulations as a frame for thinking about their action in response to climate change.

The second set of behaviours identified in this study are loss-aversion and a fixed-resource pie. These refer to the loss-averse behaviour of actors and the belief in a fixed-resource pie. Loss-aversion in network interactions was vividly illustrated in all five cases. In fact, as soon as the case companies realised that the loss of resources was a possibility, the actors rendered their response to climate change. This appeared to be further amplified by the behavioural bias of perceiving the world and its resources as limited. This congruence of thinking, evident across all cases, prompted network interactions based upon a lose-lose or win-lose frame. As a result, the network actors opted to safeguard their current network position rather than bearing the risks of change.

The third set of behaviours identified in this study is herd behaviour. This refers to the ways in which actors form and act as a herd and therefore engage in responses to climate change that are akin to other actors in their business network. As a result, the network actors made their decisions relative to how other network actors behaved. In the first case, for example, the case company decided to request a revision of the ECO scheme because compliance other network actors were not required to comply. Interestingly, previous research (e.g., Kindleberger, 1978; Banerjee, 1992; Shiller, 1995, 2000; Mouzas and Ford, 2011) found that in these herd-like network interactions, the network actors act akin when their intrinsic values and beliefs were similar. A similar congruence of behaviour was evident in this study. In the second case, for example, the two focal companies acted like a herd when cancelling their efforts to retrofit a gas-fired power plant with CCS technology.

In summary, it seems plausible to infer that antecedents related to these three sets of business behaviours explain more fully how companies respond to climate change. In fact, the findings of this study suggest that the three sets of business behaviours ingrained in the interaction in networks may explain the observed network outcomes of *discharging*, *protecting* and *herding*, which ultimately characterise the business responses to climate change. This links well to the fifth finding.

The fifth and final finding relates to the network outcomes stemming from the interaction in business relationships and networks:

> F_5. Discharging, protecting and herding are observed network outcomes stemming from the interaction in business relationships and networks.

This study observed three network outcomes that stem from the interaction in business relationships and networks: 1) *Discharging*, 2) *Protecting*, and 3) *Herding*. The first network outcome, *discharging*, relates to companies discharging their responsibility by passing the impact to others. The network outcome *discharging* was observable in all five cases. The efforts to *discharge* the business effects on the natural environment rather than eliminating it very much appeared to be a result of the risk-aversion of actors (frames) and the tendency to weigh responses to climate change against reference points that guided much of the interaction in business relationships and networks.

The second network outcome, *protecting*, relates to companies defending their resources and rationalising activities rather than bearing risks of change. As illustrated in all five cases, the observed network outcome of *protecting* seemed to be a result of the loss-aversion of actors and the belief in a fixed-resource pie that underpinned the interaction in business relationships and networks. This study, therefore, suggests that the loss-averse network behaviour of actors and the belief of a fixed-resource pie causes network actors to safeguard their existing resources (limiting the risk of losing customers and altering the network position) rather than opting for the incremental benefits stemming from a profound alteration of resources in response to climate change.

The third and final network outcome, *herding*, relates to companies forming herds and acting akin to other actors with similar intrinsic values and beliefs rather than operating in isolation. This study, therefore, shows that *herding* is the outcome of the herd behaviour that causes the network actors to *engage in activities* that are akin to other actors in their business network rather than opting for isolated action.

Based on the insights stemming from the five empirical cases and in light of the previous literature on climate change, business networks and behavioural science, it seems reasonable to conclude that the three observed network outcomes of *discharging*, *protecting* and *herding*, and the interaction in networks that cause them, may provide a more comprehensive understanding of how companies respond to climate change.

These outcomes, so the findings presented in this study show, have an effect on the socio-cultural, legal/regulatory and economic pressures at the contextual level. In other words, the network outcomes may act as a stimulus for changes at the contextual level. It appears therefore that the components of the proposed conceptual framework of business responses to climate change, implicitly introduced throughout the five findings, are not linear but *mutually reinforce* one another across the entire framework.

Collectively, these five findings comprise novel empirical insights along each of the pillars (contextual change, network tensions, network interactions and network outcomes) of the proposed conceptual framework of business responses to climate change (see Figure 16 on page 246).

Having synthesised the conclusions stemming from this study, in the next section, I discuss the theoretical contributions and implications that can be drawn from the five findings outlined above and the study as a whole.

7.2 Theoretical contributions and implications

The findings presented in this study make several contributions to the existing literature and have important implications for research in this area. Derived from the empirical examination of business responses to climate change and in light of previous literature, the conceptual framework of business responses to climate change advances theory by making two primary and one secondary theoretical contribution.

The first primary theoretical contribution of this study is to challenge the idea that companies respond to climate change individually. In fact, this study fundamentally rejects the organisation and management conceptualisation of business responses to climate change as atomistic and isolated activities of individual companies (e.g., Kolk and Levy, 2001; Banerjee et al., 2003; Kolk and Pinkse, 2004; Margolick and Russell, 2004; Jones and Levy, 2007; Slawinski and Bansal, 2012; Shevchenko et al., 2016; Wright and Nyberg, 2017). As a result of adopting the network approach, the present research provides new evidence suggesting that business responses to climate change actually involve a multitude of network actors that interact with one another in order to access the resources and mobilise the activities required to respond to climate change. As such, this study raises doubts about the existing organisation and management research on business responses to climate change.

The second primary theoretical contribution of this study is to advance the IMP understanding of the interaction and behaviour in business relationships and networks. This study contributes to opening the frequently 'black boxed' processes of interaction and behaviour. In doing so, this study proposes a novel understanding of network interaction and behaviour based on a set of integrated components. This includes contextual change (socio-cultural, legal/regulatory and economic pressures), network tensions, network interactions (guided by three sets of behaviours) and the network outcomes (*discharging*, *protecting* and *herding*) that *reinforce* one another. Hereby, this study responds to the calls for research on interaction and behaviour in business networks made by prominent IMP scholars such as Ford and Håkansson (2006), Guercini et al. (2014), La Rocca et al. (2017) as well as Håkansson and Snehota (2017).

Having broadly introduced the theoretical contributions of my study, I now dig deeper into each theoretical contribution and also highlight a secondary contribution to the behavioural science literature. In an attempt to do this, I further illuminate and specify how the findings presented in this study permit making these contributions to the existing literature and advance theory. Therefore, I now set the findings of this study against the organisation and management literature on business responses to climate change, the interactional and behavioural insights stemming from the network approach and the behavioural science literature.

7.2.1 A network approach to business responses to climate change

This study shows that the current organisation and management theories that have been employed to define and explain business responses to climate change are limited by the assumption that business responses to climate change are an outcome of atomistic and isolated activities of individual companies. Such conceptualisations have been made by prominent scholars in the field of organisation and management studies, including Kolk and Levy (2001), Banerjee et al. (2003), Kolk and Pinkse (2004), Margolick and Russell (2004), Jones and Levy (2007), Slawinski and Bansal (2012), Shevchenko et al. (2016) and Wright and Nyberg (2017). While this limited understanding of business responses to climate change has been criticised previously (see, for example, Wittneben et al., 2012), this study provides new evidence that such critiques are justified.

Indeed, by taking the IMP's network approach as a novel theoretical lens for the study of business responses to climate change, this study challenges the organisation and management theories. As result of the network approach's inherent emphasises that companies are embedded in wider networks of continuous business and non-business exchange relationships (Easton and Håkansson, 1996; Gnyawali and Madhavan, 2001; Håkansson and Ford, 2002; Ritter et al., 2004), this study unveils the problematic conceptualisation and conventional thought of businesses as operating in isolation and thereby this study poes the need to examine the interconnectedness of businesses within wider networks of relationships when examining business responses to climate change.

Such examinations appear intuitively appealing and worthwhile considering the fact that the mere scale of mounting a response to climate change goes far beyond the capacity of an individual company (Veal and Mouzas, 2010; Ferraro et al., 2015). In line with this thinking, this study highlights that business responses to climate change can only derive from the combination and application of resources and activities located within and across the relationships and networks of companies.

The findings presented in this study provide evidence that it is only by analysing the interaction and behaviour in networks that the reasons that explain how companies respond to climate change can be identified. In fact, what emanated from the study is that network interaction is guided by three sets of behaviours, which ultimately cause three network outcomes.

Collectively, these three sets of business behaviours bring about three network outcomes of 1) *discharging* (companies discharge their responsibility by passing the impact to others), 2) *protecting* (companies defend their resources and rationalising activities rather than bearing risks of change), and 3) *herding* (companies form herds and act akin to other actors with similar intrinsic values and beliefs rather than operating in isolation).

Hereby, this study has also extended the understanding of the frequently 'black boxed' processes of interaction and behaviour in business relationships and networks. Based on the conceptual framework of business responses to climate change, this study contains important theoretical contributions and implications for the business marketing literature as well as the behavioural science literature. It is to a discussion on this framework that I now turn.

7.2.2 Interaction and behaviour in business networks

As outlined above, this particular study has permitted the development of what can be termed a *novel conceptual framework of business responses to climate change*. As shown in Figure 16 on page 246, this conceptual framework is based upon a set of integrated components: 1) Contextual change, 2) Network tensions, 3) Network interactions, and 4) Network outcomes. This conceptual framework advances the IMP literature by providing a *systematic explanation* of the interaction and behaviour in business relationships and networks, thereby counteracting the lack of understanding about how actors interact and behave within and across business networks (Ford and Håkansson, 2006; Guercini et al., 2014; La Rocca et al., 2017).

In an effort to further illuminate how the novel conceptual framework of business responses to climate change advances the IMP literature, I have structured the remainder of this section along with the set of components that comprise the proposed conceptual framework of business responses to climate change.

7.2.2.1 Contextual change

Contextual change refers to the variation in context-level values, norms and rules that may act as a stimulus for business responses to climate change. This includes socio-cultural (evolving social structures, rules of behaviour and/or value systems), legal/regulatory (alterations in rules, policies and legislation that are affecting the business activities and resources) and economic pressures (ongoing economic development in relevant sectors and fields of activity). The socio-cultural, legal/regulatory and economic pressures discussed in this study were built upon previous work by Cordano (1993), Bansal and Roth (2000), Kolk and Levy (2001), Banerjee et al. (2003), Leiserowitz (2006), Adger et al. (2009), Wittneben (2009), Veal and Mouzas

(2010), Keohane and Victor (2011), Okereke et al. (2012) and Shevchenko et al. (2016). Bringing together the socio-cultural, legal/regulatory and economic pressures under the umbrella term of contextual changes was useful since it permitted a wider perspective on the drivers that prompt business responses to climate change.

This present study identified that alterations at the contextual level trigger business responses to climate change by creating a tension between the resources and activities that a company possesses (current operations) and the activities and resources required to respond to climate change (need for change). Largely in line with previous research, this study shows that the emerging socio-cultural, legal/regulatory and economic pressures, on the one hand, prompt business responses to climate change, but that these very same aspects demand companies do so as effectively as possible (e.g., Adger et al., 2009; Shevchenko et al., 2016).

Socio-cultural pressures, for example, limit business responses to climate change by the extent to which consumer's value and financially reward such responses (Adger et al., 2009). Similarly, as previously suggested by Wittneben (2009), Keohane and Victor (2011) and Okereke et al. (2012) legal/regulatory pressures act as a driver of business responses to climate change but appear to be constrained by other priorities of national governments (in this study this was the security of supply and energy affordability). Furthermore, the findings presented in this study confirm the established thinking that economic pressures act as a key driver of business responses to climate change (e.g., Cordano, 1993; Bansal and Roth, 2000; Kolk and Levy, 2001). Interestingly, this study shows that the evolving socio-cultural, legal/regulatory and economic pressures cause a discontinuity between the needs emanating from the socio-cultural, legal/regulatory and economic pressures, and the existing business resources and activities. In the next section, I focus on what I have termed as network tensions.

7.2.2.2 Network tensions

Network tensions, as the second component of the proposed conceptual framework of business responses to climate change, refers to tensions resulting from the misalignment of current operations and the need for change. Current operations relates to assessing the validity and value of business resources in light of the evolving contextual changes. The need for change, on the other hand, relates to the ways of interpreting, defining and understanding the contextual change and emerging pressures. For example, grasping the implications, needs and requirements of the new environmental legislation. The network tensions-related aspects of the proposed conceptual framework were predominantly derived from existing knowledge established by Okereke et al. (2012) and Wright and Nyberg (2017).

The previous research suggests that the business tensions brought about by climate change are between short-term profitability and mitigating emissions (Okereke et al., 2012; Wright and Nyberg, 2017). While antecedents of short-term profitability might have played a role, this study finds that the *primary* network tension is between responding to the emerging pressures and the established resources and activities that a company possesses. Indeed, in each of the five cases underpinning this study, the network actors clearly preferred to focus on their current resources and activities, or in other words what their specific expertise is (e.g., the supply of energy), rather than undergoing the process of developing the technologies necessary to respond to climate change (e.g., CCS technology). In an effort to do so, companies interact within and across their business relationships and networks to access the resources and mobilise the activities that are required to respond to climate change. This confirms that responding to climate change goes far beyond the capacity of an individual company as suggested by the previous research of Veal and Mouzas (2010) and Ferraro et al. (2015).

7.2.2.3 Network interactions

Network interactions, as the third component of the proposed conceptual framework of business responses to climate change, refers to the network-level activities aimed at accessing the resources needed to address the network tensions. This study suggests that there are two enactments of network interaction. Firstly, resource rationalisation, which relates to safeguarding an established network position, assets, profitability and other valuable possessions. Secondly, resource expansion, which relates to mobilising network resources and activities to alter network position and assets. The network interactions-related aspects discussed in this study were mostly built upon previous work by Ritter et al. (2004), Mouzas and Ford (2009), Veal and Mouzas (2010), Ansari et al. (2013) and Finke et al. (2016).

With regards to resource rationalisation activities, the current research demonstrates that network interaction in response to the evolving contextual level pressures was driven by effectiveness since network actors had to ensure that their activities were beneficial to the company's customers, thereby confirming the well-established IMP claim that businesses engage in network interaction when they perceive that value can be created (e.g., Ritter et al., 2004; Mouzas and Ford, 2009).

Furthermore, the findings presented in this study suggest that companies interacted heavily with other network actors in order to expand their resource pool. These efforts were driven by effectiveness since the focal actors perceived that they could achieve their response to climate change most effectively when mobilising network resources and activities.

When analysing the case data on the network interactions, it appeared that a set of behaviours underpins the network interactions. In fact, in congruence with previous theoretical developments in the behavioural sciences literature (e.g., Kahneman and Tversky, 1979; Sebenius, 1983, 1995; Lax and Sebenius, 1991; Tversky and Kahneman, 1991; Kahneman et al., 1991; Hampson, 1995; Tenbrunsel et al., 2000), in the present study a set of behaviours seemed to guide the network interactions. These are 1) Frames and reference points; 2) Loss aversion and the belief in a fixed-resource pie, and 3) Herd behaviour.

As suggested prior, the first set of behaviours identified in this study are frames and reference points. Frames and reference points relate to the risk-averse behaviour of actors and the tendency to weigh responses to climate change against reference points. Interestingly, the findings of this study suggest that the frame of a decision (loss- or gain-oriented) does not seem to affect the ways in which companies behave. In fact, *both* loss- and gain-oriented decisions brought about network interaction characterised and driven by risk-aversion. This finding contradicts that only positively framed decisions, i.e. the gains that can be obtained when addressing a problem, prompt risk-averse behaviour. Negatively framed decisions, i.e. what can be lost when not addressing a problem, on the other hand, would prompt risk-seeking behaviour (Kahneman and Tversky, 1979).

Additionally, this study finds that the legal/regulatory or economic pressures act as reference points for network interactions. Indeed, the case companies' efforts in response to climate change were relative to reference points. This finding supports previous research of Veal and Mouzas (2010) who, based on the prior work of Kahneman and

Tversky (1979) and Tenbrunsel et al. (2000), suggested that companies take the emerging rules and regulations as a frame for thinking about their action in response to climate change.

As I have discussed, the second set of behaviours identified in this study are loss aversion and the belief in a fixed-resource pie. Firstly, the network interaction was characterised by loss-aversion. This was evident since as soon as the focal actors realised that the loss of resources was a possibility, the companies rendered their activities aimed at responding to climate change. This played out similarly in all five cases. In the first case, for example, as soon as the actors realised that it was impossible to cost-effectively comply with the ECO scheme, they requested an alteration of the policy, hoping to safeguard profitability by minimising the costs of compliance with the legal/regulatory pressure.

In the same way, in the third case, the network interaction was rooted in not missing a commercial opportunity during the transition towards a renewables-only energy supply, or in other words, maximising profitability by running a two GW coal-fired power plant. The network interaction of actors was therefore characterised by loss aversion since the network actors had the tendency to prefer avoiding a loss and keep their current resources rather than risk losing resources. Hereby, this study confirms previous findings on behaviour in response to climate change being driven by concerns over the scarcity of resources and the basic human belief of a fixed-resource pool (e.g., Bazerman et al., 2000).

Moreover, the network interactions examined in this study were characterised by herd behaviour. This was evident since the network actors engaged in responses to climate change that were akin to other actors in their business network, rather than opting for individual, isolated activities. Thereby, this study suggests that individual actors in business relationships and networks have the tendency to act akin to others around them. In other words, the network actors made their decisions relative to how other network actors behaved. In line with previous research (e.g., Sebenius, 1983; Veal and Mouzas, 2010), these herd-like network interactions led to coalitional behaviour. Across all five empirical cases, the network actors acted as a coalition when their intrinsic values and beliefs were similar. Therefore, this confirms Mouzas and Ford's (2011) finding that herd behaviour may characterise activities when addressing a business problem.

Collectively, these three sets of behaviours that appear to guide the network interactions may bring about the three network outcomes of *discharging*, *protecting* and *herding*. This is the focus of the next section.

7.2.2.4 Network outcomes

Network outcomes, as the fourth and final component of the proposed conceptual framework of business responses to climate change, refers to the final result stemming from network-level activities aimed at mitigating the network tensions. More specifically, I observed three network outcomes: 1) companies discharge their responsibility by passing the impact to others (*discharging*), 2) companies defend their resources and rationalise their business activities rather than bearing the risks of change (*protecting*), and 3) companies form herds and act akin to other actors with similar intrinsic values and beliefs rather than operating in isolation (*herding*).

Interestingly, this study shows that the network outcomes may, in turn, act as a stimulus for changes at the contextual level. Therefore, the components of the proposed conceptual framework of business responses to climate change (contextual change, network tensions, network interactions and network outcomes) are *not linear* but *mutually reinforce* one another across the entire framework.

Collectively, the conceptual framework of business responses to climate change advances the IMP literature by not only providing a systematic explanation of the interaction and behaviour in business relationships and networks but also suggesting a considerable amount of change as an outcome of business responses to climate change. In fact, in this study, it seemed that as a result of the contextual changes (socio-cultural, legal/regulatory and economic pressures), previous activities proven to successfully operate and survive (Håkansson, 1992) were no longer perceived as guaranteeing such success and survival. Hereby, contradicting the common argument that business networks are comparably stable due to a deep process and pattern *"that drives actors to minimise the impact of externally imposed changes"* (Harrison and Easton, 2002, p.551).

DiMaggio and Powell (1983), two scholars outside the business marketing literature, have previously suggested that changes to a regulatory framework frequently stimulates alterations to companies' current pattern of behaviour. In line with this, the present study finds that the contextual changes (socio-cultural, legal/regulatory and economic pressures) may cause a considerable amount of change in network processes and patterns. In doing so, business networks appear to undergo a process of trial and error through interactions between actors, activities and resources. Ultimately leading to a considerable amount of change in business networks in response to response to climate change. As such, this study contradicts the notion that business networks are relatively stable (e.g., Håkansson, 1992; Harrison and Easton, 2002).

Through the findings on interaction and behaviour in business relationships and networks, this study makes a strong theoretical contribution to the development of the business marketing literature. This theorising has led to a secondary contribution to the behavioural sciences literature.

7.2.3 Extending the behavioural sciences literature

Based on the insights on the interaction and behaviour in business relationships and networks, this study makes a secondary theoretical contribution to the behavioural sciences literature. Indeed, by showing how behaviours play out within a 'real-life' business situation, this research counteracts the lack of empirical evidence that characterises much of the behavioural sciences literature. This empirical gap in the existing literature has been highlighted by Marewski et al. (2010), Kelman (2011) and Ferraro (2016).

This study advances the behavioural sciences literature by showing that the behaviour underpinning the decision making when companies respond to climate change is based upon three sets of business behaviours: 1) Frames and reference points; 2) Loss aversion and the belief in a fixed-resource pie; and 3) Herd behaviour.

Collectively, the insights on the interaction and behaviour in networks show how behaviours occur within a 'real-life' business situation. Interestingly, it appears that Ferraro's (2016) hypothesised explanation of how behaviours play out in the context of business responses to climate change does not hold true in the empirical world. Indeed, the findings presented in this study show that the behaviour in networks is guided by three sets of business behaviours. Accordingly, study suggests that the three fundamental changes that are occurring when examining the behaviour of companies rather than individuals (profit maximisation versus utility maximisation, the competitive environment and group versus individual; Ferraro, 2016), do not eliminate behavioural deficiencies.

In the next section, I discuss the implications for managers and policymakers that can be drawn from the primary and secondary theoretical contributions outlined above.

7.3 Implications for managers and policymakers

The findings of this study contain several important implications for managers and policymakers. These implications derived from deliberately taking an empirical approach to the research objectives. This was largely due to the aim of providing real answers that may contribute to addressing global climate change. From the outset, I was certain that – notwithstanding the importance of advancing theory – contributing to the global response to climate change is only possible when managers and policymakers can learn from this study.

In this study, I have argued that organisation and management scholars could and indeed should broaden their unit of analysis to account for the fact that business responses to climate change involve a multitude of network actors that interact with one another in order to access the resources necessary to respond to climate change. Likewise, when designing business responses to climate change managers and policymakers must take the ways in which companies are embedded in wider networks of continuous business and non-business exchange relationships into consideration. As shown in this study, it is only when moving to the network as the unit of analysis that the dynamics between actors, activities and resources when responding to climate change come to the fore. Especially, the three sets of business behaviours that appear to guide the network interactions and ultimately lead to the network outcomes of *discharging*, *protecting* and *herding* contain significant implications for managers and policymakers.

From the perspective of policymakers interested in designing and implementing a legal/regulatory framework in response to climate change, the findings presented in this study suggest the need to strengthen the legal/regulatory demands for carbon emission reductions. By introducing both loss- and gain-oriented rules and regulations, policymakers may be able to alter the frames and reference points that businesses utilise to establish their responses to climate change. When designing new rules and regulations, policymakers' could ultimately aim to encourage business responses to climate change based on proactivity and absolute effectiveness. It seems likely that this can be achieved when actively involving all network actors in the design of the legal/regulatory framework. In this process, network actors could highlight the policy support mechanisms needed to foster proactivity and absolute effectiveness of their responses to climate change.

Furthermore, this study shows that managers can gain benefits from being open to discussing the design of a legal/regulatory framework that encourages business responses to climate change. This permits managers to shape new rules and regulations that enable safeguarding the effectiveness of transitioning towards a low-carbon economy by creating economic opportunities along the way. Such a mutually constructive approach by both managers and policymakers could contribute to a more stable legal/regulatory framework in response to climate change.

Moreover, from the perspective of policymakers that seek to establish a legal/regulatory framework in response to climate change, the present research suggests designing a legal/regulatory framework that ensures that companies can obtain immediate benefits from reducing their response to climate change. This could, for example, be achieved by providing tax incentives, interest-free credits and insurance mechanisms for the large upfront investments made in response to climate change. Policymakers could thereby help to mitigate behavioural aspects such as loss aversion or the belief of a fixed-resource pie.

In addition, from the perspective of policymakers, this study suggests designing a legal/regulatory framework that encourages entire herds of actors to respond to climate change. In the present research, business responses to climate change were partially related to the ability of some network actors to make profits when operating diesel-fired power plants. It seems likely that network actors will opt for decarbonising their operations when policymakers provide a stable legal/regulatory framework that creates economic opportunities in line with responding to climate change.

Having discussed the managerial and policy implications stemming from the findings presented in this study, in the next section, I outline the limitations of this study and propose promising paths for future research.

7.4 Limitations and directions for future research

This thesis lays the ground for future work on what might emerge as a research stream called the *'behavioural network approach'*. Emanating from the theoretical gaps opened by this study, the behavioural network approach could evolve around an integration of the IMP's network approach and the behavioural sciences. This would permit a more thorough study of behavioural strategies and decisions. In fact, organisation and management scholars have started to investigate behavioural strategies (e.g., Lovallo and Sibony, 2010; Powell et al., 2011; Greve, 2013), which aim to *"strengthen the empirical integrity and practical usefulness of strategy theory by grounding strategic management in realistic assumptions about human cognition"* (Powell et al., 2011, p.1369). As it stands, however, the behavioural strategy research community does not recognise the need to adopt a network approach. Hence, these studies are commonly based on single firms. In the context of business responses to climate change, this thesis has shown how critical it is to move beyond the individual company to develop a more comprehensive understanding. It seems likely that a similar move would significantly enhance the understanding of behavioural strategies and decisions in companies.

Furthermore, some of the limitations of the conceptual framework (Figure 16 on page 246) presented in this study may help to suggest additional promising paths for future research on the behaviour in networks and the empirical phenomenon of business responses to climate change.

Firstly, this study has drawn upon the IMP's network approach and the behavioural sciences literature to explain the empirical findings. Despite the prominence of such theories, other concepts and theories may advance the proposed conceptual framework. For example, utilising sense-making theory and institutional theory appears promising. The sense-making theory could provide additional insights into the process of attributing meaning to network behaviour, as well as the reactions and re-reactions from other network actors, their respective attribution of meaning and its outcomes (e.g., Weick, 1979, 1993 1995). Related IMP concepts such as 'network theories' (e.g., Johanson and Mattsson, 1985, 1992), 'network pictures' (e.g., Ford et al., 2003; Henneberg et al., 2006) and 'network graffiti' (Hopkinson, 2015) may further illuminate the attribution of meaning that may underpin the identified behaviours in networks.

Further theoretical development may employ institutional theory. This literature could help to unravel the institutional logics, complexity and ambiguity in which the network behaviour occurs (e.g., North, 1991; Thornton, 2004; Lawrence and Suddaby, 2006; Thornton and Ocasio, 2008; Escobar and Vredenburg, 2011; Quattrone, 2015). In particular, the work of Thornton and Ocasio (2008) and Quattrone (2015) could help to advance the conceptual framework presented in this study by explaining network behaviour that seeks to alter the prevailing institutional logics and exploit institutional resources and contradictions; this has been vividly illustrated in the first and fourth empirical case of this study. Collectively, these theories seem to be promising avenues to build upon and advance the groundwork on the behaviour in networks laid in this study.

Secondly, this study has been based upon data source material drawn from semi-structured interviews and supplementary documentation. There is a potential to complement these data sources with direct observations. Participatory action research and other forms of ethnographic inquiry may permit gathering such data (e.g., Mueller et al., 2013; Pressey et al., 2014). It is likely that this would provide rich data about network interaction and behaviour in action that is not mediated by the interviewee's memory of the events. Future research could, therefore, test the findings made in the present study and possibly further illuminate the non-conscious behavioural patterns that guide the interaction and behaviour in networks.

Thirdly, the geographical, industrial and environmental scope of this research could be extended. Having examined five cases of business responses to climate change within a single industry in a single country, future research could strengthen the robustness of the findings presented in this study by examining other countries and additional industries in light of different externally generated pressures. For example, it would be interesting to learn how the interaction and behaviour in business networks play out in less mature transitions towards a low-carbon economy and institutional contexts (e.g., China). Furthermore, fruitful insights might be stemming from industries such as agriculture, transportation, tourism and fast fashion (e.g., Zara).

Moreover, the applicability of this study could be widened by examining business responses to other environmental concerns. Alongside climate change, other environmental challenges have developed faster than anticipated (Whiteman et al., 2013). It would be interesting to advance the conceptual framework presented in this study by examining business responses to the loss of biodiversity, ocean acidification, increasing phosphorus and nitrogen loads, lack of global freshwater supply and rising chemical pollution (see for example: Westley and Vredenburg, 1997; Sharma and Nguan, 1999; Nilsson and Persson, 2012). Understanding the network interaction and behaviour in and around these environmental challenges could help to advance the findings presented in this study.

Collectively, the insights stemming from the proposed pathways for future research will help to widen the applicability and robustness of the conceptual framework of business responses to climate change and improve our understanding of interaction and behaviour in business networks.

8 References

Aaltonen, K. and Sivonen, R. (2009). Response strategies to stakeholder pressures in global projects. *International Journal of Project Management, 27*, pp. 131-141.

Aarts, H. and Dijksterhuis, A. (2000). The automatic activation of goal-directed behaviour: the case of travel habit. *Journal of Environmental Psychology, 20*, pp.75-82.

Abrahamson, E. and Rosenkopf, L. (1993). Institutional and competitive bandwagons: Using mathematical modeling as a tool to explore innovation diffusion. *Academy of Management Review, 18*, pp.487-517.

Adger, W., Dessai, S., Goulden, M., Hulme, M., Lorenzoni, I., Nelson, D., Naess, L., Wolf, J. and Wreford, A. (2009). Are there social limits to adaptation to climate change? *Climatic Change, 93*, pp.335-354.

Amann, W., Khan, S., Salzmann, O., Steger, U. and Ionescu-Somers, A. (2007). Managing external pressures through corporate diplomacy. *Journal of General Management, 33*(1), pp.33-49.

Anderson, J.C., Håkansson, H. and Johanson, J. (1994). Dyadic Business Relationships within a Business Network Context. *Journal of Marketing, 58*(4), pp.1-15.

Ang, C., Toper, B. and Gambhir, A. (2016). Financial impacts of the UK's energy and climate change policies on commercial and industrial businesses. *Energy Policy, 91*, pp.273-286.

Ansari, S., Wijen, F. and Gray, B. (2013). Constructing a Climate Change Logic: An Institutional Perspective on the "Tragedy of the Commons". *Organization Science, 24*(4), pp.1014-1040.

Araujo, L., Dubois, A. and Gadde, L.-E. (2003). The Multiple Boundaries of the Firm. *Journal of Management Studies, 40*(5), pp.1255-1277.

Arnold, D. and Bustos, K. (2005). Business, Ethics, and Global Climate Change. *Business & Professional Ethics Journal, 24*(1/2), pp.103-130.

Arora, S. and Cason, T. (1995). An experiment in voluntary environmental regulation: Participation in EPS's 33/50 Program. *Journal of Environmental Economics and Management, 28*, pp.271-286.

Axelsson B. and Easton, G., eds. (1992). *Network implications for business strategy. Industrial networks – a new view of reality.* London: Routledge, pp.181-183.

Banerjee, A. (1992). A Simple Model of Herd Behavior. *Quarterly Journal of Economics, 107*(3), pp.797-817.

Banerjee, S., Easwar, S. and Kashyap, R. (2003). Corporate Environmentalism: Antecedents and Influence of Industry Type. *Journal of Marketing, 67*, pp.106-122.

Bansal, P. and Roth, K. (2000). Why Companies Go Green: A Model of Ecological Responsiveness. *Academy of Management Journal*, *43*(4), pp.717-736.

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management, 17*(1), pp.99-120.

Barney, J. (2001). Is the resource-based "view" a useful perspective for strategic management research? Yes. *Academy of Management Review*, *26*(1), pp.41-56.

Bassi, S., Dechezleprêtre, A. and Fankhauser, S. (2013). *Climate change policies and the UK business sector: overview, impacts and suggestions for reform*. Policy paper. London: Centre for Climate Change Economics and Policy, Grantham Research Institute on Climate Change and the Environment.

Bataille, C., Waisman, H., Colombier, M., Segafredo, L., Williams, J. and Jotzo, F. (2016). The need for national deep decarbonization pathways for effective climate policy. *Climate Policy*, *16*, pp.7-26.

Baum, J. and Oliver, C. (1992). Institutional embeddedness and the dynamics of organizational populations. *American Sociological Review*, *57*, pp.540-559.

Bazerman, M. (2006). Climate change as a predictable surprise. *Climatic Change, 77*, pp.179-193.

Bazerman, M. and Hoffman, A. (1999). Sources of environmentally destructive behavior: individual, organizational, and institutional perspectives. *Research in Organizational Behavior, 21*, pp.39-79.

Bazerman, M. and Malhorta, D. (2006). It's not intuitive: strategies for negotiating more rationally. *Negotiation,* pp.3-5.

Bazerman, M. and Neale, M.A. (1993). *Negotiating Rationally*. New York: The Free Press.

Bazerman, M., Curhan, J., Moore, D. and Valley, K. (2000). Negotiation. *Annual Review of Psychology, 51*, pp.279-314.

BEIS (2017). *UK Energy Statistics, 2016 & Q4 2016*. London: Department for Business, Energy & Industrial Strategy.

Bhaskar, R. (1978). *A realist theory of science*. Hemel Hempstead: Harvester Press.

Bloomberg (2017). Germany is burning too much coal: Its reputation as a leader on climate change is not entirely deserved. [online] Available at: https://www.bloomberg.com/view/articles/2017-11-14/germany-is-burning-too-much-coal [Accessed 7 May 2018].

Borghini, S., Carù, A. and Cova, B. (2010). Representing BtoB reality in case study research: Challenges and new opportunities. *Industrial Marketing Management, 39*, pp.16-24.

Boston, A. (2013). Delivering a secure electricity supply on a low carbon pathway. *Energy Policy, 52*, pp.55-59.

Brehm, J. (1966). *A theory of psychological reactance.* New York: Academic.

Carbon Disclosure Project/PricewaterhouseCoopers (2013). Sector insights: What is driving climate change action in the world's largest companies? Global 500 climate change report 2013. London: CDP/PwC.

Carroll, A. (1979). A Three-Dimensional Conceptual Model of Corporate Performance. *Academy of Management Review, 4*(4), pp.497-505.

CCC (2015). Power sector scenarios for the fifth carbon budget. London: Committee on Climate Change.

CCC (2016). UK climate action following the Paris Agreement. London: Committee on Climate Change.

Chan, S., Falkner, R., Goldberg, M. and van Asselt, H. (2016). Effective and geographically balanced? An output-based assessment of non-state climate actions. *Climate Policy*, pp.1-12.

Chatham House (2018). Chatham House Rule. *Chatham House – The Royal Institute of International Affairs.* [online] Available at: <https://www.chathamhouse.org/chatham-house-rule#> [Accessed 11 September 2018].

Chatzidakis, A. and Shaw, D. (2018). Sustainability: Issues of Scale, Care and Consumption. *British Journal of Management, 29*, pp.299-315.

Christmann, P. (2004). Multinational Companies and the Natural Environment: Determinants of Global Environmental Policy Standardization. *Academy of Management, 47*(5), pp.747-760.

Christmann, P. and Taylor, G. (2001). Globalization and the environment: Determinants of firm self-regulation in China. *Journal of International Business Studies, 32*, pp.438-458.

Coase, R. (1960). The Problem of Social Cost. *Journal of Law and Economics, 3*, pp.1-44.

Confino, J. (2012). Unilever’s Paul Polman: Challenging the corporate status quo. *The Guardian*. [online] Available at: <http://www.theguardian.com/sustainable-business/paul-polman-unilever-sustainableliving-plan> [Accessed 11 April 2018].

Cooper, H. (1998). *Synthesizing research: A guide for literature reviews.* Thousand Oaks: Sage.

Cordano, M. (1993). Making the natural connection: Justifying investment in environmental innovation. *Proceedings of the International Association for Business and Society*, pp.530-537.

D’Antone, S., Canning, L., Franklin-Johnson, E. and Spencer, R. (2017). Concerned innovation: The ebb and flow between market and society. *Industrial Marketing Management, 64*, pp.66-78.

Dasgupta, S., Hettige, H. and Wheeler, D. (2000). What improves environmental performance? Evidence from Mexican industry. *Journal of Environmental Economics and Management, 39*, pp.39-66.

Delaporte, I. and Maurel, M. (2016). Adaptation to climate change in Bangladesh. *Climate Policy,* pp.1-14.

Department of Energy & Climate Change (2014). *Delivering UK Energy Investment.* [online] Available at: <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/331071/DECC_Energy_Investment_Report.pdf> [Accessed 22 March 2018].

Dierickx, I. and Cool, K. (1989). Asset stock accumulation and sustainability of competitive advantage. *Management Science, 35*, pp.1504-1511.

DiMaggio, P. and Powell, W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review, 48*, pp.147-160.

Disparte, D. (2017). *If you think fighting climate change will be expensive, calculate the cost of letting it happen.* [online] Available at: https://hbr.org/2017/06/if-you-think-fighting-climate-change-will-be-expensive-calculate-the-cost-of-letting-it-happen [Accessed 7 May 2018].

Dubois, A. and Gadde, L.-E. (2002). Systematic combining: an abductive approach to case research. *Journal of Business Research, 55*(7), pp.553-560.

Dubois, A. and Gadde, L.-E. (2014). “Systematic combining” –A decade later. *Journal of Business Research, 67*, pp.1277-1284.

Dyer, W. and Wilkins, A. (1991). Better stories, not better constructs, to generate better theory: A rejoinder to Eisenhardt. *Academy of Management Review, 16*(3), pp.613-619.

Easton, G. (1995). Methodology and industrial networks. In: Möller, K. and Wilson, D.T. (eds.). *Business marketing: an interaction and network perspective*, Norwell: Kluwer Academic Publishing, pp.411-419.

Easton, G. (1998). Case research as a methodology for industrial networks: a Realist apologia. In: Fleetwood, S. and Ackroyd, S. (eds.). *Realist Perspectives on Management and Organisations*. London and New York: Routledge, pp.369-391.

Easton, G. (2002). Marketing: A critical realist approach. *Journal of Business Research, 55* (2), pp.103-109.

Easton, G. (2010). Critical realism in case study research. *Industrial Marketing Management, 39* (1), pp.103-109.

Easton, G. and Araujo, L. (1994). Market Exchange, Social Structure and Time. *European Journal of Marketing, 28*(3), pp.72-84.

Easton, G. and Håkansson, H. (1996). Markets as networks: Editorial introduction. *International Journal of Research in Marketing, 13*, pp.407-413.

Edwards, R. and Holland, J. (2013). *What is Qualitative Interviewing?* London: Bloomsbury Academic.

EIA (2017). International Energy Outlook 2017. [online] Available at: <https://www.eia.gov/outlooks/ieo/> [Accessed 23 February 2018].

Eisenhardt, K. (1989). Building theories from case study research. *Academy of Management Review, 14*(4), pp.532-550.

Eisenhardt, K. and Graebner, M. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal*, *50*(1), pp.25-32.

Elman, C. (2005). Explanatory typologies in qualitative studies of international politics. *International Organization, 59*, pp.293-326.

Elman, C. (2009). Explanatory typologies in qualitative analysis. In: Bryne, D. and Ragin, C. (eds.). *The SAGE Handbook of case-based methods.* London: Sage, pp.121-131.

Epley, N., Caruso, E. and Bazerman, M. (2006). When Perspective Taking Increases Taking: Reactive Egoism in Social Interaction. *Journal of Personality and Social Psychology*, *91*(5), pp.872-889.

Escobar, L. and Vredenburg, H. (2011). Multinational oil companies and the adoption of sustainable development: A resource-based and institutional theory interpretation of adoption heterogeneity. *Journal of Business Ethics, 98*(1), pp.39-65.

European Commission (2017). *Electrification of Transport System.* Brussels: European Commission.

Eurostat (2017). Greenhouse gas emission statistics - air emissions accounts. [online] Available at: <http://ec.europa.eu/eurostat/statistics-explained/index.php/Greenhouse_gas_emission_statistics_-_air_emissions_accounts/> [Accessed 20 February 2018].

Ferraro, F., Etzion D. and Gehman, J. (2015). Tackling Grand Challenges Pragmatically: Robust Action Revisited. *Organization Studies, 36*(3), pp.363-390.

Ferraro, P. (2016). Applying Behavioral Sciences to Environmental Policies and Programs. In: *Behavioral Exchange Conference. Harvard University, 6-8 June 2016.* Boston: Behavioral Insights Group.

Finke, T., Gilchrist, A. and Mouzas, S. (2016). Why companies fail to respond to climate change: Collective inaction as an outcome of barriers to interaction. *Industrial Marketing Management*, *58*, pp.94-101.

Folger, R. and Turillo, C. (1999). Theorizing as the thickness of thin abstraction. *Academy of Management Review*, *24*(4), pp.742-758.

Ford, D. and Håkansson, H. (2006). The Idea of Interaction. *The IMP Journal*, *1*(1), pp.4-20.

Ford, D. and Håkansson, H. (2013). Competition in business networks. *Industrial Marketing Management*, *42*, pp.1017-1024.

Ford, D. and Mouzas, S. (2008). Is there any hope? The idea of strategy in business networks. *Australasian Marketing Journal*, *16*(1), pp.64-78.

Ford, D. and Mouzas, S. (2010). Networking under uncertainty: Concepts and research agenda. *Industrial Marketing Management*, *39*, pp.956-962.

Ford, D. and Mouzas, S. (2011). Herd Behaviour in Business Networks. *Die Betriebswirtschaft, - Business Administration Review (BARev), Heft 71*(6), pp.541-557.

Ford, D. and Mouzas, S. (2013). Service and value in the interactive business landscape. *Industrial Marketing Management*, *42*, pp.9-17.

Ford, D., Gadde, L.-E., Håkansson, H., Snehota, J. and Waluszewski, A. (2008). *Analysing Business Interaction*. 24th IMP Conference, Uppsala, Sweden.

Ford, D., Gadde., L.-E., Håkansson, H., Snehota, I. and Waluszewski, A. (2003). *Managing business relationships.* Chichester: John Wiley & Sons.

Formuzis, A. (2017). Asbestos Industry Covered Up Danger for Decades, and Evades Responsibility Today. *The Huffington Post.* [online] Available at: <https://www.huffpost.com/entry/asbestos-industry-covered_b_10322522> [Accessed 2 July 2019].

Fouquet, R. (2010). The slow search for solutions: Lessons from historical energy transitions by sector and service. *Energy Policy*, *38*, pp.6586-6596.

Foxon, T. (2013). Transition pathways for a UK low carbon electricity future. *Energy Policy, 52*, pp.10-24.

Freytag, P., Munksgaard, K., Clarke, A. and Damgaard, T. (2016). Organizing and strategizing in changing networks: Contributions to theory, methodology and management. *Industrial Marketing Management, 58*, pp.4-10.

Friese, S. (2012). *Qualitative data analysis with ATLAS.ti*. London: Sage.

Gadde, L. and Håkansson, H. (1992). Analysing change and stability in distribution channels — a network approach. In: B. Axelsson and G. Easton (eds.). Industrial networks – a new view of reality. London: Routledge, pp.166-179.

Gadde, L.-E., Huemer, L. and Håkansson, H. (2003). Strategizing in industrial networks. *Industrial Marketing Management, 32*, pp.357-364.

Giddens, A. (2009). *The Politics of Climate Change*. Cambridge: Polity Press.

Gifford, R. (2011). The dragons of inaction: psychological barriers that limit climate change mitigation and adaptation. *American Psychology, 66,* pp.290-302.

Gifford, R. and Chen, A. (2017). Why aren't we taking action? Psychological barriers to climate-positive food choices. *Climatic Change, 140*, pp.165-178.

Glaser, B. and Strauss, A. (1967). *The discovery of grounded theory: strategies for qualitative research.* Chicago: Aldine Publishing.

Gnyawali, D. and Madhavan, R. (2001). Cooperative networks and competitive dynamics: A structural embeddedness perspective. *Academy of Management Review, 26*(3), pp.431-445.

Goodall, A. (2008). Why Have the Leading Journals in Management (and Other Social Sciences) Failed to Respond to Climate Change? *Journal of Management Inquiry, 17*(4), pp.408-420.

Goworek, H., Land, C., Burt, G., Zundel, M., Saren, M., Parker, M. and Lambe, B. (2018). Scaling Sustainability: Regulation and Resilience in Managerial Responses to Climate Change. *British Journal of Management*, *29*, pp.209-219.

Granovetter, M. (1992). Problems of Explanation in Economic Sociology. In: Nohria, N. and Eccles, R.G. (eds.). *Networks and Organizations: Structure, Form, and Action.* Boston: Harvard Business School Press, pp.25-56.

Granovetter, M.S. (1985). Economic Action and Social Structure: The Problem of Embeddedness. *American Journal of Sociology, 91*, pp.481-510.

Greve, H. (2013). Microfoundations of Management: Behavioral Strategies and Levels of Rationality in Organizational Action. *Academy of Management Perspectives*, *27*(2), pp.103-119.

Guba, E. and Lincoln, Y. (1994). Competing Paradigms in Qualitative Research. In: N. Denzin and S. Lincoln (eds.). *Handbook of qualitative research.* Thousand Oaks: Sage, pp. 105-117.

Guercini, S., La Rocca, A. Runfolda, A. and Snehota, I. (2015). Heuristics in customer-supplier interaction. *Industrial Marketing Management, 48*, pp.26-37.

Guercini, S., La Rocca, A., Runfola, A. and Snehota, I. (2014). Interaction behaviors in business relationships and heuristics: Issues for management and research agenda. *Industrial Marketing Management*, *43*, pp.929-937.

Gulati, R. (1995). Does familiarity breed trust? The implications of repeated ties for contractual choice in alliance. *Academy of Management Journal, 38*, pp.85-112.

Gulati, R., Nohria, N. and Zaheer, A. (2000). Strategic Networks. *Strategic Management Journal, 21*(3), pp.203-215.

Håkansson, H. (1992). Evolving processes in industrial networks. In: B. Axelsson and G. Easton (eds.). *Industrial networks: a new view of reality.* London: Routledge, pp.129-143.

Håkansson, H. and Ford, D. (2002). How should companies interact in business networks? *Journal of Business Research, 55*, pp.133-139.

Håkansson, H. and Johanson, J. (1992). A Model of Industrial Networks. In: B. Axelsson, and G. Easton (eds.), *Industrial Networks: A New View of Reality.* London: Routledge, pp.28-34.

Håkansson, H. and Snehota, I. (1989). No Business is an Island: The Network Concept of Business Strategy. *Scandinavian Journal of Management, 5*(3), pp.187-200.

Håkansson, H. and Snehota, I. (1995). *Developing Relationships in Business Networks.* Boston: International Thomson Press.

Håkansson, H. and Snehota, I. (2017). Interactivity in Business Networks. In: *IMP in Asia 2017*. Kuala Lumpur, Malaysia. September 2017.

Halinen, A. and Törnroos, J.-A. (1998). The role of embeddedness in the evolution of business networks. *Scandinavian Journal of Management, 14*(3), pp.187-205.

Halinen, A. and Törnroos, J.-A. (2005). Using case methods in the study of contemporary business networks. *Journal of Business Research, 58*(9), pp.1285-1297.

Hammond, G. and O'Grady, A. (2017). The potential environmental consequences of shifts in UK energy policy that impact on electricity generation. *Journal of Power and Energy, 23*(6), pp.535-550.

Hampson, F. (1995). *Multilateral Negotiations: Lessons from Arms Control, Trade, and the Environment.* Baltimore: John Hopkins University Press.

Hannon, M., Foxon, T. and Gale, W. (2013). The co-evolutionary relationship between Energy Service Companies and the UK energy system: Implications for a low-carbon transition. *Energy Policy, 61*, pp.1031-1045.

Hansford, A., Hasseldine, J. and Woodward, T. (2004). The UK Climate Change Levy: Good Intentions but Potentially Damaging to Business. *Corporate Social Responsibility and Environmental Management, 11*, pp.196-210.

Hardin, G. (1968). The tragedy of the commons. *Science, 162*(3859), pp.1243-48.

Hardin, G. (1998). Extensions of "the tragedy of the commons". *Science, 280*(5364), pp.682-683.

Harrison, D. (1999). *Strategic responses to predicted events: the case of the banning of CFCs.* Doctoral dissertation. University of Lancaster, UK.

Harrison, D. and Easton, G. (2002). Patterns of actor response to environmental change. *Journal of Business Research, 55*, pp.545-552.

Heede, R. (2014). Tracing anthropogenic carbon dioxide and methane emissions to fossil fuel and cement producers, 1854-2010. *Climatic Change, 122*, pp.229-241.

Henneberg, S., Mouzas, S. and Naudé, P. (2006). Network pictures: Concepts and representations. *European Journal of Marketing, XLIV*, pp.425-433.

Henriques, I. and Sadorsky, P. (1996). The determinants of an environmentally responsive firm: An empirical approach. *Journal of Environmental Economics and Management, 30*, pp.381-395.

Hess, D.J. (2013). Sustainability transitions: A political coalition perspective. *Research Policy, 43*, pp.278-283.

HM (2016). *Government response to the Committee on Climate Change: Progress on meeting carbon budgets.* London: Department for Business, Energy and Industrial Strategy.

Hoffman, A. and Bazerman, M. (2007). Changing practice on sustainability: Understanding and overcoming the organizational and psychological barriers to action. In: Sharma, S., Strarik, M and Husted, B. (eds.). *Organizations and the sustainability mosaic: Crafting long-term ecological and societal solutions.* Cheltenham: Edward Elgar, pp.84-105.

Hoffman, A. (2005). Climate Change Strategy: The Business Logic Behind Voluntary Greenhouse Gas Reductions. *California Management Review, 47*(3), pp.21-46.

Hoffmann, V. and Busch, T. (2008). Corporate carbon performance indicators: Carbon intensity, dependency, exposure, and risk. *Journal of Industrial Ecology, 12*, pp.505-520.

Hogg, M. and Maclaran, P. (2008). Rhetorical issues in writing interpretivist consumer research. *Qualitative Market Research: An International Journal, 11*(2), pp.130-146.

Hopkinson, C. (2015). Network graffiti: Interaction as sensemaking. *Industrial Marketing Management, 48*, pp.70-88.

Howard-Grenville, J., Buckle, S., Hoskins, B. and George, G. (2014). Climate Change and Management. *Academy of Management Journal*, *57*(3), pp.615-623.

Huberman, M. and Miles, M. (1994). Data management and analysis methods. In: N. Denzin and Y. Lincoln, (eds.). *Handbook of qualitative research,* Thousand Oaks: Sage, pp.428-444.

IEA (2016). *Recent trends in the OECD: energy and CO_2 emissions.* [online] Available at: https://www.iea.org/media/statistics/Recent_Trends_in_the_OECD.pdf [Accessed 16 October 2017].

Ihlen, Ø. (2009). Business and Climate Change: The Climate Change Response of the World's 30 Largest Corporations. *Environmental Communication, 3*(2), pp.244-262.

IMF (2017). *Real GDP growth.* [online] Available at: http://www.imf.org/external/datamapper/NGDP_RPCH@WEO/OEMDC/ADVEC/WEOWORLD [Accessed 14 October 2017].

IPCC (2014). *Climate Change 2014 Synthesis Report: Summary for Policymakers*. Geneva: IPCC.

Johanson, J. and Mattsson, L. (1985). Marketing investments and market investments in industrial networks. *International Journal of Research in Marketing, 2*(3), pp.185-195.

Johanson, J. and Mattsson, L. (1992). Network positions and strategic action – An analytic framework. In: B. Axelsson and G. Easton (eds.). *Industrial networks: A new view of reality*. London: Routledge, pp.205-217.

Jolls, C., Sunstein, C. and Thaler, R. (1998). A Behavioral Approach to Law and Economics. *Stanford Law Review, 50*, pp.1471-1550.

Jones, C. and Levy, D. (2007). North American Business Strategies Towards Climate Change. *European Management Journal, 25*(6), pp.428-440.

Jost, J. (1995). Negative Illusions: Conceptual Clarification and Psychological Evidence Concerning False Consciousness. *Political Psychology, 16*(2), pp.397-424.

Kahneman, D. (2011). *Thinking fast and slow.* New York: Farrar Strauss and Giroux.

Kahneman, D. and Tversky, A. (1979). Prospect theory: an analysis of decisions under risk. *Econometrica, 42*, pp.262-291.

Kahneman, D. Knetsch, J. and Thaler, R. (1991). The Endowment Effect, Loss Aversion, and Status Quo Bias. *Journal of Economic Perspectives, 5*(1), pp.193-206.

Kahneman, D., Tversky, A. and Slovic, P. (1982). *Judgement under Uncertainty: Heuristics and Biases.* Cambridge: Cambridge University Press.

Keay, M. (2016). UK energy policy – Stuck in ideological limbo? *Energy Policy, 94*, pp.247-252.

Kelman, M. (2011). *The heuristic debate.* New York: Oxford University Press.

Keohane, R. and Victor, D. (2011). The Regime Complex for Climate Change. *Perspectives on Politics, 9*(1), pp.7-23.

Kindleberger, C. (1978). *Manias, Panics, and Crashes: A History of Financial Crises.* Basingstoke: Palgrave Macmillan.

Knoke, D. (1994). Networks of elite structure and decision making. In: S. Wasserman and J. Galaskiewicz, (eds.). *Advances in social network analysis: Research in the social and behavioral sciences*. Thousand Oaks: Sage, pp.274-294.

Knox, R. and Inkster, J. (1968). Postdecision dissonance at post time. *Journal of Personality and Social Psychology, 8,* pp.319-323.

Kolk, A. and Levy, D. (2001). Winds of Change: Corporate Strategy, Climate Change and Oil Multinationals. *European Management Journal, 19*(5), pp.501-509.

Kolk, A. and Pinkse, J. (2004). Market Strategies for Climate Change. *European Management Journal, 22*(3), pp.304-314.

Kolk, A. and Pinkse, J. (2005). Business Responses to Climate Change: Identifying emergent strategies. *California Management Review, 47*(3), pp.6-20.

La Rocca, A., Hoholm, T. and Mørk, B. (2017). Practice theory and the study of interaction in business relationships: Some methodological implications. *Industrial Marketing Management, 60,* pp.187-195.

Lawrence, T. and Suddaby, R. (2006). Institutions and Institutional work. In: S. Clegg, C. Hardy and T. Lawrence (eds). *Handbook of Organization Studies* (2nd ed.). London: Sage, pp. 215–254.

Lax, D. and Sebenius, J. (1991). Thinking Coalitionally: Party Arithmetic, Process Opportunism, and Strategic Sequencing. In: H. Young (ed.). *Negotiation Analysis*. Ann Arbor: University of Michigan Press, pp.153-193.

Levy, D. and Kolk, A. (2002). Strategic Responses to Global Climate Change: Conflicting Pressures on Multinationals in the Oil Industry. *Business and Politics, 4*(3), pp.275-300.

Levy, D. and Egan, D. (2003). A Neo-Gramscian Approach to Corporate Political Strategy: Conflict and Accommodation in the Climate Change Negotiations. *Journal of Management Studies, 40*(4), pp.803-829.

Lindenberg, S. and Steg, L. (2007). Normative, gain and hedonic goal frame guiding environmental behavior. *Journal of Social Issues, 63*, pp.117-137.

Loewenstein, G., Weber, E., Hsee, C. and Welch, N. (2001). Risks as feelings. *Psychological Bulletin, 127*, pp.267-286.

Lovallo, D. and Sibony, O. (2010). The case for behavioral strategy. *McKinsey Quarterly, March,* pp.30-43.

Lowe, S. and Rod, M. (2018). Business network becoming: Figurations of time, change and process. *Industrial Marketing Management*, *68*, pp.156-164.

Lubin, D. and Esty, D. (2010). The sustainability imperative. *Harvard Business Review, 88*, pp.42-50.

Macneil, I. (1986). Exchange Revisited: Individual Utility and Social Solidarity. *Ethics*, *96*(3), pp.567-593.

Madhavan, R., Koka, B. and Prescott, J. (1998). Networks in Transition: How Industry Events (Re)Shape Interfirm Relationships. *Strategic Management Journal, 19*(5), pp.439-459.

Marewski., J., Schooler, L. and Gigerenzer, G. (2010). Five principles for studying people's use of heuristics. *Acta Psychologica Sinica*, *42*(1), pp.72-87.

Margolick, M. and Russel, D. (2004). *Corporate Greenhouse Gas Reduction Targets.* Arlington: Pew Center on Global Climate Change.

Markovits, D. (2004). Contract and Collaboration. *Faculty Scholarship Series*, *113*(7), pp.1417-1458.

Mason, K., Easton, G. and Lenney, P. (2013). Causal Social Mechanisms; from the what to the why. *Industrial Marketing Management*, *42*, pp.347-355.

Mattson, L. (1987). Management of strategic change in a 'markets-as-networks' perspective. In: A. Pettigrew (ed.). *The management of strategic change*. Oxford: Blackwell, pp.234-256.

Medlin, C. and Törnroos, J.-A. (2007). Inter-firm interaction from a human perspective. *Finanza Marketing and Produzione*, *25*(1), pp.41-56.

Meehl, G., Stocker, T., Collins, W., Friedlingstein, P., Gaye, A., Gregory, J., Kitoh, A., Knutti, R., Murphy, J., Noda, A., Raper, S., Watterson, I., Weaver, A. and Zhao, Z.-C. (2007). Global Climate Projections. In: *Climate Change 2007: The Physical Science Basis.* Cambridge: Cambridge University Press.

Miles, M. (1979). Qualitative data as an attractive nuisance: The problem of analysis. *Administrative Science Quarterly*, *24*, pp.590-601.

Miles, M. and Huberman, M. (1994). *Qualitative Data Analysis.* Thousand Oaks: Sage.

Mnookin, R., 2003. Strategic Barriers to Dispute Resolution: A Comparison of Bilateral and Multilateral Negotiations. *Journal of Institutions and Theoretical Economics, 159*, pp.199-22.

Moffatt, I. (2004). Global Warming: Scientific Modeling and Its Relationship to the Economic Dimensions of Policy. In: A.D. Owen and N. Hanley (eds.). *The Economics of Climate Change*. New York: Routledge, pp.26-54.

Möller, K., Rajala, A. and Svahn, S. (2005). Strategic business nets–Their type and management. *Journal of Business Research, 58*, pp.1274-1284.

Mouzas, S. (2006). Marketing action in networks. *European Journal of Marketing, 40*(11/12), pp.1271-1291.

Mouzas, S. (2016). Performance based contracting in long-term supply relationships. *Industrial Marketing Management, 59*, pp.50-62.

Mouzas, S. and Ford, D. (2009). The constitution of networks. *Industrial Marketing Management, 38*, pp.495-503.

Mouzas, S. and Ford, D. (2011). Herd behaviour in business networks. *Betriebswirtschaft, 71*(6), pp.541-557.

Mouzas, S. and Ford, D. (2018). The mediating role of consent in business marketing. *Industrial Marketing Management*, In press, corrected proof available online 17 April 2018.

Mueller, F., Whittle, A., Gilchrist, A. and Lenney, P. (2013). Politics and strategy in practice: An ethnomethodologically-informed discourse analysis perspective. *Business History*, *55*(7), pp.1168-1199.

Mullainathan, S. and Thaler, R. (2000). Behavioral Economics. *NBER Working Paper No. 7948*.

Muller, M. (2013). Nestlé baby milk scandal has grown up but not gone away. *The Guardian.* [online] Available at: <https://www.theguardian.com/sustainable-business/nestle-baby-milk-scandal-food-industry-standards> [Accessed 2 July 2019].

NASA (2019). Carbon Dioxide Direct Measurement: 2005-Present. [online] Available at: <https://climate.nasa.gov/> [Accessed 11 10 July 2019April 2018].

Nilsson, M. and Persson, Å. (2012). Can Earth system interactions be governed? Governance functions for linking climate change mitigation with land use, freshwater and biodiversity protection. *Ecological Economics, 75*, pp.61-71.

North, D. (1991). Institutions. *The Journal of Economic Perspectives, 5*(1), pp.97–112.

Nyberg, D., Wright, C. and Kirk, J. (2018). Dash for Gas: Climate Change, Hegemony and the Scalar Politics of Fracking in the UK. *British Journal of Management, 29*, pp.235-251.

Nyberg, Spicer, A. and Wright, C. (2013). Incorporating citizens: corporate political engagement with climate change in Australia. *Organization, 20,* pp.433-453.

O'Reilley, D., Allen, S. and Reedy, P. (2018). Reimagining the Scales, Dimensions and Fields of Socio-ecological Sustainability. *British Journal of Management, 29*, pp.220-234.

Ofgem (2017). *Electricity supply market shares by company: Domestic (GB).* [online] Available at: https://www.ofgem.gov.uk/data-portal/electricity-supply-market-shares-company-domestic-gb [Accessed 20 October 2017].

Okereke, C. (2007). An Exploration of Motivations, Drivers and Barriers to Carbon Management: The UK FTSE 100. *European Management Journal, 25*(6), pp.475-486.

Okereke, C. and Russel, D. (2010). Regulatory pressure and competitive dynamics: Carbon management strategies of UK energy-intensive companies. *California Management Review, 52*(4), pp.100-124.

Okereke, C., Wittneben, B. and Bowen, F. (2012). Climate Change: Challenging Business, Transforming Politics. *Business & Society, 51*(1), pp.7-30.

Opotow, S. and Weiss, l. (2000). Denial and the process of moral exclusion in environmental conflict. *Journal of Social Issues*, *56*, pp.475-490.

Ostrom, E. (1991). *Governing the Commons: The Evolution of Institutions for Collective Action.* Cambridge: Cambridge University Press.

Ostrom, E. (1999). Coping with tragedies of the commons. *Annual Review of Political Science, 2*, pp.493-535.

Pacala, S. and Socolow, R. (2004). Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies. *Science, 305*, pp.968-972.

Parkes, G. and Spataru, C. (2017). Integrating the views and perceptions of UK energy professionals in future energy scenarios to inform policymakers. *Energy Policy, 104*, pp.155-170.

Pawson, R. and Tilley, N. (1997). *Realistic evaluation*. London: Sage.

Peirce, C. (1931). *Collected paper.* Cambridge: Harvard University Press.

Perry, C. (1998). Processes of a case study methodology for postgraduate research in marketing. *European Journal of Marketing, 32*(9-10), pp.785-802.

Pinkse, J. and Kolk, A. (2009). *International business and global climate change*. London: Routledge.

Pinkse, J. and Kolk, A. (2012). Addressing the Climate Change–Sustainable Development Nexus: The Role of Multistakeholder Partnerships. *Business & Society, 51*(1), pp.176-210.

Ponterotto, J. (2005). Qualitative Research in Counseling Psychology: A Primer on Research Paradigms and Philosophy of Science. *Journal of Counseling Psychology, 52* (2), pp.126-136.

Powell, T., Lovallo, D. and Fox, C. (2011). Behavioral Strategy. *Strategy Management Journal, 32*, pp. 1369-1386.

Pressey, A., Gilchrist, A. and Lenney, P. (2014). Sales and marketing resistance to Key Account Management implementation: An ethnographic investigation. *Industrial Marketing Management, 43*(7), pp.1157-1171.

Priem, R. and Butler, J. (2001). Is the resource-based "view" a useful perspective for strategic management research? *Academy of Management Review, 26*(1), pp.22-40.

Quattrone, P. (2015). Governing Social Orders, Unfolding Rationality, and Jesuit Accounting Practices: A Procedural Approach to Institutional Logics. *Administrative Science Quarterly, 60*(3), pp.411–445.

Ragin, C. and Becker, H. (1989). How the microcomputer is changing our analytic habits, In: G. Blank, J. McCartney and E. Brent (eds.). *New technology in sociology: Practical applications in research and work.* New Brunswick: Transaction Books, pp.47-55.

Ragin, C. and Becker, H., eds. (1992). *What is a case? Exploring the foundations of social inquiry*. Cambridge: Cambridge University Press.

REN (2017). *Renewables 2017: Global Status Report.* Paris: Renewable Energy Policy Network for the 21st Century.

Resnick, M. (1998). Unblocking the traffic jam in corporate thinking. *Complexity, 3*(4), pp.27-30.

Ritter, T. (2000). A Framework for Analyzing Interconnectedness of Relationships. *Industrial Marketing Management, 29*, pp.317-329.

Ritter, T., Wilkinson, I. and Johnston, W. (2004). Managing in complex business networks. *Industrial Marketing Management, 33*, p.175-183.

Rowley, T. (1997). Moving beyond Dyadic Ties: A Network Theory of Stakeholder Influences. *Academy of Management Review, 22*(4), pp.887-910.

Rubin, J. and Brown, B. (1975). *The Social Psychology of Bargaining and Negotiation.* New York: Academy Press.

Saldaña, J. (2009). The Coding Manual for Qualitative Researchers. London: Sage.

Sayer, A. (1992). Method in social science: a realist approach. London: Routledge.

Schiffman, L., Kanuk, L. and Das, M. (2006). *Consumer behaviour.* Toronto: Pearson Education.

Sebenius, J. (1983). Negotiation arithmetic: adding and subtracting issues and parties. *International Organization, 37*(2), pp.281-316.

Sebenius, J. (1995). Overcoming Obstacles to a Successful Climate Convention. In: H. Lee (ed.) *Shaping National Responses to Climate Change: A Post-Rio Guide.* Washington, D.C.: Island Press, pp.41-80.

Sharma, S. and Nguan, O. (1999). The biotechnology industry and strategies of biodiversity conservation: The influence of managerial interpretations and risk propensity. *Business Strategy and the Environment, 8*, pp.46-61.

Shevchenko, A. Lévesque, M. and Pagell, M. (2016). Why Firms Delay Reaching True Sustainability. *Journal of Management Studies, 53*(5), pp.911-935.

Shiller, R. (1995). Rhetoric and Economic Behavior. *American Economic Review, 80*(2), pp.58-62.

Shiller, R. (2000). *Irrational Exuberance.* Princeton, NJ: Princeton University Press.

Siggelkow, N. (2007). Persuasion with case studies. *Academy of Management Journal, 50*(1), pp.20-24.

Simon H. (1990). Bounded Rationality. In: J. Eatwell, M. Milgate and P. Newman (eds.). *Utility and Probability*. London: Palgrave Macmillan, pp. 15-18.

Simon, H. (1955). A Behavioral Model of Rational Choice. *Quarterly Journal of Economics, 69*, pp.99-118.

Simon, H. (1967). The logic of heuristic decision making. In: N. Rescher (ed.). *The logic of decision and action*. Pittsburg: The University of Pittsburg, pp.1-20.

Simon, H. (1972). Theories of bounded rationality. In: C. McGuire and R. Radner (eds.), *Decision and organization.* Amsterdam: North-Holland Publishing Company, pp.161-176.

Slawinski, N. and Bansal, P. (2012). A Matter of Time: The Temporal Perspectives of Organizational Responses to Climate Change. *Organization Studies, 33*(11), pp.1537-1563.

Smith, A. (1776). *An Inquiry into the Nature and Causes of the Wealth of Nations.* Raleigh: Alex Catalogue.

Smith, B. and Hesse-Biber, S. (1996). Users' experiences with qualitative data analysis software: neither Frankenstein's monster nor muse. *Social Science Computer Review, 14*(4), pp.423-432.

Smith, P. and Laage-Hellman, J. (1992). Small group analysis in industrial networks. In: B. Axelsson and G. Easton (eds.). *Industrial Networks: A New View of Reality.* London: Routledge, pp.37-61.

Stavins, R. (1997). Policy Instruments for Climate Change: How Can National Governments Address a Global Problem. *University of Chicago Legal Forum, 293*, pp.293-329.

Stern, B. (1998). The problematics of representation. In: B. Stern, (ed.). *Representing consumers.* London: Routledge, pp.1-23.

Stern, N. (2006). *The Economics of Climate Change: The Stern Review.* Cambridge: Cambridge University Press.

Stigler, G. (1974). Free Riders and Collective Action: An Appendix to Theories of Economic Regulation. *Bell Journal of Economics, 5*(2), pp.359-365.

Susskind, L. and Weinstein, A. (1980). Towards a Theory of Environmental Dispute Resolution. *Boston College Environmental Affairs Law Review, 9*(2), pp.311-356.

Tagesspiegel (2018). Daimler-Chef Zetsche: Mehr Elektroautos nicht gut für die Bilanz. *Der Tagesspiegel.* [online] Available at: <https://www.tagesspiegel.de/wirtschaft/wandel-in-der-automobilbranche-daimler-chef-zetsche-mehr-elektroautos-nicht-gut-fuer-die-bilanz/21144716.html> [Accessed 12 April 2018].

Tenbrunsel, A., Wade-Benzoni, K., Messick, D. and Bazerman, M. (2000). Understanding the influence of environmental standards on judgements and choices. *Academy of Management Journal, 43*(5), pp.854-866.

Tesch, R. (1989). Computer software and qualitative analysis: A reassessment. In: G. Blank, J. McCartney and E. Brent, (eds.). *New technology in sociology: Practical applications in research and work.* New Brunswick: Transaction Books, pp.141-154.

Thaler, R. (1996). Doing Economics Without Homo Economicus. In: S.G. Medema and W.J. Samuels (eds.). *Foundations for Research in Economics: How Do Economists Do Economics?.* Cheltenham: Edward Elgar, pp.230-235.

The Climate Group (2005). *Carbon Down Profits Up.* Weybridge: The Climate Group.

Thornton, P. (2004). *Markets from Culture: Institutional Logics and Organizational Decisions in Higher Education Publishing.* Palo Alto: Stanford University Press.

Thornton, P. and Ocasio W. (2008). Institutional Logics. In: R. Greenwood, K. Sahlin and R. Suddaby (eds). *The Sage Handbook of Organizational Institutionalism*. London: Sage, pp. 99–128.

Törnross, J.-A., Halinen, A. and Medlin, C. (2017). Dimensions of space in business network research. *Industrial Marketing Management, 61*, pp.10-19.

Tsoukas, H. (1989). The validity of idiographic research explanations. *Academy of Management Review, 14* (4), pp.551-561.

Tversky, A. and Kahneman, D. (1991). Loss aversion in riskless choice: A reference-dependent model. *The Quarterly Journal of Economics*, *106*(4), pp.1039-1061.

UKERC (2006). *Unlocking energy services: Main findings of a joint SDC/UKERC Seminar, Meeting Report, November 2005*. London: UK Energy Research Centre.

UN (2017). *World Population Prospects 2017.* [online] Available at: https://esa.un.org/unpd/wpp/Download/Standard/Population/ [Accessed 14 October 2017].

UNFCCC (2015). *Climate Action Now: Summary for Policymakers.* Bonn: IPCC.

United Nations (2018). Glossary of climate change acronyms and terms. [online] Available at: <http://unfccc.int/essential_background/glossary/items/3666.php> [Accessed 3 March 2018].

Uzzi, B. (1996). The Sources and Consequences of Embeddedness for the Economic Performance of Organizations: The Network Effect. *American Sociological Review, 61*(4), pp.674-698.

Uzzi, B. (1997). Social structure and competition in interfirm networks: The paradox of embeddedness. *Administrative Science Quarterly, 42*, pp.35-67.

Veal, G. and Mouzas, S. (2010). Learning to collaborate: a study of business networks. *Journal of Business & Industrial Marketing, 25*(6), pp.420-434.

Veal, G. and Mouzas, S. (2011). Changing the rules of the game: Business responses to new regulation. *Industrial Marketing Management, 40*, pp.290-300.

Veal, G. and Mouzas, S. (2012). Market-Based Responses to Climate Change: CO_2 Market Design versus Operation. *Organization Studies, 33*(11), pp.1589-1616.

Weber, E. (2006). Experience-based and description-based perceptions of long-term risk: why global warming does not scare us (yet). *Climatic Change*, *77*(1), pp.103-120.

Weick, K. (1979). *The Social Psychology of Organizing* (2nd ed.). New York: Random House.

Weick, K. (1993). The Collapse of Sensemaking in Organizations: The Mann Gulch Disaster. *Administrative Science Quarterly, 38*(4), pp.628-652.

Weick, K. (1995). *Sensemaking in organisations.* Thousand Oaks: Sage.

Wernerfelt, B. (1984). A resource based view of the firm. *Strategic Management Journal*, *5*, pp.171-180.

Wernerfelt, B. (1995). The resource-based view of the firm: Ten years after. *Strategic Management Journal*, *16*, pp.171-174.

Westley, F. and Vredenburg, H. (1997). Interorganizational collaboration and the prevention of global biodiversity. *Organization Science, 8*, pp.381-403.

Westminster Forum Projects (2017). *About Westminster Forum Projects.* [online] Available at: <http://www.westminsterforumprojects.co.uk/aboutus> [Accessed 22 March 2018].

Whiteman, G., Walker, B. and Perego, P. (2013). Planetary Boundaries: Ecological Foundations for Corporate Sustainability. *Journal of Management Studies, 50*(2), pp.307-336.

Wittneben, B. (2009). Exxon is right: Let’s re-examine our choice for a cap-and-trade system over a carbon tax. *Carbon Policy, 37*, pp.2462-2464.

Wittneben, B. and Kiyar, D. (2009). Climate change basics for managers. *Management Decisions, 47*(7), pp.1122-1132.

Wittneben, B., Okereke, C., Banerjee, S. and Levy, D. (2012). Climate Change and the Emergence of New Organizational Landscapes. *Organization Studies, 33*(11), pp.1431-1450.

WMO (2016). *Provisional WMO Statement on the Status of the Global Climate in 2016*. [online] Available at: https://public.wmo.int/en/media/press-release/provisional-wmo-statement-status-of-global-climate-2016 [Accessed 14 October 2017].

Wright, C. and Nyberg, D. (2015). *Climate Change, Capitalism and Corporations: Processes of Creative Self-Destruction.* Cambridge: Cambridge University Press.

Wright, C. and Nyberg, D. (2017). An Inconvenient Truth: How Organizations Translate Climate Change into Business As Usual. *Academy of Management Journal, 59*(5), pp.1-66.

Yin, R.K. (2009). *Case study research: Design and methods* (4th ed.). Thousand Oaks: Sage.

Young, L. (2002). Whiter IMP? Or, is it 'wither' IMP? A commentary on the plenary session for the 18th IMP Conference. *Journal of Customer Behaviour, 1*(3), pp.309-316.

Zaveri, M. (2019) Monsanto Weedkiller Roundup Was 'Substantial Factor' in Causing Man's Cancer, Jury Says. *The New York Times.* [online] Available at: <https://www.nytimes.com/2019/03/19/business/monsanto-roundup-cancer.html> [Accessed 2 July 2019].

9 Appendices

Appendix 1: Sample participant recruitment email

Keynote Seminar "Next steps for UK domestic energy efficiency policy": Research Enquiry

Dear …,

I am a PhD student at Lancaster University who is investigating business relationships when collectively crafting climate change mitigation strategies. I am particularly interested in how public and private actors in the energy sector collaborate. Therefore, I was pleased to hear about the several public-private collaborations during the Westminster Energy, Environment & Transport Forum Keynote Seminar "Next steps for UK domestic energy efficiency policy" on Thursday, 28th April 2016.

Now, I was wondering if you would be able to give me some additional information about your interaction with private companies or public actors when aiming to reduce carbon emissions? This could either be via phone or in person and would not take longer than 30 minutes. I would very much appreciate your input and I will certainly share my findings with you once the study is completed.

If this sounds interesting to you and you are happy to participate, then would you be so kind as to let me know your availability during the next days/weeks.

Many thanks for your time and all the best from Lancaster,
Tobias

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Appendix 2: Sample of descriptive codes (Case 2)

E_c2_2008_UK Energy Act 2008 creates a regulatory framework

E_c2_2009_Government intention to implement CCS projects

E_c2_2009_Increases carbon reduction targets

E_c2_2009_Outlines interest and expertise in CCS development

E_c2_2010_03_Government announces funding of FEED studies

E_c2_2010_CCC shows that the UK needs to decarbonise power by 2030 to meet 2050 targets

E_c2_2010_Energy Act 2010 introduces financial incentive for CCS

E_c2_2010_Government ensures that funding will be provided for project demonstration

E_c2_2010_Links between CCS and EPS

E_c2_2010_Importance of gas in decarbonising

E_c2_2010_Raises the issue of renewables intermittency

E_c2_2010_UK Energy Act 2010 introduces CCS incentives

E_c2_2011_09_Barriers to CCS deployment

E_c2_2011_09_Resource commitment

E_c2_2011_09_Strategy

E_c2_2011_Estimates show that 20/30 GW of fossil fuel generation need to be fitted with CCS to meet targets

E_c2_2011_Government acknowledges that gas will play an important role in the future energy mix

E_c2_2011_Idea is to bury carbon under the seabed

E_c2_2011_Agree on working on CCS Project

E_c2_2011_Raises concerns over ambiguity regarding CCS policy

E_c2_2011_The potential of CCS

E_c2_2011_WWF Scotland acknowledges the potential of CCS

E_c2_2012_03_Stimulate investment in UK energy infrastructure

E_c2_2012_07_Approval for CCS project

E_c2_2012_08_Urges government to take decisive action on CCS technology

E_c2_2013_03_20_Government announces preferred bidders

E_c2_2013_03_20_Government announces preferred bidders for the CCS projects

E_c2_2013_07_Proceed without EU funding

E_c2_2013_CCS development now could deliver low carbon electricity cheaper by 2020

E_c2_2013_CCSA praises government and asks to ensure funding of 1bn

E_c2_2013_Including gas CCS in the competition

E_c2_2013_EPS and CCS

E_c2_2013_Government decides to move forward with two CCS projects

E_c2_2013_Importance of CCS to the UK

E_c2_2013_Progress update on CCS Commercialisation Programme

E_c2_2013_Closer to the depleted reservoir in the North Sea

E_c2_2013_Statement of interest in developing CCS

E_c2_2014_02_24_Government signs contract

E_c2_2014_02_CCS as a tool to mitigate climate change

E_c2_2014_02_CCS as an important step to make gas even cleaner

E_c2_2014_02_CCS technology and renewables intermittency

E_c2_2014_02_FEED expected to continue until 2015

E_c2_2014_02_Government acknowledges that without CCS it will be costly to meet climate targets

E_c2_2014_02_Government needs to secure innovative projects

E_c2_2014_02_Government spends 100m on the design phase of two projects

E_c2_2014_02_New CCGT plants incompatible with climate targets without CCS technology

E_c2_2014_02_CCS plans get approved by government

E_c2_2014_02_CCs project expected to be up and running by 2019

E_c2_2014_02_Signs contract with government

E_c2_2014_02_States that CCS could reiterate UK leadership in tackling climate change

E_c2_2014_02_Storage capacity

E_c2_2014_03_CCS has the potential to reduce gas-related emissions by 90%

E_c2_2014_04_CCS is expensive

E_c2_2014_04_Gas as the world's most dominant fuel by 2050

E_c2_2014_04_Gas has half as much carbon as coal

E_c2_2014_06_Ongoing support from the government

E_c2_2014_06_Shows that technology is feasible

E_c2_2014_06_Significant amount of infrastructure is already in place

E_c2_2014_07_Advantages of CCS

E_c2_2014_07_CCS project in Canada

E_c2_2014_08_Employment during construction phase

E_c2_2014_08_Individually proven technologies that need to be put together

E_c2_2014_08_Locals excited about Peterhead plans

E_c2_2014_08_Could pave the way for massive investment in CCS

E_c2_2014_08_Potential demand for technology from overseas

E_c2_2014_08_The North Sea as a huge resource for storing carbon

E_c2_2014_11_CCS could generate 6.5bn annually and cut decarbonisation costs

E_c2_2014_11_CCS factsheet

E_c2_2014_11_IPCC praises CCS technology

E_c2_2014_12_Loses at capacity market auction

E_c2_2014_12_Only wins few contracts in the capacity auction for 2018-19

E_c2_2014_CCS technology needed to tackle Climate Change

E_c2_2014_External examiners approve capability of storing carbon

E_c2_2014_Government award contract to gas-CCS project

E_c2_2014_Government role in CCS

E_c2_2014_Deliver project management during FEED phase

E_c2_2014_Leading generator of renewables

E_c2_2014_Work on CCS

E_c2_2015_05_CCS projects as a sign of government's commitment to decarbonise

E_c2_2015_05_Save 10-15m tons of carbon

E_c2_2015_06_04_Receives back up gas supply contract

E_c2_2015_06_Council approves CCS planning application

E_c2_2015_06_CCS encourages burning further carbon

E_c2_2015_06_Critiques argue that CCS encourages burning more fossil fuels

E_c2_2015_06_Driving CCS down the cost curve

E_c2_2015_06_How CCS works

E_c2_2015_06_Final decision whether bids are attractive

E_c2_2015_06_Offshore and onshore Environmental Impact Assessment

E_c2_2015_06_CCS can capture 1m tonnes annually for 10-15 years

E_c2_2015_06_Put priority on developing CCS

E_c2_2015_06_Starting construction depends on positive investment decision

E_c2_2015_06_Summary of CCS technology

E_c2_2015_07_CCS buys time to get entirely rid of fossil fuels

E_c2_2015_07_Fossil fuel firms have an interest in developing CCS to keep burning carbon

E_c2_2015_09_Effort to develop CCS

E_c2_2015_09_Verified as suitable for safe carbon storage

E_c2_2015_09_Requirement of more CCS projects to reach net zero emissions

E_c2_2015_09_Only takes the project forward when the government commits to funding

E_c2_2015_10_Achieving carbon budget only possible with low carbon sources

E_c2_2015_11_25_Cancellation described as extremely damaging

E_c2_2015_11_25_Cancellation not in the long-term interest of the UK

E_c2_2015_11_25_CCS cancellation as an example of how climate policy should not be executed

E_c2_2015_11_25_CCS crucial for a diverse energy mix

E_c2_2015_11_25_CCS is crucial for cost-effective decarbonisation

E_c2_2015_11_25_For many industry CCS is the only option to cut emissions

E_c2_2015_11_25_Government decision makes it almost impossible to meet carbon budgets

E_c2_2015_11_25_Government manifesto on CCS

E_c2_2015_11_25_Government reset of energy policy inconsistent with CCS competition cancellation

E_c2_2015_11_25_Greenpeace states the severe consequences of cancelling the CCS competition

E_c2_2015_11_25_IPCC on CCS

E_c2_2015_11_25_CCS Project is now dead

E_c2_2015_11_25_UK Committee on Climate Change on CCS

E_c2_2015_11_25_UK government cancels CCS competition

E_c2_2015_11_Coal to be replaced by gas

E_c2_2015_11_Gas struggles to secure contracts under capacity market

E_c2_2015_11_UK electricity supply must be virtually carbon-free by 2030

E_c2_2015_11_UK energy secretary is backing gas and nuclear

E_c2_2015_25_11_Government decides to not take CCS competition forward

E_c2_2015_Cancellation will delay demonstration of CCS process on CCGT

E_c2_2015_CCS is already being used around the world

E_c2_2015_History of CCS

E_c2_2015_Persuading people takes time

E_c2_2015_CCS Project

E_c2_2015_Reducing follow-on project costs by a third

E_c2_2016_01_31_CCS still has a long-term role to play in the UK

E_c2_2016_01_31_UK government spent GBP28m

E_c2_2016_01_CCS is crucial and it's working

E_c2_2016_01_Solar revolution

E_c2_2016_02_10_Cancellation has put back the project by at least 5 years

E_c2_2016_02_10_Companies heard about the cancellation in the news

E_c2_2016_02_10_Failure to develop CCS is bad for business and environment

E_c2_2016_02_10_UK policy to replace coal with gas

E_c2_2016_02_Challenges of meeting the Climate Change Act target without CCS

E_c2_2016_05_18_New EU fund could breathe life into UK CCS

E_c2_2016_06_CCS lessons learned

E_c2_2016_12_15_Lack of government support

E_c2_2016_Government working on ways to decarbonise companies

E_c2_2016_Big difference between having CCS and not

E_c2_2016_Bizarre decision to abandon the CCS competition

E_c2_2016_By 2030 concern about climate change may have intensified enormously

E_c2_2016_Cancellation may have delayed roll-out of CCS by a decade

E_c2_2016_Carbon tax helped to decarbonise

E_c2_2016_Carbon tax not used to ensure carbon reduction

E_c2_2016_CCS as a technology that balances renewables intermittency

E_c2_2016_CCS can contribute to reducing the cost of the transition

E_c2_2016_CCS crucial for the transition towards low carbon

E_c2_2016_CCS had a tricky time because of government

E_c2_2016_CCS key because of negative emissions

E_c2_2016_CCS Project cancellation impact

E_c2_2016_CCS required to meet net zero emissions

E_C2_2016_CCS technology is absolutely essential

E_c2_2016_CCS the only technology to decarbonise gas emissions

E_c2_2016_Challenges beyond getting the technology right

E_c2_2016_Collaboration makes something possible that wasn't possible before

E_c2_2016_Collaboration on innovation

E_c2_2016_Commerical scale demonstration of CCS is key

E_c2_2016_Costs of CCS cancellation

E_c2_2016_Decarbonisation is a huge challenge across all sector

E_c2_2016_Deployment at scale is crucial

E_c2_2016_Economics of CCS don't work out

E_c2_2016_Energy efficiency measures lose out because of opportunity cost

E_c2_2016_Energy innovation is key

E_c2_2016_Energy innovation acuter than ever

E_c2_2016_Energy transition is huge and has to happen quickly

E_c2_2016_Energy transition towards low carbon challenges traditional approaches to security of supply

E_c2_2016_Exciting growth in decarbonisation

E_c2_2016_Existing relationships as a start for interaction

E_c2_2016_Explanation of the CCS Project

E_c2_2016_Getting the technology right isn't enough

E_c2_2016_Government acknowledges tough decision on CCS

E_c2_2016_Government funded FEED phase of CCS

E_c2_2016_Government lacks technical expertise

E_c2_2016_Government not able to meet carbon budget by 2020

E_c2_2016_Government policy and sense of urgency hinder collaboration

E_c2_2016_Government with a strategic role in investment stimulation

E_c2_2016_How to align incentives to do something about climate change

E_c2_2016_Increased cost of decarbonisation without CCS

E_c2_2016_Inertia of big companies makes it difficult to quickly change direction

E_c2_2016_Innovation drag issue

E_c2_2016_Institutional barriers preventing innovation to break through

E_c2_2016_It would be crazy to believe that one company can do the energy transition alone

E_c2_2016_Lack of government direction is an issue for the industry and investors

E_c2_2016_Lack of upfront capital support to make CCS work

E_c2_2016_Losing the flexibility and storage inherent in fossil fuel generation

E_c2_2016_Market mechanisms give price incentive but are too uncertain to base decision upon it

E_c2_2016_More resources than ever before

E_c2_2016_Partnerships are good but bear risks

E_c2_2016_Would have been the world's first commercial-scale demonstration of CCS

E_c2_2016_Public needs to be made aware of the costs associated with the low carbon transition

E_c2_2016_Renewables Obligation on Suppliers forces them to source from renewables

E_c2_2016_Response to climate change driven by the government but delivered by industry

E_c2_2016_Risk of retrospective changes to policy

E_c2_2016_Concluded that there is no longer a future for CCS

E_c2_2016_Focuses on energy efficiency measures

E_c2_2016_Disappointed about cancellation

E_c2_2016_Impact on UK CCS industry

E_c2_2016_CCS needs to come down the cost curve

E_c2_2016_Remains committed to CCS

E_c2_2016_Interact with the government to influence policies

E_c2_2016_Would respond to climate change alone unless they lack a resource

E_c2_2016_Challenges of setting up new partnerships

E_c2_2016_Acknowledges that markets fail to deliver sufficient decarbonisation

E_c2_2016_A partnership organisation

E_c2_2016_A utility, not a technology provider

E_c2_2016_Government intervention is a good way of innovating

E_c2_2016_Channels of interaction with government

E_c2_2016_Generation portfolio

E_c2_2016_Interact when they lack a resource

E_c2_2016_Interaction with government

E_c2_2016_On flip-flopping of government policies

E_c2_2016_On the issue with the energy trilemma

E_c2_2016_The opportunity cost issue

E_c2_2016_Response to climate change based on commercial opportunities

E_c2_2016_Responsibility in the CCS Project

E_c2_2016_Sees policies and auction outcomes to make sense of government direction

E_c2_2016_View of the CCS project

E_c2_2016_Strong signals that government favours markets and competition

E_c2_2016_The advantage of negative emissions technology

E_c2_2016_The carbon text clarification

E_c2_2016_The costs of a decarbonised energy system

E_c2_2016_The immense costs of CCS

E_c2_2016_The importance of CCS

E_c2_2016_The issue of low carbon innovation

E_c2_2016_The risk of investing in new technologies

E_c2_2016_Top down drive towards decarbonisation

E_c2_2016_UK energy system undergoes a transition towards low carbon

E_c2_2016_UK is a significant net importer of energy

E_c2_2016_Unsuccessful CCS competition

E_c2_2016_Utilities are changing shape in the front of our eyes

E_c2_2016_Very long-term investments in energy

E_c2_2016_Without CCS the use of nuclear is inevitable

E_c2_2017_01_20_DECC wasn't clear about the budget from the start

E_c2_2017_01_20_Disagreement in government led to CCS cancellation

E_c2_2017_01_Cancellation ended 10 years of work

E_c2_2017_01_Costs of CCS with government support

E_c2_2017_01_Government support is needed for big projects

E_c2_2017_01_Lack of consensus that supports CCS technology

E_c2_2017_02_Announces to investigate the future of the site

E_c2_2017_08_UK electricity and gas consumption summary

E_c2_2017_CCS competition facts

E_c2_2017_Definition of CCS

E_c2_2017_Government explains reasons for cancelling the second competition

E_c2_2017_Government on second CCS competition

E_c2_2017_Government on the role of CCS in decarbonising the energy system

E_c2_2017_Government view on CCS

E_c2_2017_Lessons learned from the CCS competition

Appendix 3: Participant Information Sheet

Lancaster University
Management School

INFORMATION SHEET

Project Title: *Negotiating Responses to Climate Change*

Researcher: *Mr. Tobias Finke*

First of all, thank you for taking the time to read this information sheet, which you have received because I believe that you could provide insightful data on business interactions in response to climate change. Before you decide whether you are willing to take part in this study or not, I would like to provide answers to some of the key questions regarding this research project. In case you would like to discuss this information sheet with me or have any questions, I am happy to call you at your earliest convenience.

What is the purpose of this study?

The study aims to explore business interactions when crafting business responses to climate change. Here, I am particularly interested in the challenges you are facing in this context and how you have or intend to overcome them. The overall purpose is to understand how consensus is reached when negotiating responses to climate change, which would ultimately lead to more effective business responses to climate change.

Why have I been invited to take part?

You have been invited to take part in this study because I require information from people that are involved in interactions surrounding business responses to climate change. This information sheet has been sent to you either because you are the representative of a company that develops responses to climate change or because a representative of your company promotes this study and has identified you as a potential participant in the study.

Do I have to take part?

No. Your participation in this study is entirely voluntary and it is completely up to you to decide whether or not you want to take part.

What will I be asked to do if I take part?

If you agree to take part in the study, I will contact you to schedule a face-to-face or telephone interview. This interview will either take place at your office, at Lancaster University or at a public place that is convenient for you, depending on your preference. The interview is likely to last between 45 minutes and one hour, will be audio-recorded and later typed up in full. Furthermore, you will be asked to complete a consent form before participating. You are free to withdraw your consent without giving a reason within the first three months after the interview.

What will the interview involve?

During the interview you will be asked questions about your organisations' behaviour in response to climate change. This will involve questions about specific measures to tackle climate change, your interactions with other businesses when developing these measures and we will discuss challenges that your organisation is facing and how you have or intend to overcome them. Furthermore, you will be asked about the actors you interact with in responses to climate change and ideally you would promote the study among your colleagues and forward my contact details. Your colleagues can then contact the researcher themselves. Although you are not expected to promote this study, I believe it is highly important to gather the views of all actors involved in order to identify a mechanism that enables more effective responses to climate change. Moreover, you will not be expected to answer any questions that you do not wish to answer and you can withdraw from the interview at any time, without given reason.

What are the possible risks of taking part?

I do not anticipate that you will experience any distress. However, climate change and businesses behaviour in this context is a political and sensitive topic and thus, I have put highest priority on confidentiality and anonymity of you personally and of the organisation you represent. I believe that this study can only be truly successful when it is ensured that you and the organisation you represent are not facing distress in any form. In case you have any doubts you can decide to end the interview at any time. Furthermore, I will provide some time at the end of the interview to discuss any concerns.

What are the possible benefits of taking part?

Although this study does not intend to provide any specific benefits to individuals taking part, it is hoped that the information I gain enables more effective business responses to climate change. Ultimately, this would reduce the risk of potentially devastating consequences of climate change. Furthermore, I intend to advance the unveiled mechanism in my post-doctoral research to enable consensus when crafting business responses to other threats such as poverty or epidemics.

Will my data be identifiable?

Any information collected from you will be treated with confidentiality and in accordance with the UK Data Protection Act (1998). Only the research team will have access to any raw information that can be associated with you. Any information that is shared beyond this team will be made anonymous. Your name and the name of the entity that you represent will be removed, and a pseudonym will be used instead. Personal details and the research content will be stored in two separated, encrypted and password protected files.

What will happen to results of the study?

As this study will form a key part of my doctoral dissertation, the results will be summarised and submitted to Lancaster University for marking. Furthermore, I plan to publish the findings of this study in a reputable journal and I intend to present the findings at a conference. A brief report of the findings will be sent to you, if interested. Participants and the organisations they represent will not be identifiable within any of these publications, but anonymous quotes will be included, if consent is provided.

Who has reviewed the study?

This study has been reviewed by the Head of the Marketing Department, and has been approved by the University Research Ethics Committee at Lancaster University.

What if there is a problem?

If you have any concerns about this study, I am happy to discuss this with you and I will do my best to answer your questions. Please see my contact details at the end of this information sheet. If you remain unhappy and wish to complain formally, you can do so by contacting the Head of the Marketing Department at Lancaster University.

Professor Maria Piacentini
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Where can I obtain further information about the study if I need it?

If you have any questions about the study, please contact the Principal Investigator or the supervisors of this research project.

Thank you for taking the time to read this information sheet.

Lancaster University
Management School

Contact Details

The Principal Investigator of this research project is Mr. Tobias Finke, Lancaster University.

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This research project is supervised by Professor Stefanos Mouzas and Dr. Alan Gilchrist.

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