EXPLORING THE INHERENT CONFLICT BETWEEN THE INTERNATIONALISATION AND CARBON MANAGEMENT AGENDAS IN THE UK HIGHER EDUCATION SECTOR

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Abstract

Globally, higher education institutions (HEIs) can help facilitate the transition to a low-carbon society through their role as educators, researchers and community leaders. Focusing on their role as educators, one of the central concepts of education for sustainable development is global citizenship, where for UK HEIs the recruitment of international students and study abroad schemes have been a fundamental way of encouraging home students to develop global perspectives. However, this approach conflicts with the sector's low-carbon agenda due to the significant emissions from air travel (hereafter 'the Conflict'). To evaluate the scale of student air travel emissions, and to explore students and HEIs awareness of, and willingness to mitigate and/or compensate for these emissions, this study adopted a convergent and integrated parallel strand mixed methods design. This comprised of a cross-sectional survey of 663 international and study abroad students and document analysis and in-depth interviews under the umbrella of eight HEI case studies.

An analysis of UK HE sector statistics, in combination with flight frequencies determined from the student survey, found that student air travel emissions were equivalent to 68% of estates emissions, or 119% when visiting friends and relatives were taken into account. Furthermore, scenario analysis suggested that by 2020/21, increases in these emissions are likely to exceed the reductions achieved in estates emissions unless HEIs reinvigorate efforts to achieve their ambitious reduction targets, and/or there is close to zero annual growth in inbound and outbound student numbers. The findings from the eight case studies revealed that the sector is poorly equipped to respond to the Conflict. This relates to an ongoing focus on, and difficulties achieving, estates emission reductions, varied engagement with indirect (supply chain) emissions, and an unwillingness at the institutional level from the majority of HEIs to engage with the Conflict. To have credibility and be in a position to respond strategically to the Conflict, HEIs should include student air travel emissions in a comprehensive carbon footprint. Moreover, a robust carbon management strategy for the sector should include offsetting due to the limited potential to avoid or reduce these emissions through reduction in air travel consumption. This is evidenced by both responses to the student survey and the importance placed on student mobility by the HEIs. Clearly, there are challenges for organisations who face conflicting

business priorities in responding to the carbon management agenda. Organisations need to account for and engage with indirect emission sources such as employee commuting and business travel, and the emissions associated with products (goods and services). The reluctance and inability to engage with challenges that require a trade-off, or compromise between socio-economic benefits and environmental costs has implications for the achievability of a global reduction in emissions.

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List of Abbreviations and Acronyms

AFOLU	Agriculture, forestry and other land use
AIC	Aviation induced cloudiness
CCL	Climate Change Levy
CDM	Clean Development Mechanism
CDP	Carbon Disclosure Project
CER	Certified emission reduction
CF	Conversion factor
CH_4	Methane
CM	Choice modelling
CMP	Carbon Management Plan
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide equivalent
COP	Conference of the Parties
CRCEES	Caron Reduction Commitment Energy Efficiency Scheme
CS	Corporate sustainability
CSR	Corporate social responsibility
CV	Contingent valuation
DBIS	Department for Business, Innovation and Skills
DECC	Department of Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
DOE	Department of Environment
EEA	European Economic Area
EMR	Estates Management Record
ESD	Education for sustainable development
EU	European Union
EU ETS	European Union Emissions Trading Scheme
FAR	First Assessment Report
FTE	Full-time equivalent
GCD	Great circle distance
GDP	Gross domestic product
GHG	Greenhouse gas
GIS	Gross internal area
GWP	Global warming potential
HE	Higher education
HEFCE	Higher Education Funding Council for England
HEFCW	Higher Education Funding Council for Wales
HEI	Higher education institutions
HESA	Higher Education Statistics Agency
HMSO	Her Majesty's Stationery Office
HFCs	Hydrofuorocarbons
ICAO	International Civil Aviation Organization
INDC	Intended Nationally Determined Contributions

IPCC	Intergovernmental Panel on Climate Change
IT	Information Technology
IUCN	International Union for Conservation of Nature and Natural Resources
KPI	Key performance indicator
LHR	London Heathrow
LULUCF	Land use, land use change and forestry
N_20	Nitrous oxide
NGO	Non-governmental organisation
OECD	Organisation for Economic Co-operation and Development
PCA	Principal component analysis
PFCs	Perfluorocarbons
PG	Postgraduate
PPUL	People and Planet University League
REF	Research Excellence Framework
RF	Radiative forcing
RoW	Rest of the world
RP	Revealed preferences
RQ	Research question
SD	Sustainable Development
SF_6	Sulphur Hexafluoride
SFC	Scottish Funding Council
SP	Stated preferences
TBL	Triple Bottom Line
THE	Times Higher Education
TNE	Transnational education
UG	Undergraduate
UK	United Kingdom
UKCISA	United Kingdom Council for International Student Affairs
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNGA	United Nations General Assembly
USA	United States of America
VFR	Visiting friends and relatives
WBCSD	World Business Council for Sustainable Development
WCED	World Commission on Environment and Development
WMO	World Meteorological Organization
WRI	World Resources Institute
WTP	Willingness to pay

Chapter 1. Introduction

Anthropogenic emissions of greenhouse gases (GHG) are contributing to climate change, where if we continue to emit GHGs on a business as usual basis, global average temperature may increase by over 4°C by 2100 (IPCC, 2013a). Recognising this threat of dangerous climate change, world leaders have adopted a target to limit the temperature increase to 2°C, where to achieve this will require rapid and substantial GHG emissions reductions (IPCC, 2013a; UNFCCC, 2015).

Globally, the higher education (HE) sector can play a key role in facilitating the transition to a more sustainable society. As organisations, HE institutions (HEIs) can be considered analogous to small cities with significant environmental impacts (Klein-Banai and Theis, 2011), where in recent years, many have started to embed sustainable practices into their systems (Lozano et al., 2015). While campus greening is often an area of focus (Müller-Christ et al., 2014), the potential contribution of HEIs is not limited to the operation of their estates, but extends to a wider sphere of influence through their role as educators, researchers, and community leaders (UNESCO, 2012). Indeed, the key role of education in promoting sustainable development has been highlighted in a number of international reports (UN, 1992a, 2012). Education for sustainable development (ESD) is an interdisciplinary approach to teaching and learning aiming to enable everyone to acquire the values, competencies, skills and knowledge to contribute to the transition to a more sustainable society (UN, 2012). ESD encourages students to consider concepts such as environmental stewardship, social justice, and global citizenship and how they relate to their private and professional lives (HEA/QAA, 2014).

Promoting global citizenship is a key aspect of ESD, given that we live in an increasingly interconnected world comprising of related environmental, social and economic systems. It is important that students are aware of the wider world and recognise their own role in the global community (Rieckmann, 2012). Moreover, the major issues facing the planet (e.g. climate change, global poverty, etc.) will require an innovative generation with a global perspective to find solutions (Rieckmann, 2012). This new global context is forcing

HEIs to reconsider their mission, tasks and responsibilities and engage with internationalisation, providing students with a global learning experience (Gacel-Avila, 2005). The recruitment of international students and study abroad schemes have been a fundamental aspect of the internationalisation agenda in the UK HE sector and it is clear that HEIs will continue to place significant importance on student mobility going forward (Robson, 2011; DBIS, 2013).

1.1 The research problem

While the recruitment of international students and promotion of study abroad for UK students provides significant benefits, not only in promoting global citizenship, but also financially for HEIs, there are significant carbon consequences in terms of emissions from air travel. Thus, there are conflicting priorities with regard to the UK HE sector's internationalisation and sustainability/carbon management agendas (hereafter referred to as 'the Conflict', presented in Figure 1.1). This is one example of the sustainability/carbon management agenda in the sector competing with other interests, where these include increasing energy-intensive research activity and increasing the size of estates.

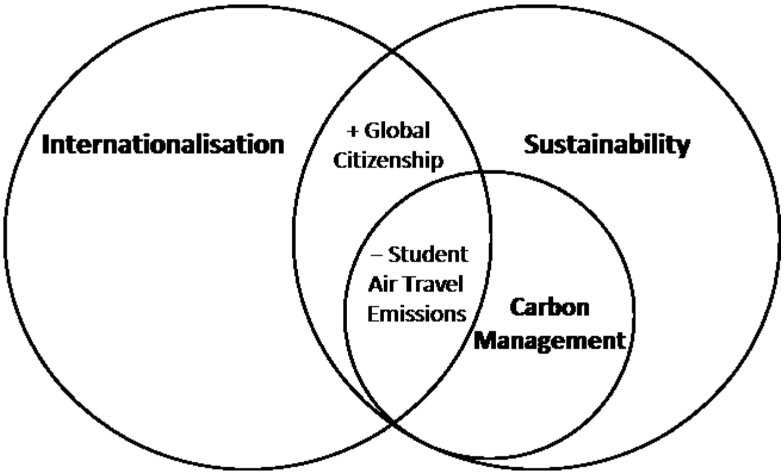

Figure 1.1. Model demonstrating the Conflict between the HE sector's sustainability/carbon management and internationalisation agendas

The Higher Education Funding Council for England (HEFCE) acknowledges the Conflict between the sustainability/carbon management and internationalisation agendas within its sustainable development strategy (HEFCE, 2014: 3-4):

> *…over the last 10 years there has been an increasing recognition of the need to educate our students to become 'global graduates'. Often this has meant providing UK students with opportunities to travel overseas to study at partner institutions, conduct research, or contribute through voluntary work to community development in another country. Similarly, international students, who bring so much to life on UK campuses, have to travel in order to study here. But air travel in particular has a carbon cost associated with it.*

However, they do not offer any solutions or recommendations beyond providing guidance to measure emissions (HEFCE, 2010b). Similarly, while previous articles and reports have identified the Conflict (Fawcett, 2005; Roy et al., 2008; Dvorak et al., 2011; Long et al., 2014; Mazhar et al., 2014), there is no prior research from a UK perspective exploring institutional and student responses. The Conflict between internationalisation and sustainability/carbon management is a prime example of the challenges that organisations across all sectors of the economy can face in responding to the sustainability agenda and the need to account for the environmental impacts of their operations alongside the economic and social benefits.

Engagement with student air travel emissions may prove challenging for (or be challenged by) HEIs for a number of reasons. Firstly, given that there are minimal alternatives to air transport, these emissions are expected to increase in line with the continued internationalisation of the sector and the drive to increase inbound and outbound student numbers (Dvorak et al., 2011; Hale et al., 2013; Long et al., 2014). Secondly, questions can be asked regarding responsibility for the associated emissions. The GHG Protocol Corporate Standard (WBCSD/WRI, 2004) is the most highly regarded GHG assessment guidance, however it is potentially open to interpretation regarding whether or not student air travel emissions are attributable to HEIs. Thirdly, accurately accounting for the emissions associated with student air travel relies on a robust methodology and robust data. While HEFCE provide guidance (HEFCE, 2010b) on accounting for student air travel emissions, a number of assumptions within it can be questioned, particularly regarding flight frequency.

This research explores the potential conflict between the internationalisation and carbon management agendas in the UK HE sector. Importantly, the research develops an improved methodology for accounting for student air travel emissions and establishes the current and potential future carbon impact of international student air travel. Furthermore, the research explores the views that key stakeholder groups hold towards the internationalisation and carbon agendas, including benefits and challenges, the extent to which the Conflict has been considered, and attitudes towards a range of potential mitigation and compensatory activities.

The intended outcome of this research is to provide best practice guidance for HEIs and to inform HEFCE policy so as to enhance corporate social responsibility policies and contribute to improved environmental sustainability across the UK HE sector. This research is therefore exploratory in nature and framed by the following aim:

To critically evaluate the inherent conflict between the carbon management and internationalisation agendas in the UK HE sector.

1.2 Thesis outline

Figure 1.2 displays the overall structure of the thesis. Chapter 2 provides context to the thesis by reviewing literature on sustainable development, climate change and carbon management, sustainability in HE, internationalisation in HE and finally, carbon management in HE. The research objectives and associated research questions are then presented, along with the research framework.

Chapter 3 presents the research methodology, beginning with a discussion of the philosophical paradigm that explains the reasoning behind the choice of research design and strategies of enquiry. This study employed a mixed methods research design and utilised both a dominantly quantitative cross-sectional survey strategy and a dominantly qualitative case study strategy.

Chapter 4 reports student flight frequency results from the survey and evaluates both the robustness of sector accounting guidance and the potential significance of student flight emissions to the carbon footprint of the UK HE sector.

Chapter 5 presents the results from the second part of the survey, exploring students' perceptions of responsibility for air travel emissions and their views on a range of options to mitigate or compensate for these emissions.

Chapter 6 presents four UK HEI case studies and appraises institutional awareness of and willingness to engage with the Conflict. The subsequent Chapter 7 sought verification for the emerging themes by reference to four additional case studies.

Finally, Chapter 8 draws together the findings from the two strands and presents the conclusions, including contribution to knowledge and practical implications for HEIs to encourage proactive engagement with the Conflict.

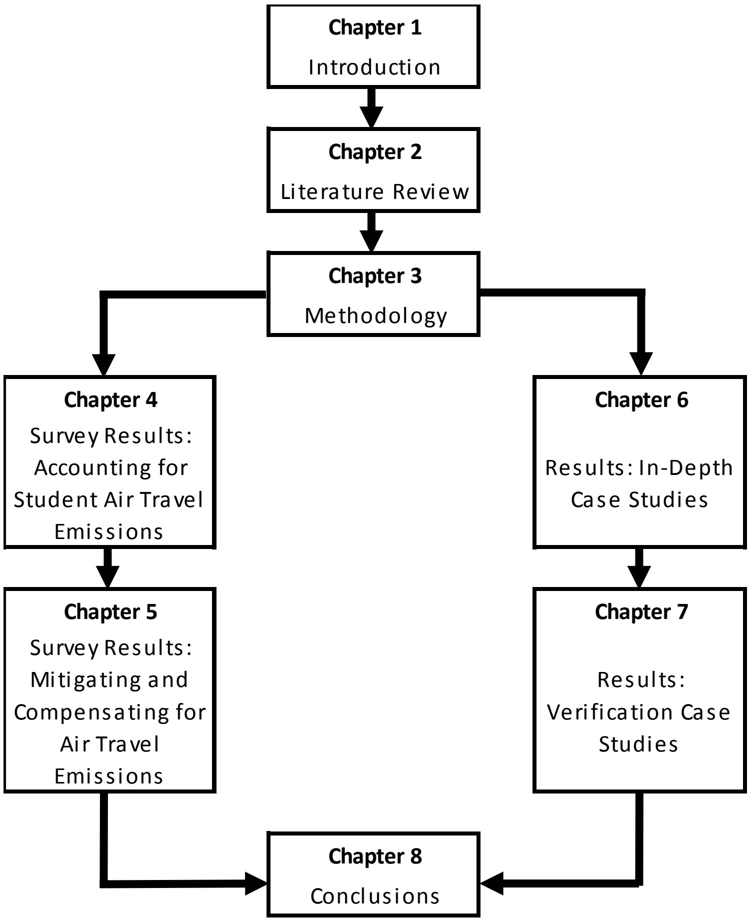

Figure 1.2. Thesis outline

1.3 Contribution to knowledge

This research is both novel and timely, particularly with the recent adoption of the Paris Agreement (UNFCCC, 2015) and the commitment to limit global average temperature to well below 2 °C above pre-industrial levels. To achieve this aim will require stringent cuts in GHG emissions from every sector of the economy.

The main contribution of this research is the in-depth exploration of the Conflict between the carbon management and internationalisation agendas from the perspective of both the students and the HEIs. From a practical perspective, this thesis is particularly useful for Environment/Sustainability Managers in HEIs who are looking towards accounting, managing and reporting student air travel emissions. The thesis presents, (a) justification for inclusion of student air travel emissions within the operational boundary of the HEI, (b) a methodology for calculating emissions, and (c) potential mitigation and compensation options.

An article examining the potential significance of emissions arising from the air travel of students (Chapter 4) has been published in the peer-reviewed journal *Carbon Management* (see Appendix 14 for the full paper). In addition, elements of the research were presented at a number of conferences, also presented in Appendix 14.

Chapter 2. Literature Review

2.1 Introduction and chapter outline

This chapter presents a review of the literature pertaining to carbon management in higher education, placing it within the broader context of sustainable development and corporate social responsibility. Section 2.2 first examines the history and evolution of the concept of sustainable development, with Section 2.3 exploring the corporate response to sustainability. Section 2.4 then examines the specific issue of climate change, briefly outlining the scientific evidence for climate change before focusing on the policy response and carbon management. Section 2.5 moves on to explore sustainability in higher education and the apparent conflict with the internationalisation agenda (examined in Section 2.6) with Section 2.7 focusing on carbon management in higher education. Finally, Section 2.8 presents a summary of the literature review along with the aims and objectives of the study.

2.2 Sustainable development

2.2.1 Introduction: Evolution of the concept of sustainable development

It was the writings of the eighteenth century economist Thomas Malthus that first led to a debate on the resource-population nexus (Malthus, 1798). Malthus warned of the potentially dire consequences of the human population growing exponentially while farmland grew at a constant rate year on year (Malthus, 1798). While the 19th century saw food shortages and malnutrition, the technological advancements of the 20th century and cheap fossil fuel energy, ensured that agricultural production also increased exponentially thus averting the predicted famine (Hall and Day, 2009).

The industrial revolution and exploitation of fossil fuels paved the way for the human population to experience unprecedented growth over the last hundred years. During this time, the natural environment was seen as external to humanity and so suffered severe degradation and exploitation (Hopwood et al., 2005). It was concern about the magnitude and pace of this environmental degradation and resource use that led to questions in the

1960/70s about the longer-term viability of the current model of economic growth and development.

Rachel Carson's book *Silent Spring* (Carson, 1962) was one of a number of influential publications of the time that drew attention to human impacts on the natural environment. *Silent Spring* helped to expose the detrimental effects on the environment, particularly on bird populations, caused by the indiscriminate use of pesticides, and in turn brought attention to environmental issues not previously considered (Carson, 1962). The main concept of *Silent Spring* was that a technology intended to better the condition of the human race actually had unintended and unpredicted negative consequences (Dresner, 2008). Carson's book helped to bring attention to the fact that humanity's actions had implications not just on a local scale but on a global scale, given that traces of pesticides were found in the Antarctic, thousands of miles away from their source (Carson, 1962).

In the second half of the 20th century, after a period of industrialisation, urbanisation and globalisation, people were beginning to realise that humans are a part of, and rely upon, nature (McCormick, 1991). It was becoming increasingly obvious to groups within society that environmental damage and degradation, the human population, poverty and resource shortages, were increasing at a scale that could not be continued in the long-term (Bartlett, 2006). Questions about the acceptability of conventional growth models were raised, which led to some quarters calling for a zero-growth strategy (Baker et al., 1997). An important inspiration for this argument was the publication of a report commissioned by the Club of Rome in 1972, entitled *The Limits to Growth* (Meadows et al., 1972).

The *Limits to Growth* were based on computer models designed to specifically investigate increasing industrialisation, exponential population growth, widespread malnutrition, resource scarcity and a deteriorating environment (Meadows et al., 1972). The authors stressed that the model was not a prediction of what will happen, but an exploration of what might happen with current trends. It was limited in that it did not take into account changes in social variables, income distribution, attitudes about family size, and choices about food and goods, instead assuming that these variables would follow a pattern similar to that of recent history.

The model forecast that if present trends in population, pollution, food production and resource depletion continued, then the limits to growth would likely be reached at some point within the next hundred years and a sudden decline in the human population and industrial capacity would ensue (Meadows et al., 1972).

A series of alternative future scenarios were also examined, incorporating changes in nuclear power, recycling, mining, increasing food production and crop yields, but again the result was still an end to growth before the year 2100. Only when the authors modelled zero population growth and zero capital growth along with efficiency improvements and investment in agriculture, did the model give a stable state at a European average standard of living (Dresner, 2008). However resources would still gradually deplete, but at a rate where there would be time for technology and industry to adjust (Dresner, 2008).

While the report was generally well received by the public, it was critiqued by some members of the scientific community, particularly with regard to the assumptions surrounding the rate of technological innovation and availability of physical resources made by the authors (who were of an essentially Malthusian persuasion) being too pessimistic (Dresner, 2008). Cole et al. (1973) re-ran the model using an assumption of continual exponential increases in resource stocks (through technological advances in resource extraction and increased recycling rates). Unsurprisingly they produced different results, suggesting any physical limits were much more distant. Nevertheless, they agreed with Meadows et al. (1972) that indefinite physical growth cannot continue on a finite planet. On more recent analysis of the model's forecasts, Hall and Day (2009: 235) found that the original results "…are almost exactly on course some 35 years later in 2008". In addition, Bardi (2011) concluded that the warnings from 1972 are becoming increasingly worrisome as actual figures over the last 30 years follow closely with the forecasts from Meadows et al. (1972).

The environmental issues that were coming to light in the 1970/80s, e.g. acid rain, global warming and ozone depletion, as well as the oil crisis at the time, were all adding to the theory of the Earth reaching its limit in terms of being able to support the human population and economy (Hall and Day, 2009). There was a growing feeling that the model's forecasts and the theory of limits to growth were already a reality. Nonetheless, many, particularly economists, were not willing to accept the view that there is a limit to economic growth resulting from constraints imposed by the natural environment (Hall and Day, 2009). Although they did not dispute that high value resources were being depleted, they took a technocentric approach, belief in technology to overcome environmental problems (O'Riordan, 1985), and argued that technical innovation and resource substitution, driven by market incentives, should ensure that resources do not run out and would continue to solve the longer-term environmental issues (Hall and Day, 2009).

The argument over the viability of the model of economic growth at that time meant that the 1970s and 80s saw environmentalists and the pro-growth lobby at loggerheads and there was a tendency to, "…view industry and the environment as mutually antagonistic" (Elkington and Burke, 1989: 245). A shift in the fundamental basis of the discussion occurred when the term 'sustainable development' was first introduced internationally in 1980 with the publication of the International Union for Conservation of Nature and Natural Resources (IUCN) *World Conservation Strategy* (IUCN, 1980). The goal of the strategy was (IUCN, 1980: Chapter 1, p.4):

> *The integration of conservation and development to ensure that modifications to the planet do indeed secure the survival and well-being of all people.*

The World Conservation Strategy highlighted the importance of the integration of development and conservation, which, up until this point had been represented as being incompatible with one another. The strategy first introduced many of the proposals associated with the concept of sustainable development, particularly in the identification of the causes of habitat destruction and the emphasis it placed on incorporating conservation into development planning from the start (Dresner, 2008). However, according to Baker et al. (1997) the World Conservation Strategy was limited in the sense that it focused on ecological sustainability rather than linking sustainability to social and economic issues.

2.2.2 The Brundtland formulation of sustainable development

Although the term sustainable development started to gain some recognition in 1980, it was not until the 1987 UN sponsored report *Our Common Future* (the Brundtland Report, as it has come to be known, after the Chairperson Gro Harlem Brundtland; WCED, 1987), that the term was popularised (Baker, 2006). Since then the term has acquired preeminent status in many environmental policies (Zaccai, 2012). The Commissioners of the report sought to find common ground between environmentalists, who were advocating zero-growth strategies, and economists, particularly from the Third World, who argued the need for development to alleviate poverty in their countries (Mitcham, 1995). Therefore, the emphasis of the report was placed on harmonisation between economic growth and environment (Ekins, 1993), something that the World Conservation Strategy had not done. The report utilised systems theory, suggesting that ecological, social and economic systems are interrelated and connected components that form a complex whole, and called for a "…new era of economic growth – growth that is forceful and at the same time socially and environmentally sustainable" (WCED, 1987: 14). The Brundtland Report defined 'sustainable development' as (WCED, 1987: 24):

> *Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*

Underpinning this definition of sustainable development are a number of key concepts, the first being the requirement that the basic needs of all humans are met, as the report recognises that a healthy environment is not possible when there is extreme poverty in the world (c.f. hierarchy of needs; Maslow, 1943), and the second being environmental limits. In order for standards of living in the 'Global South'[1] to be comparable to the 'Global North', the world economy would need to expand by a factor of 5-10 (WCED, 1987). However, economic growth of this scale using current technologies would be ecologically impossible, especially if the increases were based on fossil fuels (WCED, 1987). The Commission stated the answer must be improving energy efficiency and increases in the efficiency of production in terms of resource use and waste (WCED, 1987). The Brundtland approach presents sustainable development as a model of social change (Baker, 2006). It

[1] The 'Global South' or 'South' refers to developing countries that are primarily in the Southern Hemisphere, including countries from Africa, Caribbean, Central America, South America, Asia (excluding Japan) and Oceania (excluding Australia and New Zealand). The 'Global North' or 'North' refers to developed countries, primarily in North America and Europe but includes Japan, Australia and New Zealand (UN, 2014).

emphasised the need for intra- and inter-generational equity and recognised that the industrialised world is driven by wants, not needs, and challenged it to reduce its consumption to stay within boundaries set by ecological limits and by considerations of equity and justice (Baker, 2006). This societal change in understanding needs and wants, and what is needed to have a good life allows necessary development in the Global South (Baker, 2006). With respect to limitations, although the Commission broadly supports economic growth, this growth must be bound within the environment's ability to meet present and future needs (WCED, 1987: 24):

> *The concept of sustainable development does imply limits - not absolute limits but limitations imposed by the present state of technology and social organization on environmental resources and by the ability of the biosphere to absorb the effects of human activities. But technology and social organization can be both managed and improved to make way for a new era of economic growth.*

The report argues the need to shift from thinking about the economy affecting the environment to thinking about the environment influencing the economy. Sustainable development grew out of the realisation that resource depletion and environmental degradation could undermine the economy (Gupta, 2002). Therefore, the concept of sustainable development provided by the Brundtland Report provides a framework for which economic development and environmental protection could be integrated and mutually reinforcing, thus breaking the perception of the preceding decades that protecting the environment could only happen if economic growth was curbed (Baker et al., 1997).

Although the WCED's definition of sustainable development is brief, to drive forward interdependent environment and development policies that follow from the concept of sustainable development, the Commission gave the following operational objectives (WCED, 1987):

- Reviving growth;
- Changing the quality of growth;
- Meeting essential needs for jobs, food, energy, water, and sanitation;

- Ensuring a sustainable level of population;
- Conserving and enhancing the resource base:
- Reorienting technology and managing risk; and
- Merging environment and economics in decision-making.

2.2.3 Sustainable development: a contested concept

The Brundtland Report focussed on the economic and social needs of humans (Robinson, 2004; Hopwood et al., 2005; Imran et al., 2014), and was thus anthropocentric in character:

> *Our message is, above all, directed towards people, whose well-being is the ultimate goal of all environment and development politics (WCED, 1987: 16).*

The report not only emphasised economic growth was a priority for society, but advocated a five or even ten-fold increase in global manufacturing output to meet the needs of less developed countries (Richardson, 1997) and called for greater improvements in technology and efficiency (Robinson, 2004).

Critics argued that the fundamental contradiction between the call for greater levels of conservation and a renewed call for economic growth in developing nations would thwart steps towards sustainability (Daly, 1990; Sneddon et al., 2006). Richardson (1997) argues that in order for developing countries to grow and increase consumption within ecological limits, developed countries will be required to reduce their consumption. However, as Richardson (1997) propounds, it is difficult to envisage people voluntarily accepting reduced standards of living and even more difficult to envisage traditional politicians advocating such an approach.

Some viewed the report and the definition of sustainable development as a 'catch-all' definition which left everyone happy, was an excellent political slogan, but on deeper analysis was based on an ambiguity of meaning in order to gain widespread acceptance (Baker et al., 1997; Giddings et al., 2002). The term has been described as an oxymoron, due to development, as currently conceived (i.e. continued economic growth), contradicting what a sustainable existence (living within the carrying capacity of the planet) should be (Robinson, 2004). Much of what is conventionally called ‘development’, in reality equates to the Western way of life of additional consumption to meet wants rather than needs (Dresner, 2008), and raises questions about what needs to be sustained and over what time period (Tilbury and Fien, 2002). As Richardson (1997) identified, the problem is that human activity is already exhausting non-renewable resources, is using renewable resources faster than the planet can regenerate them and producing pollution beyond the carrying capacity of the Earth.

The technocentric approach adopted by Brundtland did not fully overcome the differences in values between ecologists and economists (Dresner, 2008). More radical ‘greens’ argued for profound changes in social thought and values and a move away from the belief that the human race has top priority, able to dominate nature through technological and scientific development (Giddings et al., 2002). Therefore, there is no single worldview of sustainable development, rather, multiple concepts as shown in Figure 2.1, polarising around a focus on the anthropocentric stance (weak sustainable development) and ecocentric stance (strong sustainable development) (Thompson and Barton, 1994).

Figure 2.1. Spectrum of worldviews of sustainable development

Anthropocentrism bases its approach to sustainable development on the belief that humans are the most important life form, and thus values nature based on its usefulness to humans (Thompson and Barton, 1994). The anthropocentric position can be traced back to the industrial revolution of the eighteenth and nineteenth centuries and the development of a technocentric approach towards nature (Richardson, 1997). Those holding a technocentric perspective towards the natural world believe humans have control over nature and although they accept environmental problems exist, they argue that technology can overcome them (O’Riordan, 1985). By prioritising economic growth, transformation of current social and economic systems is not supported, and great emphasis is placed on technology and economic tools (Tilbury and Fien, 2002). This aligns with a 'weak' approach to sustainable development (Dresner, 2008) and the neoclassical economists' perspective, who argue that improvements in environmental quality are fully compatible with economic growth (Hussen, 2013).

Ecocentrics on the other hand, argue that nature has a value in its own sake, value aside from its usefulness to humans (Thompson and Barton, 1994; Kortenkamp and Moore, 2001). The ecocentric philosophy deems "humans as a part of nature, not above it; that all life forms, of which humankind is only one, are interconnected in a self-sustaining biosphere" (Richardson, 1997: 44). This philosophy aligns with those advocating a 'strong' approach to sustainable development, focussing on ecological limits and social equity (Palmer et al., 1997). Strong sustainable development is used to describe the ecological economics approach to sustainable development (Hussen, 2013). Those within this group remark that resources are scarce, consumption cannot be continued indefinitely, natural resources should be used within the carrying capacity of the Earth and environmental capital should remain constant (non-declining natural capital) (Lozano, 2008). This is to ensure that the next generation inherits a stock of environmental assets no smaller than that received by the previous generation (Hussen, 2013). Proponents of strong sustainable development (e.g. Meadows et al. (1972), Daly (1990)) question models that are predicated on assumptions of unlimited economic growth and believe the focus must be on development rather than growth (Tilbury and Fien, 2002). According to Daly (1990), quantitative growth in populations and commodities must ultimately end; nevertheless, qualitative improvement can happen under a sustainable development regime. Furthermore, Daly (1990) argues that the 5-10 fold increase in the size of the economy, deemed imperative by Brundtland, requires an enormous growth of throughputs and would ultimately be ecologically devastating.

In terms of intergenerational equity, the idea of leaving capital stock unchanged (as a minimum), i.e. the following generation has at least much capital at its disposal as the preceding generation, is widely accepted by everyone. A defining characteristic of the neoclassical approach to sustainable development is the belief that natural capital can be substituted by human and manufactured capital in order to make the transition to a more sustainable society (Hussen, 2013). This assumption is a source of lively debate between ecological and neoclassical economists (Hussen, 2013), and how intergenerational equity is to be achieved. Strong sustainable development argues that manmade capital and natural capital are complementary but not interchangeable (Costanza et al., 1997) and that manmade substitutes cannot replicate natural processes, or 'critical natural capital' (Dresner, 2008), for example, the role of the ozone layer or rainforests (Hopwood et al., 2005). Thus, the concept of sustainable development represents a shift in thinking of humanity's place on the planet, but it is open to a wide spectrum of interpretation. Due to the anthropocentric nature of the Brundtland formulation of sustainable development, some have reverted to using the term 'sustainability' instead, which is perceived to have more of a focus on the social aspect of what a sustainable society would look like (Palmer et al., 1997). It is common to find the terms used interchangeably, but Lozano (2008) argues that they are inherently different stating that sustainable development is the path or journey towards sustainability.

There is consensus within the literature in conceptualising sustainable development from an integrational perspective, often represented as three interlocking circles (Figure 2.2a) or nested circles (Figure 2.2b), encompassing economic development, social equity and environmental protection. While the pillars of sustainability model (Figure 2.2c) is also a common conceptualisation, it fails to portray the integrative nature of sustainable development. When examining an interpretation of sustainable development it is important to bear in mind the philosophy underlying peoples' point of view (Giddings et al., 2002). Moreover, these underlying worldviews influence the amount of emphasis placed on each pillar or circle, and the choices about which policies should be implemented and actions taken (Giddings et al., 2002). For example deep ecologists' principal concerns are for the environment, while human needs come very much second (Hopwood et al., 2005).

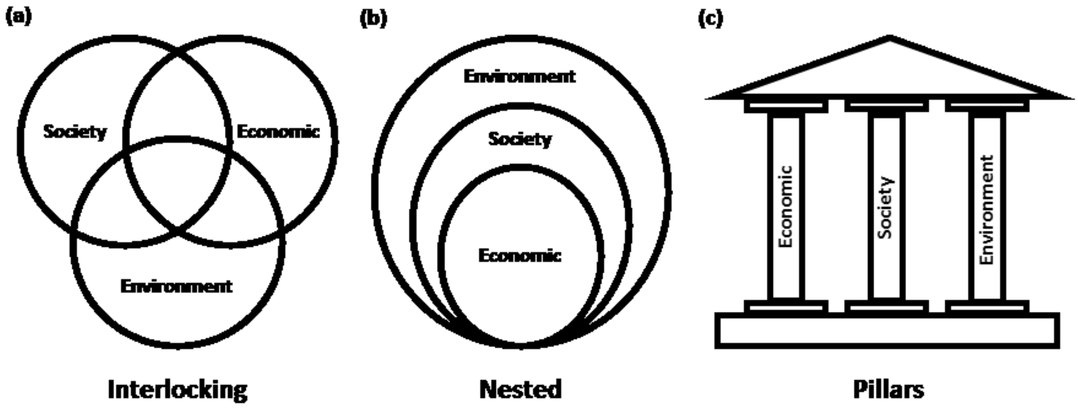

Figure 2.2. Three models of sustainability

The researcher advocates the view of Lozano (2008) and takes a holistic perspective of sustainable development. This perspective proposes two dynamic and simultaneous equilibria, the first among economic, social and environmental sustainability, and the second amongst intergenerational aspects (short-, medium- and long-term perspectives) (Lozano, 2008). Thus, understood in a holistic form, sustainable development is a multidimensional model of development that, from a short-, medium- and long-term perspective, limits economic growth and other human activities to the capacity of the Earth for self-regeneration. Moreover, sustainable development places social equity and human development as its primary goal, and places environmental protection and limits of nature at the core of any economic or political strategy (Nieto, 1999). Adding to this perspective, sustainable development is not a fixed state, but instead, a process of change to a more sustainable society (WCED, 1987). Finally, the researcher prefers to view sustainable development as a nested model; the global economy serves society, which lies within Earth's carrying capacity (Griggs et al., 2013).

2.2.4 Summary: The legacy of Brundtland

There is a recognition that current patterns of human activity and consumption cannot continue going forward, and that if we were to pursue a 'business as usual' path, this would lead to intolerable consequences (Heal, 1998).

The concept of sustainable development is open to interpretation and is clearly an area of contention (Hopwood et al., 2005). Nevertheless, the Brundtland understanding of the concept, as a challenge to the conventional form of development, has achieved a respected and commanding status, with an increasing number of parties adhering to at least some, or more often than not, most or all of its objectives (Baker, 2006).

The Brundtland concept of sustainable development has become instrumental in developing a global view with respect to the planet's future and constituted a major political turning point for the concept of sustainable development (Mebratu, 1998). It represents a shift in understanding of humanity's place on the planet (Hopwood et al., 2005). Arguably, the central message of the Brundtland Report was that, at the global level, environmental problems could not be successfully addressed in isolation from human problems of poverty and development (Robinson and Herbert, 2001). Moreover, two key concerns were recognised by the Brundtland Report, firstly, a recognition of the long-term impact of resource and environmental constraints on development and consumption patterns. Secondly, a concern for the well-being of future generations, particularly with respect to their ability to access natural resources (Heal, 1998).

2.3 Sustainable development and the corporation

2.3.1 Introduction

This section examines corporate social responsibility (CSR) and corporate sustainability (CS), including conceptualising both concepts, identifying the motivations for corporate sustainability and exploring the influence of stakeholders, external factors and internal organisational capabilities on the environmental performance of corporations.

2.3.2 Corporate social responsibility

In the 1980s the corporation[2] was viewed as having responsibility only to its shareholders, however since the early 1990s, a more stakeholder-based view (stakeholder theory) has

[2] "Corporations are the most common form of business organisation, and one which is chartered by a state and given many legal rights as an entity separate from its owners" (InvestorWords, 2016).

come to the fore (Hubbard, 2009). Stakeholder theory suggests that corporations must also give consideration to "…any group or individual who can affect or is affected by the achievement of the organisation's objectives" (Freeman, 1984: 46). Given the influence of various stakeholders, there has been a shift in corporate behaviour, moving away from the neo-classical model (Figure 2.3a), which focuses on short-term profit maximisation and as such, its behaviour is an outcome of the economic incentives impinging upon it, to a socio-economic model (Figure 2.3b) (Tomer, 1992). The socio-economic model of the firm's behaviour incorporates the influence from a wider range of stakeholders (e.g. consumers, local communities, etc.) and internal organisational capabilities (Tomer, 1992). These stakeholders can exert pressure on firms to adopt principles of CSR that improves their social and environmental performance (Darnall et al., 2010).

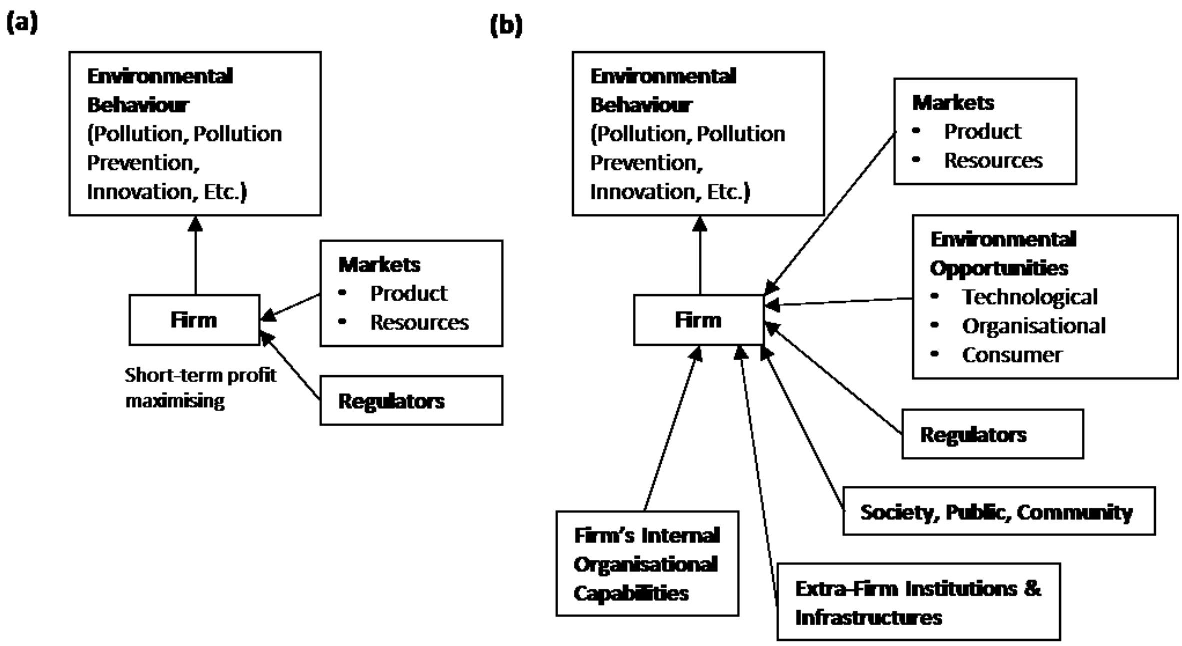

Figure 2.3. (a) The neoclassical model of the firm's environmental behaviour. (b) The socio-economic model of the human firm's environmental behaviour (adapted from: Tomer, 1992)

A number of common themes emerge from a review of the various definitions and principles of CSR found in the literature:

- CSR is action taken over and above legal requirements (McWilliams and Siegel, 2001; DBIS, 2014);

- Therefore, CSR is voluntary (Marrewijk, 2003; DBIS, 2014).
- CSR refers to the obligations of the corporation to society (specifically, the corporation's stakeholders) (Smith, 2003).
- Actions that further some social good, beyond the interests of the corporation (McWilliams and Siegel, 2001).
- CSR focuses on areas of relevance to the corporation's sphere of operations (ECRC, 2016).
- CSR is about the core behaviour and values of the corporation, and responsibility/accountability of the corporation for the totality of its impacts (Frederick et al., 1992; Marsden, 2001; Marrewijk, 2003).
- CSR involves constructive engagement with stakeholders, creating shared value for both the corporation and society (DBIS, 2014).
- A socially responsible business is profitable (Marsden, 2001).

In summary, CSR encompasses "…the economic, legal, ethical, and discretionary expectations that society has of organisations at a given point in time" (Carroll, 1979: 500). It appears that CSR as a concept will continue to remain an essential part of business language. Indeed, as (Carroll, 1999: 292) states, "…at its core, it addresses and captures the most important concerns of the public regarding business and society relationships".

2.3.3 Corporate social responsibility and corporate sustainability

CSR is a cluster concept which acts as an umbrella term, overlapping with some, and being synonymous with other concepts regarding business-society relations such as business ethics, corporate philanthropy, corporate citizenship, CS and environmental responsibility (Matten and Moon, 2007, 2008). Although the terms CSR and CS are sometimes used interchangeably in the literature, Steurer et al. (2005) present three distinct differences:

1. **CSR is very specific and depends more heavily on stakeholders' claims.** CS is a guiding model, dependent upon society's interpretations, while CSR is a voluntary management approach where stakeholders play a prominent role.

2. **The temporal scope of CSR does not go as far as CS.** CSR is about meeting the demands of current stakeholders, while CS extends to the needs of future stakeholders.
3. **The concepts have different historical perspectives.** While CSR and CS integrate economic, social and environmental perspectives, this was not always the case. In the 1980s, CS grew out of the environmental dimension (e.g. IUCN, 1980), while CSR initially focused on issues such as human rights and working conditions.

2.3.4 Conceptualising corporate sustainability

When transposing the Brundtland concept of sustainable development to the corporate level, Dyllick and Hockerts (2002: 131) define CS as "meeting the needs of a firm's direct and indirect stakeholders (such as shareholders, employees, clients, pressure groups, communities etc.) without compromising its ability to meet the needs of future stakeholders as well". Montiel (2008), in his review of the definitions of CS in the literature, found that some researchers identify CS within the environmental sustainability dimension of business (e.g. Shrivastava, 1995), while others (e.g. Bansal, 2005) follow the Brundtland definition, identifying CS as a three dimensional concept (society, environment and economy).

As discussed above (Section 2.2.2), the Bruntland Report called for increased efficiency in order to support economic growth and raise living standards in the Global South without causing environmental harms. For businesses, this is known as eco-efficiency; a management philosophy that encourages businesses to reduce their impact on the environment whilst simultaneously meeting the needs of society and achieving economic benefits (WBCSD, 2016):

> *Eco-efficiency is achieved by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life-cycle to a level at least in line with the Earth's estimated carrying capacity.*

The World Business Council for Sustainable Development (WBCSD) has placed eco-efficiency at the heart of its response to the sustainability agenda (Mebratu, 1998) and

Benn et al. (2014) suggest a growing awareness in corporations to the advantages of engaging with eco-efficiency. Therefore, many organisations and corporations have opted for eco-efficiency as their guiding principle (Gladwin et al., 1995; Dyllick and Hockerts, 2002; Benn et al., 2014).

However, improvements in efficiency can lead to cheaper prices for goods, which in turn increase demand and consumption. The negative environmental impacts associated with this increased consumption could exceed gains created by eco-efficiency (Steiner and Posch, 2006). Young and Tilley (2006) reason that using eco-efficiency as a way of protecting the environment is not a long-term solution to the environmental challenges facing humankind as making a destructive system less destructive only serves to let industry deplete nature more slowly. Indeed, eco-efficiency does not target the root cause of the problem; consumption and lifestyle choice, but tends to reinforce economic logic (Steiner and Posch, 2006), thus it is a technical fix that ignores the social dimensions of sustainability (Robinson and Herbert, 2001). Because of this, many have argued that it is not legitimate to state that CS is made up of improved eco-efficiency alone (Gladwin et al., 1995; Dyllick and Hockerts, 2002; Robinson, 2004; Steiner and Posch, 2006). Rather, eco-efficiency is one aspect of the sustainable development agenda (Dyllick and Hockerts, 2002), a necessary pre-requisite for full sustainable development, but not sufficient in itself (Gladwin et al., 1995). Indeed, the Brundtland Report stated that "…energy efficiency can only buy time for the world to develop low-energy paths based on renewable sources" (WCED, 1987: 10).

Elkington (1997) provided a practical definition of sustainable development for organisations through introducing the concept of the "Triple Bottom Line" (TBL), which has been embraced by the business world (Norman and Macdonald, 2004). The idea behind the TBL is that a corporation's ultimate success or health should be measured not just by the traditional financial bottom line (economic sustainability), but also by its social and environmental performance (Norman and Macdonald, 2004). As the phrase 'bottom line' suggests, it originates from management science and is seen as a way to operationalise CS (Kuhlman and Farrington, 2010).

Building on the TBL concept, Dyllick and Hockerts (2002) discuss moving beyond eco- and socio-efficiency (the business case for sustainability), towards eco- and socio-effectiveness, sufficiency and ecological equity (Figure 2.4a). While they agree that eco- and socio-efficiency are valuable tools, they reiterate the point discussed above that efficiency only leads to relative improvements (Dyllick and Hockerts, 2002). For example, transitioning from eco-efficiency to eco-effectiveness in the motor industry would involve moving from increasing fossil fuel efficiency to improving the effectiveness of electric cars (Dyllick and Hockerts, 2002). Moving from socio-efficiency to socio-effectiveness requires businesses to focus not just on its customers, but also on having a positive impact on society, for example, fair trade companies that focus on helping marginalised producers in developing countries achieve better trading conditions (Young and Tilley, 2006). However, as Shrivastava (1995) notes, corporations are only one of the actors involved in making the transition to a more sustainable society, consumers also have a significant role in terms of reducing consumption (sufficiency). Finally, the concept of ecological equity links to intergenerational equity discussed in Section 2.2, the idea that the following generation has at least as much natural capital at its disposal as the preceding generation. If social sustainability is to be achieved, then an equitable solution for the distribution of natural capital needs to be found (Dyllick and Hockerts, 2002).

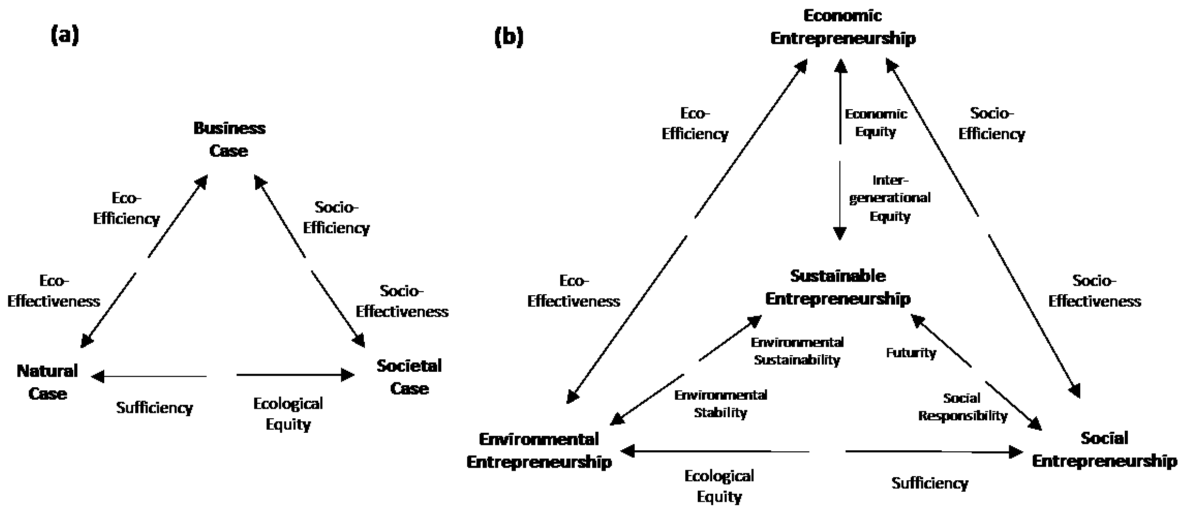

Figure 2.4. (a) Overview of six criteria for CS (source: Dyllick and Hockerts, 2002). (b) The sustainable entrepreneurship model (adapted from: Young and Tilley, 2006)

Young and Tilley (2006) sought to advance Dyllick and Hockerts' (2002) conceptualisation of CS and present a model of sustainable entrepreneurship (Figure 2.4b). The sustainable entrepreneurship model incorporates a number of two-way relationships, in line with Dyllick and Hockerts' (2002) model:

- The relationship between economic and sustainable entrepreneurship involves economic equity, which is promoting the equal distribution of wealth on an intra- and inter-generational time scale.
- The relationship between environmental and sustainable entrepreneurship involves environmental stability, referring to efforts to counter current environmental challenges e.g. climate change, as well as environmental sustainability, which involves taking into account the long-term sustainability of the environment during decision-making.
- The relationship between social and sustainable entrepreneurship involves taking responsibility and being accountable for both negative and positive impacts on society now and in the future, in addition to taking into account the welfare of future generations during decision-making.

Ultimately, sustainable entrepreneurship is all 12 elements of the model working in unison and it cannot be achieved by subscribing to only social or environmental entrepreneurship (Young and Tilley, 2006).

2.3.5 Motivations for corporate sustainability

The main motivations for CS (as well as CSR) that emerge in the literature can be grouped under the terms enlightened self-interest, legitimacy, and moral responsibility (Keim, 1978; Bansal and Roth, 2000; Garriga and Melé, 2004; Buhr, 2006; Hahn and Scheermesser, 2006; Porter and Kramer, 2006; Brønn and Vidaver-Cohen, 2008; Ihlen, 2009; van der Laan, 2009; Carroll and Shabana, 2010; Windolph et al., 2014; Lozano, 2015; Schaltegger and Hörisch, 2015). These are discussed in turn below.

Corporations can engage with sustainability with the expectation that the benefits (e.g. cost reduction and profit maximisation, reputation management and improvement, enhanced stakeholder relationships, etc.) exceed the costs of engaging, and a business case for sustainability is made (Carroll and Shabana, 2010). Thus, CS is simply a question of enlightened self-interest (Keim, 1978), since it is ultimately an instrument for profit maximisation (measured by the value of the share price) and the strategic goal of gaining competitive advantage in the long-term (Garriga and Melé, 2004).

Legitimacy theory suggests that corporations are continually looking to ensure they operate within the bounds and norms of society (van der Laan, 2009). A number of studies examining sustainability in large companies based in countries with varying levels of economic development found seeking legitimacy to be a significant motivation for CS (Brønn and Vidaver-Cohen, 2008; Windolph et al., 2014; Schaltegger and Hörisch, 2015). Legitimacy theory and stakeholder theory are closely linked, given the dependence of corporations on their stakeholders. Legitimacy can be conceived as having a license to operate, which derives from the fact that corporations need tacit or explicit permission from Government, non-governmental organisations (NGOs), communities, and customers in order to be able to continue as a business (Porter and Kramer, 2006). A legitimacy gap occurs when the performance or value system of a corporation is not congruent with, and falls below that expected by society (Ihlen, 2009). Buhr (2006) identified two dimensions of legitimacy attainment in the environmental context, action and presentation. A company “chooses” its level of environmental action along a spectrum of possible behaviours, from the status quo to leadership, and “chooses” its level of environmental disclosure to appear to be doing the right thing, even when it may not be.

Finally, in terms of moral responsibility, corporations engage with sustainability because of a concern for the greater good (Bansal and Roth, 2000). This moral motivation stands in contrast to the enlightened self-interest rationale, as the corporation will engage in social and environmental activities even where financial losses may occur. Furthermore, due to the size of many corporations, they have greater social and economic power than some governments, and so have an inherent responsibility to use that power in a socially responsible manner (Garriga and Melé, 2004).

2.3.6 Conceptual model of environmental behaviour

This section expands on the socio-economic model of organisational behaviour (Figure 2.3b) and explores the influence of various factors and stakeholders on the environmental performance of corporations. While it is acknowledged that environmental performance is only one aspect of the sustainability agenda, in the context of the aim of this thesis, it is pertinent to explore these factors and stakeholders through the lens of environmental sustainability.

Contingency theory suggests that managers respond to, and look for solutions based on situational disposition, i.e. responses to environmental issues are contingent upon a number of external and internal factors (Burritt et al., 2011). A number of studies have explored determinants influencing proactive environmental management practices in firms (Henriques and Sadorsky, 1996; Florida et al., 2001; Gonzalez-Benito and Gonzalez-Benito, 2006; Zhang et al., 2008; Darnall et al., 2010; Vazquez Brust and Liston-Heyes, 2010; Singh et al., 2014). These determinants can be categorised as stakeholder pressures, company characteristics and external factors. Figure 2.5 presents a conceptual framework identifying the determinants of proactive environmental management in firms, with each discussed below.

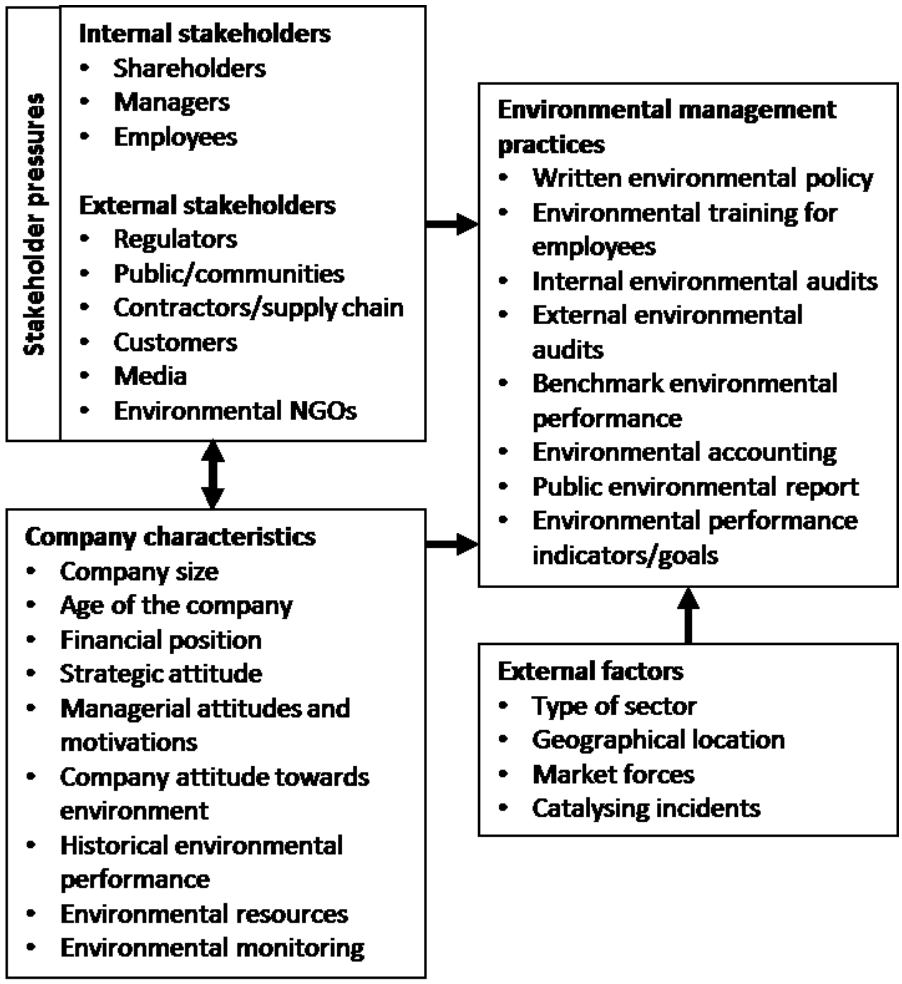

Figure 2.5. Stakeholders, company characteristics and external factors influencing environmental performance

In relation to stakeholder pressures, Henriques and Sadorsky (1996), in their study of large Canadian companies, found that customer, shareholder, regulatory and neighbourhood and community group pressure, positively influenced the formulation of an environmental plan. Likewise, Zhang et al. (2008), in their study of Chinese firms, found that customers and communities had positive roles in engaging firms with environmental management, in addition to pressure from the supply chain. However, in contrast to Henriques and Sadorsky (1996) and Zhang et al. (2008), Singh et al. (2014) in their examination of Indian firms, found that societal pressures (e.g. from household consumers, environmental NGOs and the media) were not significant factors in contributing to proactive environmental activities, highlighting a difference between developed/transitioning economies and developing economies.

The impact of the media is an additional reason why large companies tend to be more engaged, indeed for the Anglo-Dutch oil and gas company, Shell, the negative media attention and subsequent NGO and public scrutiny following the Brent Spar incident and its association with events in Nigeria in the 1990s, led to it adopting revised business principles (Moon, 2007). These included a notable commitment to reduce carbon dioxide emissions (Moon, 2007).

Darnall et al. (2010) state that researchers should be cautious about associating stakeholder pressures with firms' environmental strategies as the relationship tends to vary with the size of the firm, with smaller firms less likely to engage in proactive environmental practices. Thus, stakeholder pressure interacts with company characteristics. Indeed, Gonzalez-Benito and Gonzalez-Benito (2006) assert that larger firms are more likely to engage proactively with environmental management due to increased stakeholder pressures, but also because larger size firms will tend to have more resource availability to devote to environmental management. Likewise, Singh et al. (2014), found that size was a significant determinant of proactive environmental performance. They asserted that larger firms have more resources to adopt comprehensive environmental management practices as compared to smaller firms. Furthermore, Singh et al. (2014) found that firm age had a positive influence on environmental management practices,

Florida et al. (2001) in their study on manufacturing firms in the USA, found that organisational capabilities mattered significantly in the process of adopting environmental practices and suggest that too much weight has been placed on external factors in previous research on this subject. They found that external factors such as regulatory pressures, market forces and catalysing incidents (e.g. environmental disaster, government enforcement, new reporting requirements etc.) did play a role, but only offered a limited explanation for proactive behaviour. They stated that two classes of organisational capabilities were significant in the adoption of environmental practices: organisational resources and organisational monitoring. In line with Gonzalez-Benito and Gonzalez-Benito (2006), Darnall et al. (2010) and Singh et al. (2014), they assert that larger firms with greater organisational resources can commit greater resources to environmental actions. In addition, they stated that environmental resources in terms of specific staff numbers and the experience of staff, was significantly associated with the adoption of environmental practices. In terms of organisational monitoring, they found that having specific environmental goals and objectives and environmental performance monitoring systems, were significantly associated with the adoption of proactive environmental actions (Florida et al., 2001).

Gonzalez-Benito and Gonzalez-Benito (2006) identified additional determinants in their review of the literature including internationalisation, position in the value chain, managerial attitudes and motivations, strategic attitude, industrial sector and geographical location.

2.3.7 Summary

Corporations are paying increased attention to sustainable development and the concept of the TBL, whereby a corporation's ultimate success is measured by the traditional financial bottom line and by its social and environmental performance. Motivations for CS include legitimation, enlightened self-interest and moral responsibility. There is a recognition now that corporations have responsibilities that extend beyond an obligation to their shareholders, and that the extent of engagement with sustainability is contingent upon stakeholder pressures, company characteristics and various external factors.

In order to provide background for the higher education sector's response to the sustainability/carbon management agenda, the focus of this chapter now turns to reviewing the scientific evidence for climate change and the international/UK policy response.

2.4 Climate change and carbon management

2.4.1 Introduction

Climate change is considered one of the six major sustainability problems facing the planet and human society, the others being deforestation, loss of biodiversity, population growth, poverty and scarcity of drinking water (Schaltegger and Csutora, 2012). This section therefore briefly reviews the scientific evidence for climate change and the policy response, however it does not seek to critique international policy as this is beyond the scope of this review. For a comprehensive evaluation of the current understanding of climate change see IPCC (2013a) and for a complete discussion around the international policy response prior to the Paris Agreement see Korhola (2014). For an up to date commentary on the Paris Agreement (UNFCCC, 2015) see Jacquet and Jamieson (2016).

While taking action on climate change is only one aspect of the broader sustainable development agenda, it is widely recognised that the two are intrinsically linked (Pinkse and Kolk, 2012), where the reduction of GHG emissions is of critical importance to sustainable development (IPCC, 2013a). Sustainable development and climate change interact on a number of levels (Robinson and Herbert, 2001) and these can be both positive and negative. Climate change is influencing both the natural and built environment on which the human population is dependent, e.g. water availability, rise of extreme weather events (IPCC, 2013a), thereby affecting socio-economic development, particularly in developing countries (Pinkse and Kolk, 2012). From a policy perspective, there are opportunities for positive interaction with sustainable development policies influencing anthropogenic GHG emissions that are causing climate change, e.g. the Clean Development Mechanism[3] (Pinkse and Kolk, 2012). Robinson et al. (2006) state that with regard to the goals traditionally associated with climate change (reducing emissions, increasing adaptive capacity and minimising climate change impacts), the successful achievement of sustainable development may be a prerequisite of the successful achievement of climate policy goals. Thus, climate policy responses should be placed in the larger context of socio-economic policy development rather than be viewed as an add-on (Swart et al., 2003).

As with debates about sustainable development, the climate change issue raises questions about the conventional development model causing both environmental and poverty

[3] The Clean Development Mechanism (CDM) allows emission reduction projects in developing countries to earn certified emission reduction (CER) credits, equivalent to one tonne of CO_2. CERs can be traded and sold and used by industrialised nations to meet emission reduction targets under the Kyoto Protocol (UNFCCC, 2015).

problems (Eriksen et al., 2011). The issue of climate change and sustainable development therefore combine in their call for fundamental changes to development pathways (Eriksen et al., 2011). Growing affluence, a rapidly expanding middle class in transition economies such as China, and the right to development among the world's developing nations, demand that people of all nations make the shift to sustainable lifestyles (Griggs et al., 2013).

The issue of 'fairness' is a significant aspect of the debate on global climate change and the various distributed impacts of climate change can be considered under the frame of 'climate justice' (Dunk et al., 2016). There are two aspects of climate justice, procedural and outcome justice. On the outcome justice side, issues include the unequal distribution of climate change impacts, the distribution of responsibilities for mitigation and adaptation and the distribution of the benefits of mitigation and adaptation actions (Beg et al., 2002; Dunk et al., 2016). On the procedural side, fairness in the making of climate policy relates to access to and participation in the international climate policy process (Dunk et al., 2016). All these dimensions of climate justice are interlinked, both with each other and others aspects of vulnerability (Dunk et al., 2016; Figure 2.6).

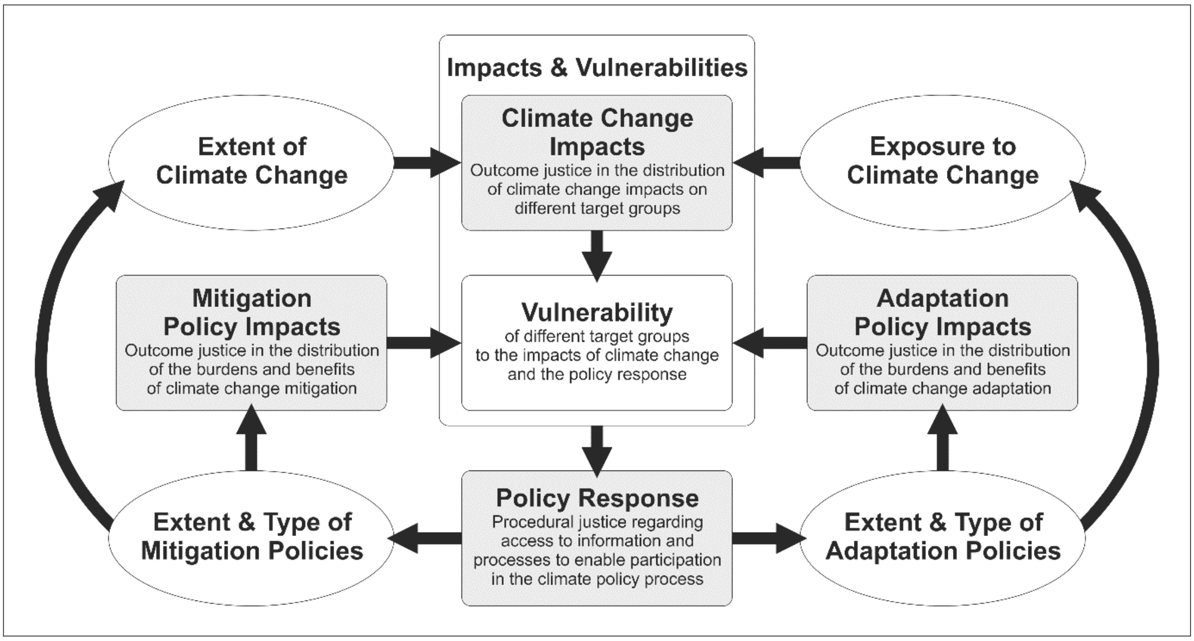

Figure 2.6. Interlinkages between dimensions of climate justice and vulnerability in the policy response to climate change (source: Dunk et al. 2016)

2.4.2 The scientific evidence for climate change

GHGs such as carbon dioxide, methane and nitrous oxide, absorb infrared radiation, thereby trapping and holding heat in the atmosphere. The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2013a) states that it is extremely likely anthropogenic activities that release GHGs, such as the burning of fossil fuels in transport and electricity generation, are contributing to the unprecedented rise in average global temperatures. At the beginning of the industrial revolution (around 1750) carbon dioxide (CO_2) concentrations in the atmosphere were around 280 parts per million (ppm) (IPCC, 2013a). By 2015, CO_2 concentrations exceeded 400 ppm (Scripps, 2016) and the average global surface temperature had reached 1°C above the pre-industrial average (Met Office, 2016). On current trends, average global temperatures could rise by 3 - 4°C within the next century (IPCC, 2013a). Scientific evidence suggests that if the average global temperature were to rise above 2°C, a tipping point would be reached with a high or very high level of additional risk from climate change in terms of sea level rise, reduction in permafrost, ocean acidification, increases in frequency and intensity of extreme weather events, etc. (IPCC, 2013a). As a result, a warming limit of 2° has been adopted in science circles and the international policy process as a goal to prevent dangerous climate change, with a potential shift to 1.5°C if appropriate (UNFCCC, 2015).

Figure 2.7 shows total anthropogenic GHG emissions by economic sector. Of the 49 $GtCO_2e$ emissions in 2010, 35% of GHG emissions were released in the energy supply sector, 24% in agriculture, forestry and other land use (AFOLU), 21% in industry, 14% in transport and 6% in buildings (IPCC, 2014).

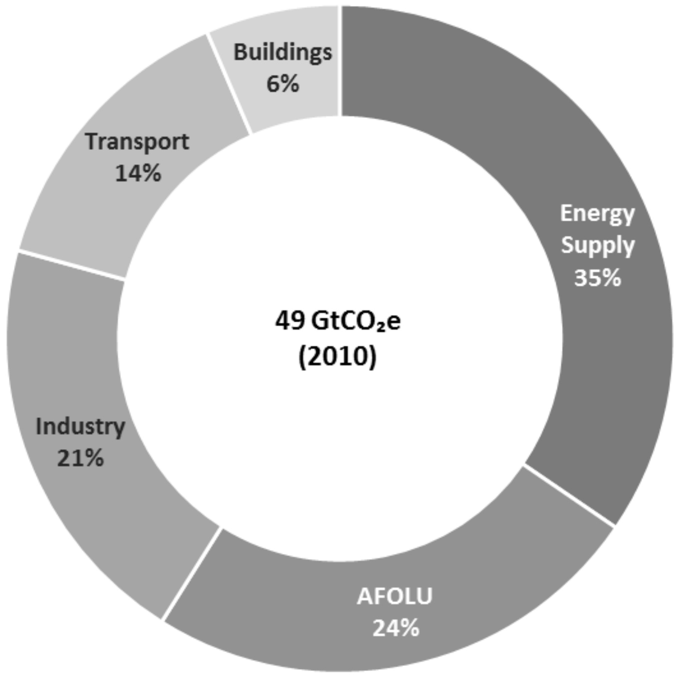

Figure 2.7. Total anthropogenic GHG emissions ($GtCO_2e$) by economic sector in 2010 (adapted from: IPCC, 2014)

Given the context of this research, it is pertinent to explore the contribution of aviation emissions to climate change. Aviation currently accounts for between 2-3% of global anthropogenic CO_2 emissions and as much as 4.9% when non-CO_2 impacts are considered, where forecasts for strong growth in air traffic will likely increase this proportion significantly going forward (Lee et al., 2009; Grote et al., 2014). Unlike other sectors of the economy, international aviation (and shipping) emissions are not included in national targets under international agreements (discussed in the following section). Instead, responsibility for reducing emissions from international air travel rests with the International Civil Aviation Organization (ICAO), a specialized agency of the UN (ICAO, 2016).

ICAO has developed a range of standards, policies and guidance for the application of measures to reduce emissions through technological enhancements, operational improvements and a global, market-based measure scheme (ICAO, 2016). However, even if all mitigation measures are successfully implemented, it is still likely that traffic growth rates will continue to outpace emission reduction rates (Grote et al., 2014). Thus, to achieve absolute reductions will likely require consumer behavioural changes (Grote et al., 2014).

2.4.3 International climate change policy

This section presents an overview of three key components of the international policy process in response to the climate change agenda, the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol and Paris Agreement. See Appendix 1 for a complete timeline of international events over the past three decades.

In response to growing environmental concerns, the UNFCCC was one of two legally binding conventions opened for signature at the Rio Earth Summit in 1992 (UN, 1997). The UNFCCC called for international cooperation in stabilising GHG emissions in the atmosphere at a level that would prevent dangerous anthropogenic climate change (UN, 1992b). One of the key principles agreed was that countries (UN, 1992b: 4):

> *…should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof.*

This has become a dominant interpretation of climate justice (discussed in Section 2.4.1) - equity in the distribution of responsibilities and burdens. While the UNFCCC set the framework for the international response to climate change, it did not set a legally binding commitment.

An international agreement to limit GHG emissions, the Kyoto Protocol, which was adopted in 1997 and entered into force in 2005, set legally binding emission reduction targets for 37 industrialised nations (UN, 1998). Under the Kyoto Protocol the industrialised nations were required to reduce emissions from the six GHGs[4] by an average of 5% from 2008-2012 against a baseline of 1990 levels (UN, 1998). The EU (which has always operated as a block) committed to an 8% reduction with individual targets tailored for each member state based on their relative wealth at the time (European Commission, 2016a).

International efforts to agree reduction targets post-Kyoto were slow, culminating in the Doha Amendment (the second commitment period of the Kyoto Protocol), essentially a voluntary commitment to reduce GHG emissions[5] (UNFCCC, 2012). The EU committed to a 20% reduction by 2020, from a 1990 baseline, but stated a conditional offer to move to a 30% reduction provided other developed countries commit to similar targets (UNFCCC, 2012). Japan, Russia and New Zealand have not adopted new targets for the second commitment period (UNFCCC, 2012).

In 2015, nations reached a deal to combat climate change covering GHG emissions mitigation, adaptation and finance from 2020 (UNFCCC, 2015). The Paris Agreement requires all nations to outline what post-2020 climate actions they intend to take through 'intended nationally determined contributions' (INDCs) and to strengthen these efforts going forward (UNFCCC, 2015). It is a separate instrument rather than an amendment to the Kyoto Protocol, set within the framework of the UNFCCC. The final text includes a notable commitment to hold the increase in the global average temperature to (UNFCCC, 2015: 21):

> *…well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change.*

However, the final text emphasised with serious concern (UNFCCC, 2015: 2):

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[4] Carbon dioxide ($C0_2$), Methane (CH_4), Nitrous oxide (N_20), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulphur hexafluoride (SF_6) (UN, 1998).

[5] Nitrogen trifluoride (NF_3) was added to the six Kyoto GHGs for the second commitment period (UNFCCC, 2012).

…the urgent need to address the significant gap between the aggregate effect of Parties' mitigation pledges in terms of global annual emissions of greenhouse gases by 2020 and aggregate emission pathways consistent with holding the increase in the global average temperature to well below 2 °C above preindustrial levels and pursuing efforts to limit the temperature increase to 1.5 °C.

Given that the Kyoto Protocol and subsequent second commitment period took many years to finalise, the Paris Agreement was achieved through a new, bottom-up, negotiation process with countries establishing their own targets for reducing emissions. Moreover, unlike the Kyoto Protocol, which only covered industrialised nations, the Paris Agreement involves industrialised, transition and developing economies.

2.4.4 European Union climate change policy

The EU has identified climate change as a key issue and the 2020 package is a set of legally binding legislation to help the EU meet its targets for the year 2020. It is important to note that EU policy is driving how Europe and the international arena operates and the EU package will be implemented irrespective of what is happening in the international arena. The package includes a commitment to reduce GHG emissions by 20%, to obtain 20% of energy from renewables, and achieve a 20% improvement in energy efficiency (European Commission, 2016b). The EU has taken action in several areas to achieve this target, most notably, it established the European Union Emissions Trading Scheme (EU ETS), which became effective in 2005 (European Commission, 2016b). The EU ETS is a cap and trade system that sets limits on a number of specific industrial activities, and this limit is reduced each year. Within the limit, companies from the power and heat generation sector, energy-intensive industry sectors and the commercial aviation sector[6], can buy and sell emission allowances as required (European Commission, 2016b). In addition, member states are required to set national emission reduction targets for sectors not covered by the EU ETS including housing, agriculture, waste, and transport (except international aviation and maritime shipping). These targets fall under the 'Effort-sharing decision'

[6] The aviation sector was brought into the EU ETS in 2012 but until 2016, only applies to flights between airports located in the European Economic Area (European Commission, 2016b).

whereby targets differ according to national wealth, from a 20% cut for the richest countries and maximum increase of 20% for the least wealthy (European Commission, 2016b). EU member countries have also taken on binding national targets for renewable energy generation in order to meet the 20% target by 2020 (European Commission, 2016b).

2.4.5 UK climate change policy

While international efforts prior to the first Kyoto Period (2008-2012) influenced UK policy, failure to achieve agreement on reduction targets post-Kyoto led to the UK taking the lead and being at the forefront of the response to climate change. In 2006, a UK Government commissioned review of the economics of climate change (The Stern Review) concluded that the benefits of strong and early action on climate change (mitigation) far outweigh the economic costs of not acting (Stern, 2006). The Stern Review aligned with the principles of the UNFCCC, concluding that rich countries should take responsibility for emission reductions of 60%-80% from 1990 levels by 2050 (Stern, 2006).

The Climate Change Act (2008) sets out a framework for the UK to achieving emission reductions and includes a legally binding commitment to reduce GHG emissions by 80% by 2050, from a 1990 baseline (HMSO, 2008). The UK was the first country in the world to set a legally binding GHG reduction target (Nachmany et al., 2014). Included within the Act is an interim target of a 34% reduction by 2020, thus it exceeds the European Union target under the second commitment period of the Kyoto Protocol. Moreover, it requires the Government to set 'carbon budgets', which is a limit on the amount of GHG emissions the UK can emit over a five-year period.

Figure 2.8 shows UK GHG emissions by sector in 1990 and 2014. While the UK has reduced GHG emissions by 35% between 1990 (796.6 $MtCO_2e$) and 2014 (514.4 $MtCO_2e$), this was largely due to a switch from coal- to gas-fired power stations in the 1990s (DECC, 2016).

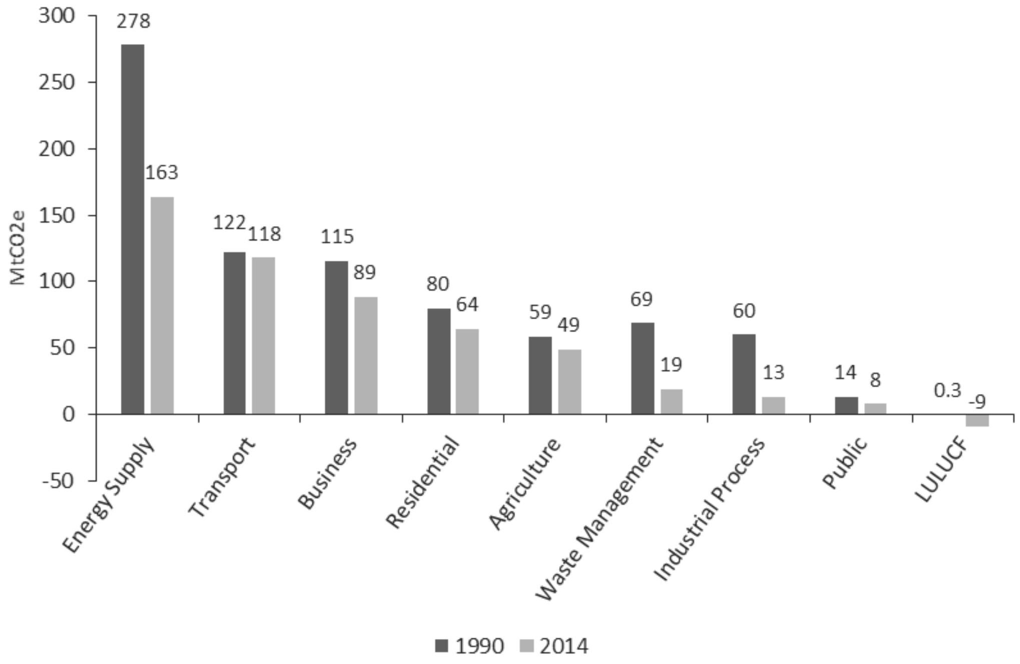

Figure 2.8. GHG emissions by source sector, UK, 2014 (adapted from: DECC, 2016)

In terms of the scale of the challenge remaining, emissions in 2050 will need to be around the size of energy supply emissions in 2014. Clearly, this will require action from every level of UK society including major infrastructure changes to the energy sector. In terms of individual organisations, Table 2.1 details legislation established by the UK Government to reduce energy demand in the business, industry and public sector.

Table 2.1. UK Government climate change legislation

Legislation	Description
Climate Change Levy (CCL)	A tax on energy delivered to non-domestic users and is designed to provide an incentive for business to improve energy efficiency (UK Government, 2016).
Climate Change Agreements (CCAs)	Voluntary agreements to reduce emissions made by UK industry in return for a reduction in CCL costs (UK Government, 2014).
Carbon Reduction Commitment Energy Efficiency Scheme (CRCEES)	Focuses on emissions from non-energy intensive sectors and requires participants to buy allowance for every tonne of carbon they emit (UK Government, 2016). The CRCEES applies to emissions not already covered by CCAs or the EU ETS (UK Government, 2016).
Mandatory Carbon Reporting	The Companies Act 2006 (Strategic and Directors' Reports) Regulations 2013, requires quoted companies[a] to report their annual Scope 1 and 2 GHG emissions (HMSO, 2013). While reporting of Scope 3 emissions is not required, it is advised (DEFRA, 2013). The Department for Environment, Food and Rural Affairs has published environmental reporting guidelines (DEFRA, 2013) for UK companies based on the GHG Protocol Corporate Accounting and Reporting Standard (WBCSD/WRI, 2004).

Note. (a) A quoted company is defined as a company that is UK incorporated and whose equity share capital is listed on the Main Market of the London Stock Exchange or in an EEA State, or admitted to trading on the New York Stock Exchange or Nasdaq.

2.4.6 Organisational carbon management

The reduction of GHG emissions is of great significance for sustainable development and an important business topic (Schaltegger and Csutora, 2012). GHG emissions, as discussed in the previous section, are contributing to the unprecedented rise in average global temperatures and society must make significant absolute reductions in emissions and yet, must do so in a world seeking economic growth and social development.

Table 2.2 presents definitions of carbon management[7] found in the peer reviewed and grey literature (including similar terms for carbon management). Hereafter, the term 'carbon management' refers to the measurement and management of carbon dioxide equivalent[8] (CO_2e) emissions in order to achieve direct and indirect reductions from an organisation's operations. The process of carbon management in organisations is critical

[7] Managing GHG emissions is commonly referred to as carbon management.

[8] CO_2e signifies for any quantity or GHG type, the amount of CO_2 that would have the equivalent global warming impact.

to keeping global average temperature to well below 2 °C, and this section explores the drivers and motivations for organisational carbon management and provides a systematic guide to the process.

Table 2.2. Definitions of carbon management found in the literature

Source	**Definition**
CPSL/BIC (2009)	"'Carbon management' is used […] to refer to the measurement and management of emissions of carbon dioxide (CO_2) and of the other five greenhouse gases covered by the Kyoto Protocol, i.e: Methane (CH_4); Nitrous oxide (N_20); Sulphur hexafluoride (SF_6); Hydrofuorocarbons (HFCs); and Perfluorocarbons (PFCs)".
Burritt et al. (2011)	"Carbon management accounting (CMA)is one part of sustainability accounting designed to provide managers with information that will assist companies facing short- and long-termdecisions about carbon emission issues […]".
Lee (2012)	"…carbon management requires a systematically established management control system to identify and monitor carbon risks in business operations".
Schaltegger and Csutora (2012)	Carbon management is an, "…interdepartmental management function designed to assist in achieving substantial carbon reductions in companies, institutions and homes".

Drivers and motivations for carbon management

As discussed in Section 2.3.5, motivations for CS can be grouped under the terms enlightened self-interest, legitimacy and moral responsibility. With specific respect to carbon management, Hoffman (2005) asserts that a company's motivations are decidedly strategic and to achieve competitive advantage, attempting to reap near term economic benefits and at the same time searching for ways to prepare for a carbon-constrained world. Indeed, Okereke (2007) and Jeswani et al. (2008) identified profit and cost-savings as key motivations, while Wal-Mart CEO Lee Scott stated, "It will save money for our customers, make us a more efficient business, and help position us to compete more effectively in a carbon-constrained world" (Lash and Wellington, 2007: 97).

Additional motivations and drivers identified in the literature include rising energy and operational costs, corporate targets, regulatory compliance, ethical considerations, technological change and market shifts, risk management, elevating reputation and accessing new sources of capital (Bansal and Roth, 2000; Hoffman, 2005; Schultz and Williamson, 2005; Lash and Wellington, 2007; Okereke, 2007; Jeswani et al., 2008; Weinhofer and Hoffmann, 2010).

Carbon management process

The literature reveals a clear process for carbon management (WBCSD/WRI, 2004, 2011a; CPSL/BIC, 2009):

- Developing a GHG emissions inventory of all key sources of carbon associated with the organisation
- Setting a baseline of current carbon emissions and targets for future reductions
- Identifying and implementing cost effective mitigation measures
- Monitoring, and reporting emissions (Figure 2.9).

These steps are discussed in turn below.

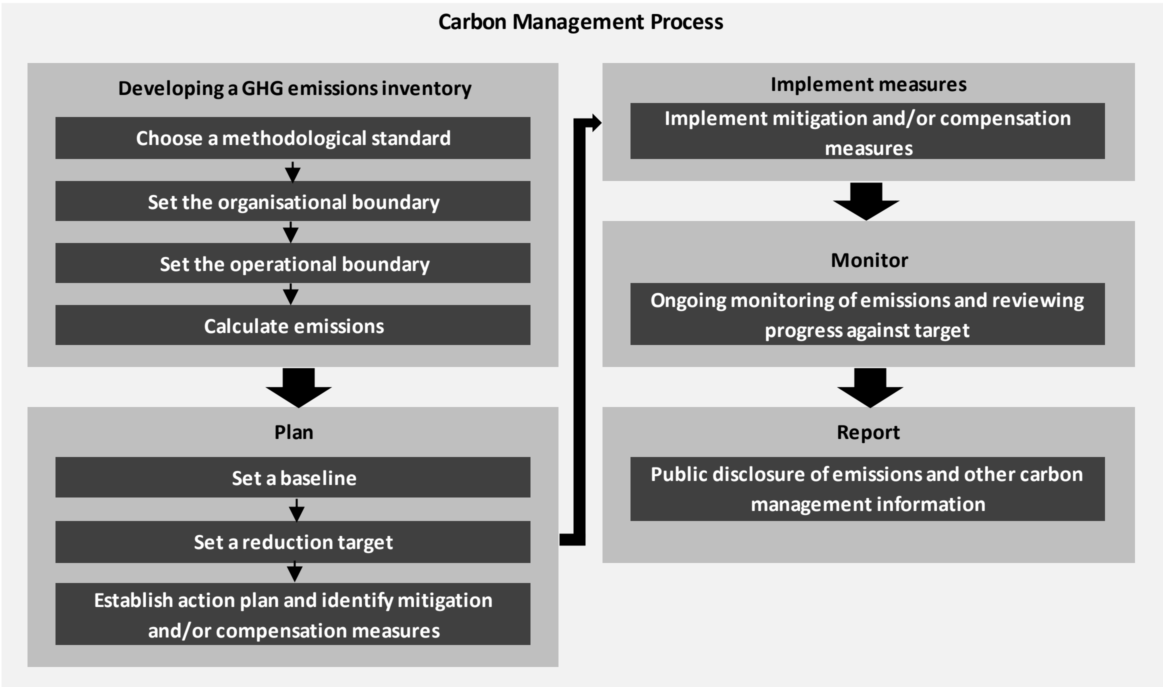

Figure 2.9. The organisational carbon management process

Developing a GHG emissions inventory

Developing a GHG emissions inventory (also known as a 'carbon footprint') is the first stage of carbon management and refers to the process undertaken to measure amounts of CO_2e emitted by an organisation. The concept of the 'carbon footprint' is increasingly recognised as a valuable tool that can help organisations better assess the link between GHG emissions and their activities (Turner et al., 2011; Wright et al., 2011; Williams et al., 2012). Robust approaches for the measurement of GHG emissions are required to enable comparability between organisations, for target setting, and assessing the success of mitigation schemes (Wright et al., 2011). The GHG Protocol Corporate Standard (WBCSD/WRI, 2004) (hereafter referred to as the 'Corporate Standard'), developed by the World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI), is the most highly regarded and widely used GHG assessment guidance (Downie and Stubbs, 2013).

Setting the organisational boundary

When developing a GHG emissions inventory, the organisation must determine its organisational boundary (Matthews et al., 2008; Huang et al., 2009), that is, entities and activities that can legitimately be regarded as being part of the operation of the organisation. There are two approaches: the equity share approach and the control approach. In the equity share approach, the organisation accounts for GHG emissions according to its share of equity in the operation, while under the control approach, the organisation accounts for all GHG emissions from operations over which it has control. The organisation would not account for emissions from operations in which it owns an interest but does not have control (WBCSD/WRI, 2004).

Setting the operational boundary

The company must then set operational boundaries and the Corporate Standard classifies an organisation's GHG emissions in three 'Scopes' (WBCSD/WRI, 2004; Figure 2.10). These 'Scopes' help to delineate between direct and indirect emissions and help to avoid double counting[9] (WBCSD/WRI, 2004):

Scope 1: Direct emissions from sources owned or controlled by the business.
Scope 2: Indirect emissions attributed to generation of purchased energy.

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[9] A company's Scope 1, Scope 2 and Scope 3 emissions are mutually exclusive, i.e. there is no double counting of emissions between Scopes (WBCSD/WRI, 2011a).

Scope 3: Indirect emissions that are a consequence of activities of the business but occur from sources not owned or controlled by the business.

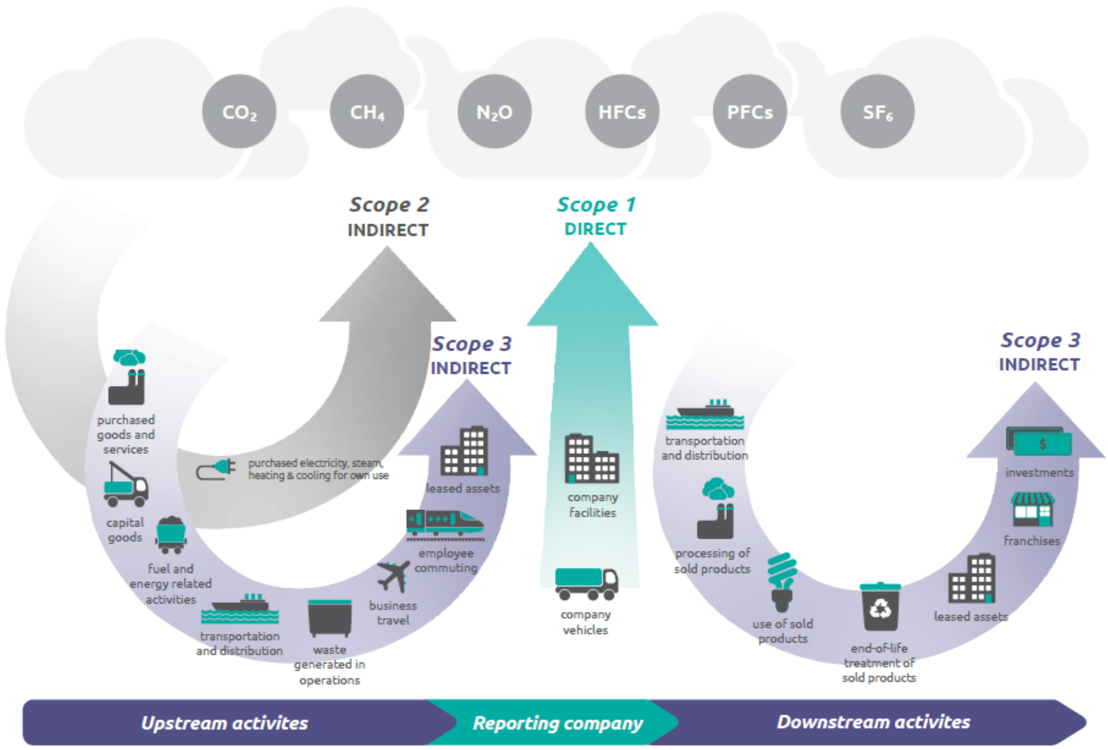

Figure 2.10. GHG Protocol 'Scopes' and example sources (reproduced with permission from WBCSD/WRI, 2011a)

The Corporate Standard considers measurement of Scope 1 and 2 emissions as a minimum requirement while accounting and reporting on Scope 3 is optional for corporations (WBCSD/WRI, 2004). Similarly, from a UK perspective, mandatory carbon reporting covers Scope 1 and 2 emissions, while reporting of Scope 3 is advised (HMSO, 2013). However, for an effective GHG management strategy, setting operational boundaries that are comprehensive with respect to both Scope 1 and 2, and Scope 3 indirect emissions will allow a company to better manage the full spectrum of GHG risks and opportunities (WBCSD/WRI, 2004).

The GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard (hereafter the 'Scope 3 Standard'), developed in 2011, provides an internationally accepted method to enable GHG management of companies' value chains (WBCSD/WRI, 2011a). The standard divides Scope 3 emissions into upstream and downstream emissions as shown in Figure 2.10. The Scope 3 Standard specifies minimum boundary requirements for accounting for emissions from each of the Scope 3 categories presented in Figure 2.10. Companies should account for all Scope 3 emissions defined in the standard and must justify any exclusions (WBCSD/WRI, 2011a). Table 2.3 presents criteria for identifying relevant Scope 3 activities.

Table 2.3. Criteria for identifying relevant Scope 3 emission sources (Source: WBCSD/WRI, 2011a)

Criteria	Description
Size	The source will likely account for a large proportion of the company's total anticipated Scope 3 footprint
Influence	The company could potentially undertake or influence emissions reductions
Risk	They contribute to the company's risk exposure (e.g. climate change related risks such as financial, regulatory, supply chain, customer, and reputational risks)
Stakeholders	Key stakeholders deem the source to be critical (e.g. customers, suppliers, investors, or civic society)
Outsourcing	They are outsourced activities that were previously performed in-house, or they are outsourced activities that are usually performed in-house by other companies in the sector
Sector guidance	Sector guidance has identified the source as significant
Other	They meet any additional criteria for determining relevance developed by the company or industry sector

Justification for extending the operational boundary to include Scope 3

Organisations can be thought of as a system, and a system, by definition comprises of interconnected parts, with every system having at least two elements. Systems may be closed or open and it follows that systems have boundaries that separate them from their environments. The concept of boundaries are relatively easily defined in physical and biological systems, but are very difficult to delineate in social systems, such as organisations (Kast and Rosenzweig, 1972). Thinking of an organisation as a semi-open system, there are elements that enter and exit the system (e.g. resource and human capital) and there are elements that stay within the system (e.g. buildings). If organisations are going to deliver the substantial reduction in carbon emissions needed to avert dangerous temperature rises, then they have to take a holistic, whole system approach. Therefore, they need to have a comprehensive understanding of the entire carbon footprint, not just direct emissions but emissions from their entire product-service systems (Matthews et al., 2008; Schaltegger and Csutora, 2012). Because it is a systems problem, supply chain emissions, e.g. aviation emissions, need to form part of the carbon footprint. Indeed, narrowly set boundaries and exclusion of Scope 3 sources can significantly underestimate emissions and thus provide a misleading picture of an organisation's carbon footprint (Matthews et al., 2008; Williams et al., 2012). The significance of Scope 3 emissions for industry is highlighted by Huang et al. (2009), who estimate that on average, upstream Scope 3 sources account for 70%-80% of the carbon footprint for most manufacturing industries in the USA.

Lack of understanding of Scope 3 emissions will inhibit an organisation's ability to pursue the most cost-effective carbon mitigation strategies (Matthews et al., 2008), it will inhibit identification of emission hotspots, resource and energy risks in the supply chain (Carbon Trust, 2016). Furthermore, Peters (2010) argues that a company will have a much better understanding of the potential risk of carbon price fluctuations on their business activities both upstream, through supply chain purchases, and downstream, through potential losses in sales. Thus, including Scope 3 in a carbon footprint increases understanding of a company's full GHG emissions exposure (Downie and Stubbs, 2013).

Despite the benefits of calculating Scope 3 emissions, many companies do not report on them as they are not well understood, and there are challenges associated with assigning responsibility, data availability, calculation methodology and boundary setting (Huang et al., 2009; Schaltegger and Csutora, 2012). Capturing Scope 3 emissions is one of the most sizeable challenges when estimating a carbon footprint because by definition, Scope 3 emissions take place outside the normal geographical, financial and operational boundaries of the subject of the footprint (Williams et al., 2012). Nevertheless, a footprint containing only Scope 1 and 2 does not allow for full allocation of responsibility for indirect emissions (Williams et al., 2012) and an organisation would be in no position to work with partners to mitigate these environmental impacts.

Sullivan (2009), in his examination of 125 large European companies' responses to GHG emissions reduction, found that reporting of Scope 3 emissions was inconsistent. Those that had reported on Scope 3 tended to focus on business travel and to a lesser extent, transport and logistics. Upon further examination, Sullivan (2009) identifies two arguments for non-reporting of Scope 3. First, is the limits to responsibility and the debate regarding consumer vs producer responsibility (Bastianoni et al., 2004; Lenzen et al., 2007). The second argument for non-reporting is that the calculation of emissions from supply chains and product use is a technically difficult and time-consuming task (Sullivan, 2009).

Further to these issues, Scope 3 emissions pose additional challenges for organisations. In contrast to Scope 1 and 2 sources, if an organisation can influence Scope 3 emissions, then any beneficial change is received by a third party. Finally, it is widely recognised that organisations can have multiple goals or purposes (Kast and Rosenzweig, 1972), where clashes are now emerging between reducing Scope 3 emissions and core business priorities. For example, airports around the world derive a large proportion of revenue from car park fees but car travel to the airport is one of largest components of the carbon footprint (Budd et al., 2011). Thus, any drive to reduce emissions from car travel will be at odds with commercial pressures to maximise revenue from car parking (Budd et al., 2011).

All organisations have a role (moral responsibility) to take action on reducing Scope 3 emissions, where this presents both opportunities and challenges (Downie and Stubbs, 2013). Some large companies are recognising the positive reputational benefits of engagement with Scope 3 emissions. Indeed, Wal-Mart has provided assistance to several suppliers in China to undertake energy assessments resulting in one supplier reducing its annual energy bill by 70% (Hanifan et al., 2012). Nestle, working with farmers in China, assisted in the installation of biogas digesters and the implementation of waste management solutions to trap methane as it is produced, helping to reduce GHG emissions in its supply chain (Hanifan et al., 2012). Table 2.4 presents the benefits and challenges of engaging with indirect emissions identified in the literature review.

Table 2.4. The benefits and challenges for organisations when engaging with Scope 3 emissions

Benefits	Challenges
Identify emission hotspots (WBCSD/WRI, 2011a; Carbon Trust, 2016)	Assigning responsibility for emissions (Sullivan, 2009; Schaltegger and Csutora, 2012)
Identify resource and energy risk in supply chain (Carbon Trust, 2016)	Obtaining data from suppliers can be difficult (Huang et al., 2009; Schaltegger and Csutora, 2012)
Better understanding of the potential risk of carbon price fluctuations on business activities and increased understanding of full GHG emissions exposure (Peters, 2010; Downie and Stubbs, 2013)	Time consuming (Sullivan, 2009)
Reducing emissions from supply chain may be more cost-effective than reducing Scope 1 and 2 emissions (Matthews et al., 2008)	Methodology may contain assumptions and gaps in data, decreasing the reliability of the estimate (Schaltegger and Csutora, 2012)
Identify poor performers in the supply chain and proactively engage with them to reduce emissions (Carbon Trust, 2016)	Deciding on the boundary of the footprint
Reputational benefits and competitive differentiator (WBCSD/WRI, 2011a)	Scope 3 emissions can be in conflict with core business priorities

Calculation of emissions

There are two main approaches for measuring emissions, direct measurement, and calculation (Table 2.5). The most common approach to GHG emissions measurement is calculation using activity data and emission factors (WBCSD/WRI, 2004, 2011a). To quantify GHG emissions, activity data (a measure of the amount of resource consumed/activity engaged with) is multiplied by the appropriate emission factor (an estimate of GHG emissions per unit of activity) and global warming potential (GWP) (WBCSD/WRI, 2011a). GWP values describe the radiative forcing impact (how much heat a gas traps in the atmosphere) of one unit of a given GHG relative to one unit of carbon dioxide. Thus, GWP values convert GHG emissions data for non-CO_2 gases into carbon dioxide equivalent (CO_2e) data (WBCSD/WRI, 2011a). Moreover, companies should use GWP values based on a 100-year[10] time horizon (GWP_{100}) (WBCSD/WRI, 2011a).

There are two types of emission factors used to convert energy activity data into emissions data:

- **Combustion emission factors,** which only includes emissions resulting from fuel combustion.
- **Life cycle emission factors,** which includes the emissions resulting from fuel combustion as well as all other emissions that occur from the life cycle of the fuel, including extraction, processing and transportation (WBCSD/WRI, 2011a).

Table 2.5. Approaches for measuring GHG emissions (adapted from: WBCSD/WRI, 2011a)

Quantification method	Description	Relevant data types
Direct measurement	Quantification of GHG emissions using direct monitoring, mass balance or stoichiometry **(GHG = Emissions Data x GWP)**	Direct emissions data
Calculation	Quantification of GHG emissions by multiplying activity data by an emission factor **(GHG = Activity data x Emission Factor x GWP)**	Activity data (e.g. litres of fuel consumed, quantity of money spent, kilometres of distance travelled). Emission factors (e.g. kgCO_2 emitted per litre of fuel consumed, kgCO_2 emitted per £ spent, kgCO_2 emitted per kilometre travelled)

With regard to Scope 3 emissions, companies can use two types of data when estimating emissions: primary data and secondary data (WBCSD/WRI, 2011a). Primary data includes that provided by suppliers or other value chain partners relating to specific activities in the reporting company's value chain, while secondary data includes industry-average data (e.g. from published databases, government statistics, academic studies, and industry associations), financial data, and other generic data (WBCSD/WRI, 2011a).

[10] The 100-year time horizon was adopted as a metric to implement the multi-gas approach embedded in the UNFCCC and made operational in the Kyoto Protocol (IPCC, 2013b). The Fifth Assessment Report does not give metric values for longer time scales than 100 years (IPCC, 2013b).

Ultimately, the quality of the GHG inventory is dependent upon the quality of the data used to estimate emissions. The reporting company must ensure that it collects data of sufficient quality in order to ensure that the carbon footprint adequately reflects the GHG emissions of the company, supports the decision-making needs of users, and supports the company's management goals (WBCSD/WRI, 2011a). Thus, companies should ensure they collect high quality, primary data for high priority activities and for activities for which a reduction target has been set (WBCSD/WRI, 2011a).

Setting a baseline

In order to set a reduction target and/or be able to communicate emission reductions to customers and other key stakeholders, the organisation needs to set a baseline year. There are three approaches to calculating baseline emission figures (CPSL/BIC, 2009):

- Set a single year baseline: ideally, the first year for which accurate data is available.
- Average annual emissions over a number of consecutive years: some companies choose to average emissions out over a baseline comprising of several years. The main reason for this is to average out unusual yearly fluctuations in emissions, for example due to changes in levels of business activity or weather.
- Rolling base year: where progress is always measured against the previous period of measurement, e.g. the previous year.

The most common approach and the easiest to understand and communicate, is the single year baseline (CPSL/BIC, 2009).

GHG emissions reduction target

A GHG emissions reduction target will help to raise internal awareness and focus employees to achieve real reductions, as well as demonstrate commitment to customers and other key stakeholders (WBCSD/WRI, 2004; CPSL/BIC, 2009). When setting reduction targets there are a number of key decisions to make. Firstly, the company must decide on the type of target, absolute targets (i.e. a reduction in the total quantity of GHG emissions), intensity targets (i.e. a reduction in GHG emissions per unit of economic output), or both. Secondly, the target boundaries must be established, providing clarity as to which GHGs (see Section 2.4.3) are included and whether or not Scope 3 emissions are to be addressed. Finally, a target completion date must be set and a decision made as to whether to include interim targets (WBCSD/WRI, 2004; CPSL/BIC, 2009).

Identifying mitigation and compensation measures

In engaging with emissions, many organisations have embraced the concept of a hierarchy of carbon management options (Figure 2.11). The hierarchy prioritises actions to avoid emissions, followed by options to reduce emissions (e.g. investing in equipment that is more efficient) or substitution (e.g. adoption of renewable energy technologies). Figure 2.11 presents reduce and substitute side by side, in contrast to other GHG/carbon management hierarchy models found in the literature (Forum for the Future/Clean Air-Cool Planet, 2008; IEMA, 2010), given that in some cases a substitution option may be preferable to a reduction option. Moreover, some measures, e.g. Combined Heat and Power, could be categorised as either a reduction or a substitution option.

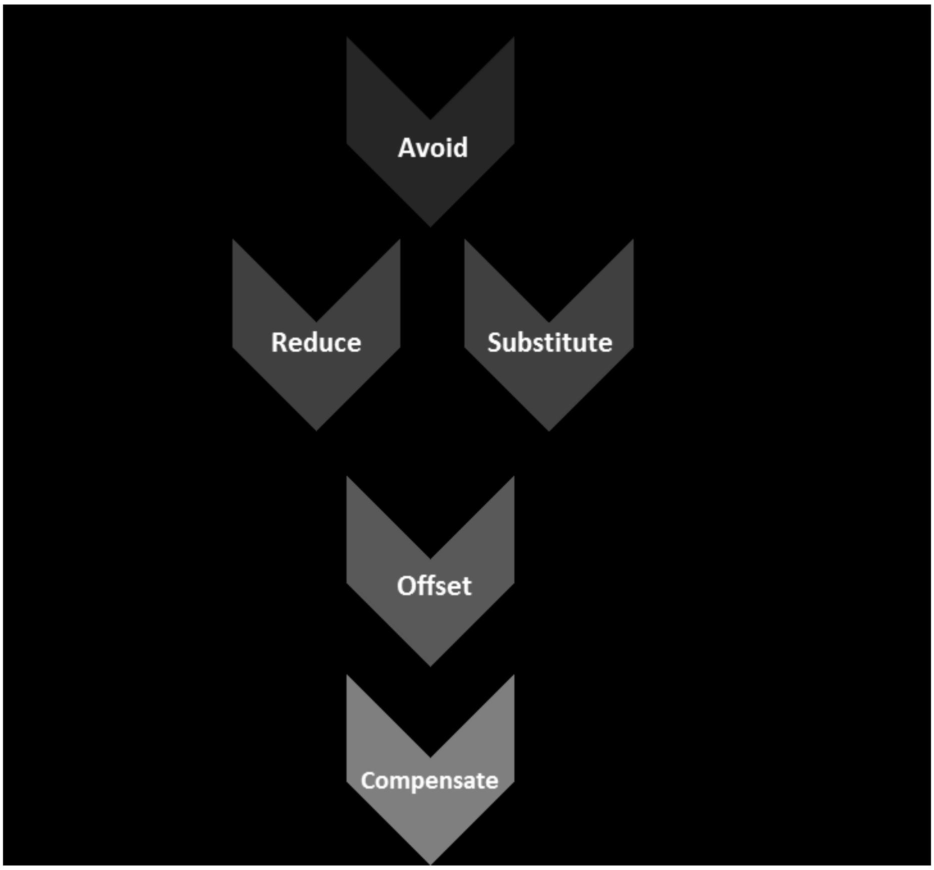

Figure 2.11. Carbon management hierarchy

Once an organisation has implemented all possible internal mitigation options, carbon offsetting can be used to mitigate the remaining 'unavoidable' emissions (Lovell et al., 2009). Carbon offsetting is a mechanism for mitigating GHG emissions generated by a particular activity by purchasing carbon credits that pay for equivalent emissions savings or reductions to be made elsewhere in the economy (Hooper et al., 2008). Given that climate change is a global problem, reducing GHG emissions anywhere contributes to overall climate protection (Kollmuss et al., 2008). Providing the cost of offsetting remains lower than the cost of carbon reduction action within the organisation, this mechanism will remain the most financially attractive and allow the organisation to deliver carbon reductions with the lowest marginal cost (Dautremont-Smith, 2003; Kollmuss and Lazarus, 2011).

There are however a number of criticisms regarding carbon offsetting. First, such an approach does not enable an organisation to move away from a reliance upon carbon and therefore adapt to a low-carbon economy. Polluters are able to pay to offset and continue polluting behaviour (Lovell, 2008). Second, there are concerns regarding the credibility of projects and whether they demonstrate additionality[11] (Lovell, 2008). Third, offsetting projects often claim to help facilitate the transfer of clean technologies and bring sustainable development benefits for local communities in developing countries (which is where offsetting projects are usually located) as well as GHG emissions savings. However, analysis of the number of CERs issued through the CDM reveals that carbon reductions have principally come from industrial gas destruction rather than projects that bring sustainable development benefits for local communities (UNEP, 2016).

For a carbon credit to be credible, it must meet strict criteria including proof that it is additional, delivers permanent benefits and is traceable and quantifiable (Kollmuss et al., 2008). Organisations should ensure that the project used a third party standard such as the Gold Standard, the Verified Carbon Standard etc. (see Kollmuss et al. (2008) for a

[11] Additionality answers a simple question: would the project have happened anyway, even if it were not implemented as an offset project? If the answer is yes, the project is not additional (Kollmuss et al., 2008).

review of these standards), and has independent third party verification (Carbon Neutral, 2016).

Finally, as an alternative to conventional carbon offsets, organisations can look to carbon compensation, i.e. actions to compensate for emissions. Carbon compensation activities do not meet the criteria for carbon offsets in that they may not be additional, quantifiable or traceable, e.g. companies could support local community projects that achieve both carbon and CSR benefits.

Reporting

In recent years, increasing stakeholder demand (e.g. from consumers, governments, investors and environmental NGOs) for more corporate transparency has led to an increasing number of firms publicly reporting their environmental performance, including GHG emissions. Indeed, 82% of the Global 500[12] voluntarily disclosed their GHG emissions through the Carbon Disclosure Project (CDP) in 2010, up from 59% in 2003 (CDP, 2006, 2010). Moreover, the total number of companies voluntarily disclosing through the CDP increased by 10% between 2010 (1,799 reporting companies) and 2015 (1,997 reporting companies) (CDP, 2015).

While a joint report by PricewaterhouseCoopers and the CDP (PwC/CDP, 2010) found that external reporting of GHG emissions did not in itself drive GHG reductions, they state that reporting of GHG emissions enables companies to identify reduction opportunities and set realistic targets (PwC/CDP, 2010), thus is an important step in the carbon management process.

2.4.7 Summary

Corporations have embraced carbon management in response to the sustainability agenda and the literature review has led to the following conclusions in relation to corporate carbon management:

[12] The Global 500 are the largest companies by market capitalization included in the FTSE Global Equity Index Series, as at 1 Jan 2013 (CDP, 2015).

- Traditionally corporations have focused on Scope 1 and 2 emissions because essentially, carbon is a cost and if an organisation can reduce its Scope 1 and 2 emissions, it reduces its operating costs.
- Reporting of Scope 3 emissions is inconsistent, with organisations defining their operational boundary differently and many not accounting for Scope 3 emissions at all. However, there is recognition now that a robust carbon footprint requires all three Scopes to be accounted for.
- There are challenges in accounting for Scope 3 emissions including data availability, calculation methodology and boundary setting, and attributing responsibility.
- The carbon management hierarchy suggests avoiding emitting in the first place, followed by reducing emissions or using low-carbon substitutes and carbon offsetting. Finally, organisations can look to actions that compensate for emissions.

2.5 Sustainability in higher education

2.5.1 Introduction

This section examines the concept of sustainability and its application to the higher education (HE) sector, including motivations for institutional change and barriers, and explores what sustainability means in practice for higher education institutions (HEIs).

HEIs have lagged behind business sectors in rising to the sustainability challenge (Ralph and Stubbs, 2014). The responsibility of HEIs to manage the impact of their operations on the economy, society and environment is in common with corporations (Godemann et al., 2014) and they are not immune to many of the external drivers behind the corporate shift to sustainability (Krizek et al., 2012). However, as Krizek et al. (2012) state, there are additional pressure to implementing sustainability into HE systems due to competing priorities within the institution, management challenges akin to small cities and a philosophy of protecting academic freedom and tradition hindering sweeping change.

Globally, HEIs have a key role in disseminating sustainability thinking (Owens and Legere, 2015) and helping to facilitate the transition to a sustainable/low-carbon economy, not only through taking action and reducing emissions from their own estates and activities, but also through teaching, research and their role as community leaders and major employers (UNESCO, 2012). Through demonstration of best practice in their operations, research and teaching activities, HEIs can have both multiple and multiplier effects on society (Ralph and Stubbs, 2014).

Over the last two decades, many HEIs have started to implement measures to embed sustainable practices within their systems, including education, research, campus operations, community outreach, and assessment and reporting (Lozano et al., 2015). However, despite some HEIs embracing their role in fostering a sustainable society, as long established and often very traditional institutions, in many ways universities have been slow to adapt and continue to contribute to and even accelerate unsustainable ways of development (Ferrer-Balas et al., 2010; Stephens and Graham, 2010; Lozano et al., 2013). This slow rate of change presents a significant challenge to the sector and society in its efforts to become 'more sustainable' (Larrán Jorge et al., 2014). Moreover, there remains a challenge involved with both defining the boundaries of sustainable development and integrating it holistically in university systems (Ramos et al., 2015). Indeed, Lozano et al. (2015) found that whilst most HEIs are making at least some efforts to contribute to sustainable development, in general, the implementation of sustainable development in HEIs has been compartmentalised (made up of a number of disconnected, individual initiatives). Cortese (2003) concludes that the issue is not the ability of HEIs to take on this challenge; it is the will and the time frame for doing so.

2.5.2 The sustainable university

Although it is difficult to define the meaning of a sustainable university and even more complex to define in quantitative terms (Rauch and Newman, 2009), the literature reveals that universities can engage with the challenge of sustainable development in a variety of different ways. One would expect a genuine commitment to creating a sustainable future to be evidenced within critical dimensions of institutional life (Wright, 2002). Indeed, in line with standard change management approaches (Kanter et al., 1992; Kotter and Cohen, 2002; Doppelt, 2003), HEIs should have a sustainability vision, sustainability should be written into the university mission statement, and the HEI should have a sustainability strategy. However, the implementation of sustainable development at universities is not just a matter of policy. Strategies and declarations need to be backed up by concrete action in the areas of teaching and research, outreach and partnership, and campus greening (Velazquez et al., 2006; Alshuwaikhat and Abubakar, 2008; Filho, 2011).

Cortese (2003) states that in many cases HEIs see teaching, research, operations and engagement with local communities as being separate activities but he argues that each dimension is interdependent and only by connecting all parts of the university system can HEIs achieve transformative change. This is a view echoed by McMillin and Dyball (2009), who argue that a holistic, whole-of-university systems approach is needed which recognises that a university operates with the complexity of a small city and so all its interdependent parts must be considered if it is to develop in a sustainable manner. The following sections explore the role of HEIs in contributing to making the transition to a more sustainable society and how HEIs can achieve sustainable development in their own operations.

Outreach and partnership

Universities can engage in outreach and forming partnerships, both locally and globally, with other institutions, private, governmental and non-governmental organisations, as well as civil society to help clarify and promote action to address sustainability (Clugston and Calder, 1999; Alshuwaikhat and Abubakar, 2008). Moreover, universities can participate in forums and networks within the HE sector to support sustainable development and carbon management.

Recognising that HEIs do not exist independently of their surroundings (Koester et al., 2006), Alshuwaikhat and Abubakar (2008) argue that HEIs should support firstly, communities in the local region in promoting sustainability through community projects and awareness services and secondly, local businesses that foster sustainable practices. HEIs can demonstrate ways to achieve environmentally and socially responsible living and reinforce sustainability values and behaviours in the whole community (Alshuwaikhat and Abubakar, 2008).

Campus greening

As organisations, HEIs operate as small cities with a significant environmental impact (Klein-Banai and Theis, 2011). Campus greening initiatives are an essential part of the sustainability agenda and as Rappaport (2008) asserts, at present, is a more accurate description of the HE sector's response to the sustainability agenda. University campuses are not only places to study but also places to model sustainable practices. This demonstration of sustainability initiatives has the potential to positively influence all those who engage with the university (Stephens et al., 2008). Therefore, HEIs should be implementing carbon reduction initiatives (e.g. energy efficiency interventions, renewable or low carbon energy generation), promoting and investing in sustainable transport initiatives (e.g. improving cycle paths), reducing waste and promoting recycling, reducing water consumption, purchasing and investing in environmentally and socially responsible products, sourcing food locally and investing in sustainable/green buildings, amongst others (Clugston and Calder, 1999; Velazquez et al., 2006; Alshuwaikhat and Abubakar, 2008; Altan, 2010). Furthermore, these operational practices should be incorporated into the scholarly activities within the university (Clugston and Calder, 1999).

Teaching and Research

Education for sustainable development (ESD) is an interdisciplinary approach to teaching and learning that aims to enable everyone to acquire the values, competencies, skills and knowledge to contribute to making the transition to a more sustainable society (UN, 2012). Achieving a sustainable future will not transpire unless the educational system trains citizens who understand the interconnections among the environmental, economic and social disciplines (Erdogan and Tuncer, 2009). Figure 2.12 presents the key competency areas for students in ESD.

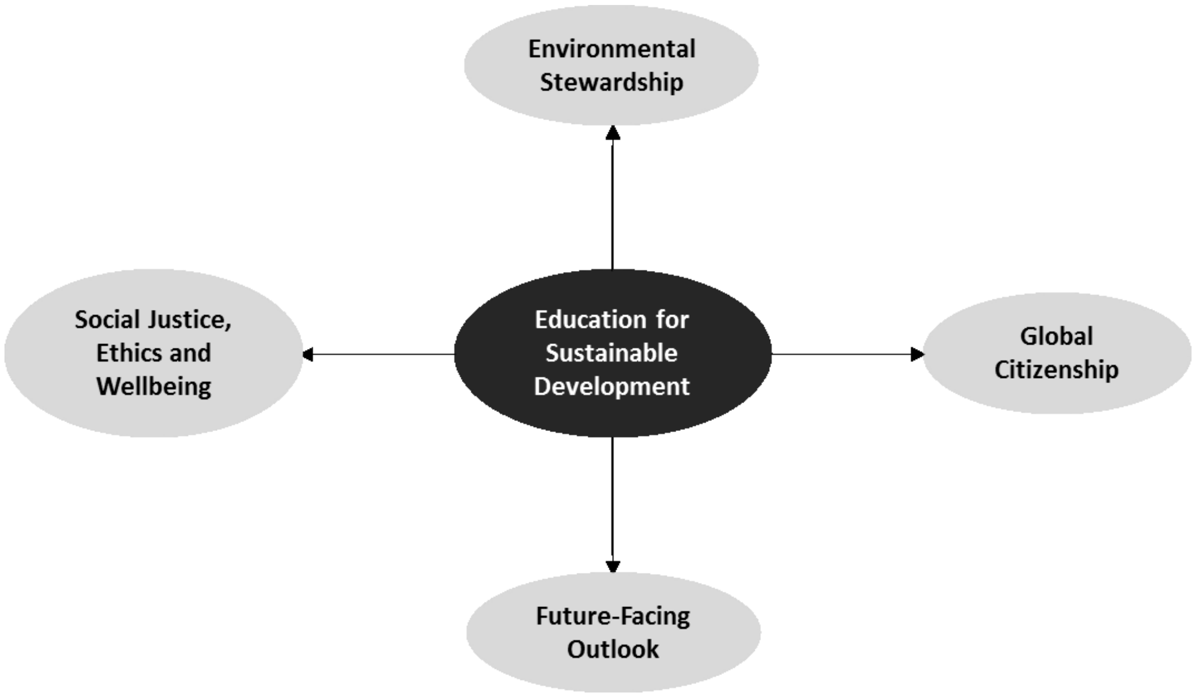

Figure 2.12. Key competency areas for students in ESD

ESD encourages students to consider what the concept of environmental stewardship (responsible use and protection of the natural environment) means in the context of their own discipline and everyday professional and personal lives (HEA/QAA, 2014). In addition, ESD looks to promote global citizenship among students (HEA/QAA, 2014) given that we live in an increasingly interconnected world comprising of related environmental, social and economic systems. It is important that students are aware of the wider world and recognise their own role in the global community (Rieckmann, 2012). Moreover, the major issues facing the planet, e.g. climate change, global poverty, will require an innovative generation with a global perspective to find solutions (Rieckmann, 2012). Thus, according to Hanson (2010: 80), a global citizen is, "involved locally, nationally, and internationally; is conscientious, informed, and educated about issues; exhibits environmental and social responsibility; advocates alongside the oppressed; or lives by the dictum, 'Be the change you want to see in the world'". ESD therefore links to the HE sector's internationalisation agenda given that international student recruitment and study abroad schemes are ways of promoting global citizenship. Moreover, ESD encourages students to consider issues of social justice, ethics and wellbeing and how these relate to economic and ecological factors. Finally, students are encouraged to develop a future-facing outlook, considering how their actions will affect future generations and how societies can be adapted to achieve more sustainable futures (HEA/QAA, 2014).

The key role of education, in promoting sustainable development has been highlighted in a number of international reports including Agenda 21, one of the outcome agreements of the 1992 Rio Earth Summit (UN, 1992a: Chapter 36):

> *Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues.*

The importance of promoting ESD was also emphasised in the outcome document of the United Nations Conference on Sustainable Development in 2012 (Rio+20), the Future We Want (UN, 2012: 44):

> *We resolve to promote education for sustainable development and to integrate sustainable development more actively into education beyond the United Nations Decade of Education for Sustainable Development.*

HEIs educate many future leaders, entrepreneurs and decision makers and through incorporation of the concepts of sustainability into all academic disciplines, can become an effective avenue for communicating sustainability to a wide audience (Alshuwaikhat and Abubakar, 2008), creating an entire generation of sustainability aware citizens.

With respect to research, HEIs can pursue pure and applied academic research related to sustainability (Wright, 2002). Through research and development, HEIs can promote sustainability by clarifying the challenges and developing effective ways of dealing with environmental and social issues such as climate change (Alshuwaikhat and Abubakar, 2008). HEIs should be promoting and practicing transdisciplinary approaches and responses in order to deliver creative and innovative solutions to problems (Moore, 2005).

2.5.3 Motivations and barriers for higher education institutions in engaging with sustainability

This section considers the motivations, key factors and barriers influencing engagement with sustainability in HEIs (Figure 2.13).

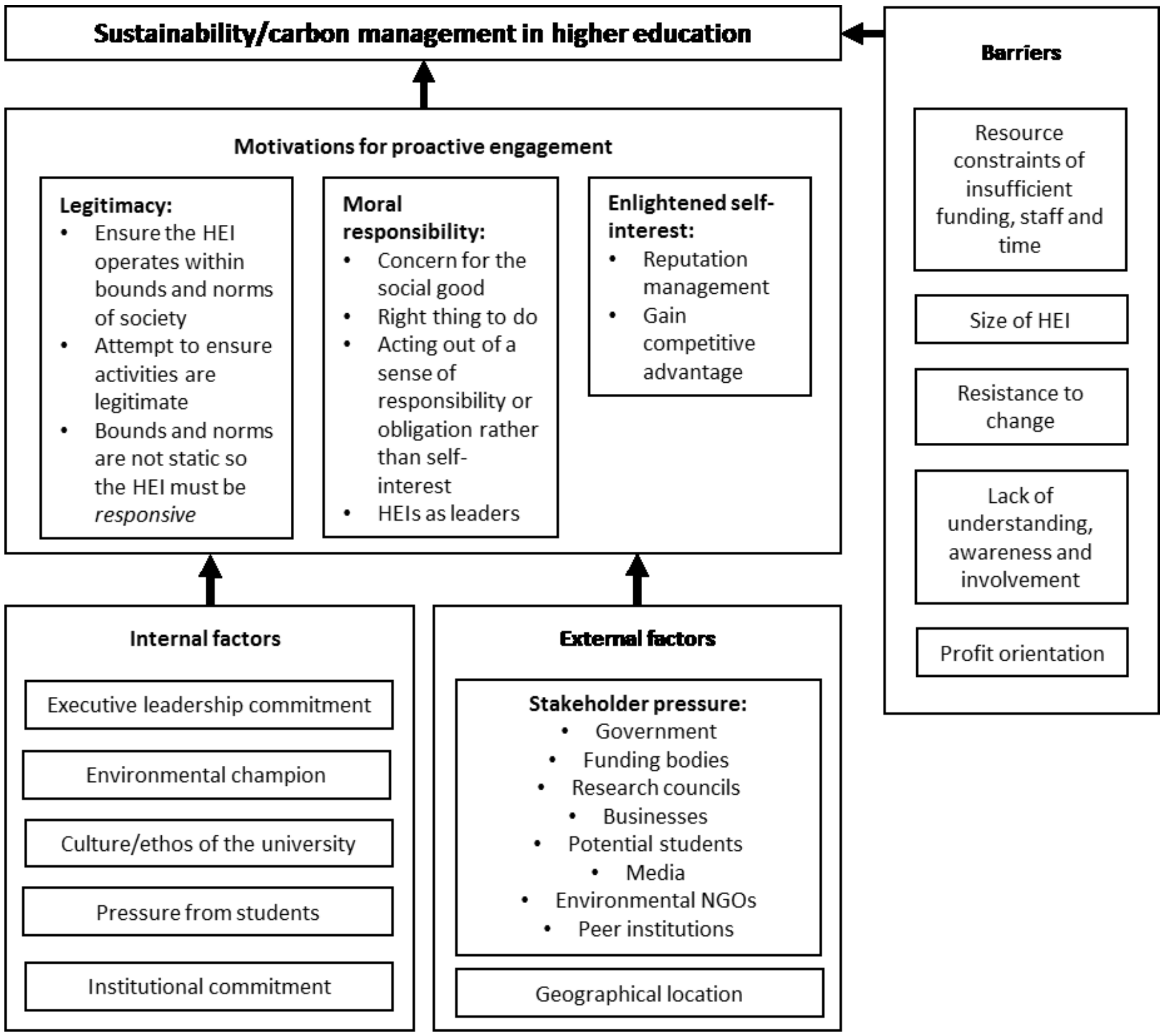

Figure 2.13. Motivations, factors and barriers influencing engagement with sustainability/carbon management in HEIs

Motivations

Dyball (2010) determined that legitimation was a significant motivation for the university in their study pursuing its sustainability strategy. With respect to the two dimensions of legitimation identified by Buhr (2006), action and presentation (discussed in Section 2.3.5), Dyball (2010) found both to operate at the university in their study in that it was aligning its operations with societal expectations of environmental protection, social equity, etc., and publishing an annual sustainability report.

One of the most compelling reasons for HEIs to commit to sustainability is the moral obligation to address this significant challenge (Wright, 2002; Ralph and Stubbs, 2014). Given HEIs knowledge and research capacity, there is a moral responsibility to educate future leaders and help make the transition to a more sustainable future (Cortese, 2003; Ralph and Stubbs, 2014). The COPERNICUS Charter for sustainable development in higher education sums up this argument (COPERNICUS, 1994: Chapter 10):

> *Universities and equivalent institutions of higher education train the coming generations of citizens and have expertise in all fields of research, both in technology as well as in the natural, human and social sciences. It is consequently their duty to propagate environmental literacy and to promote the practice of environmental ethics in society, in accordance with the principles set out in the Magna Charta of European Universities and subsequent university declarations, and along the lines of the UNCED recommendations for environment and development education.*

Increasingly, 'enlightened self-interest' is a motivation for proactive engagement as HEIs are aware of the need for reputation management, the potential reputational benefits of adopting sustainability as a core principle (Altan, 2010), and the potential to distinguish themselves from their peers through environmental league tables such as the People and Planet University League (PPUL, 2015). The enhanced public image can improve financial resilience through increased student recruitment (Nicolaides, 2006). In addition, engagement with sustainability, and specifically carbon management, can generate significant financial savings through for example, reduced energy usage and a reduction in CRCEES costs (Nhamo and Ntombela, 2014).

Moreover, engagement with sustainability will be contingent upon a number of internal and external situational factors:

Sources of funding and business demands

University research is, to a significant extent driven by its sources of funding. In the absence of a direct financial driver, the willingness of research councils to pay for sustainability focused research can be an important issue in determining the extent of university-wide transformations, as will be the level of engagement of HEIs with the needs of employers who are increasingly demanding sustainability literate graduates (Ferrer-Balas et al., 2008).

Sustainability and environmental champions

Respected individuals from any area of the university who are willing to promote and lead sustainability initiatives can be effective agents for change (Clugston and Calder, 1999; Ferrer-Balas et al., 2008; Ralph and Stubbs, 2014; Zhao and Zou, 2015).

Leadership commitment

Executive leadership, directing the institution towards greater sustainability through appropriate mission statements, plans and policies is essential, while leadership support is also crucial for ensuring that bottom-up sustainability initiatives have longevity (Clugston and Calder, 1999; Ferrer-Balas et al., 2008; McNamara, 2010; Brinkhurst et al., 2011; Ralph and Stubbs, 2014; Zhao and Zou, 2015). The establishment of a sustainability coordination unit or coordinator is important to keep the change process moving forward and to delegate responsibilities (Clugston and Calder, 1999; Ferrer-Balas et al., 2008; McNamara, 2010).

Students

Given the size and impact of the student population at a university, pressure for institutional engagement with the sustainability agenda is likely to be influenced by dissatisfaction amongst these stakeholders with the current situation. This could occur because of a general lack of engagement with sustainability at an HEI or because of gaps between claims and reality (Barth, 2013).

Institutional commitment

Research has shown that for universities to take the lead in sustainable development, all levels of stakeholders (administrators, students, staff and faculty) must be involved in, and actively engaged with sustainability initiatives and decision making to ensure their long-term success (McNamara, 2010; Wright, 2010; Lozano et al., 2013). In order to drive forward the sustainability agenda in HEIs, the most successful campus initiatives involve a combination of both top-down and bottom-up approaches (Shriberg, 2002; Townsend and Barrett, 2015), have support from individuals at lower levels (e.g. staff and students), commitment from the top (e.g. Vice-Chancellor) and have at least one environmental 'champion' (Shriberg, 2002).

Furthermore, Brinkhurst et al. (2011) suggest that whilst top-down and bottom-up efforts both have strengths, the greatest potential for long-term change comes from campus sustainability efforts led by the institutional 'middle', faculty and staff. Furthermore, the ability to involve as many stakeholders as possible in the institutional change process through effective communication, strongly influences the degree of implementation and acceptance of the sustainability agenda (Doppelt, 2003; Disterheft et al., 2012; Barth, 2013).

Additional stakeholder pressures

Further stakeholders identified in the literature as having intensified the pressure on HEIs to engage with the sustainability and carbon management agenda include, environmental NGOs, national government (through legislation and because they recognise the key role HEIs have in the sustainability agenda) and the media (Clugston and Calder, 1999; Alshuwaikhat and Abubakar, 2008; Littledyke et al., 2013).

Barriers to sustainability

There are many potential barriers and challenges to the integration of sustainability holistically into university systems (Filho, 2000; Dahle and Neumayer, 2001; Velazquez et al., 2005; Lozano, 2006; Ferrer-Balas et al., 2008; Sibbel, 2009; Djordjevic and Cotton, 2011; Krizek et al., 2012). Some are internal, due to university structure and culture, while others are imposed on the university from external sources (Ferrer-Balas et al., 2008). The principal challenges are summarised below:

Resistance to change

Universities have long established and deep-rooted traditions (Stephens and Graham, 2010). Changing individual and organisational habits, established ways of working and surpassing the cultural resistance prevalent within institutions can be an arduous task and take a substantial amount of time and effort (Dyball, 2010; Krizek et al., 2012).

Lack of understanding, awareness and involvement

Misconceptions of the meaning of sustainable development can act as a barrier (Filho, 2000; Sibbel, 2009). Universities may view sustainable development as too broad a concept and cannot see how the principles of sustainable development apply to their institution (Filho, 2000). Staff are often reluctant to engage with the sustainability agenda, as they either perceive it as largely irrelevant (Townsend and Barrett, 2015), do not recognise or understand the direct and indirect benefits, or they are unaware or have no interest in sustainability (Velazquez et al., 2005).

Lack of time and resources

A lack of time and resources, and the extensive costs associated with implementing sustainability initiatives can also act as a barrier (Filho, 2000; Dyball, 2010). More often than not, campus leadership accept eco-efficiency options that reduce costs but are unsupportive of sustainability initiatives where the benefits are less tangible and are unable to meet these goals (Velazquez et al., 2005). As with corporations, costs still outweigh many other considerations and economic terms guide most decisions (Krizek et al., 2012).

Size of the university

Large HEIs often find that the complexity of the organisation means it is difficult to achieve rapid transformation (Ferrer-Balas et al., 2008). Ferrer-Balas et al. (2008), in their analysis of sustainability transformation across seven case study HEIs, found that the two smallest HEIs considered their size as a driver for change, suggesting that the nimbleness of small HEIs may aid transformation. This is in contrast to the findings regarding corporate engagement with sustainability, which suggested larger organisations are more proactive given their financial resources and greater stakeholder pressures (see Section 2.3).

Profit orientation

A focus on profits is identified as barrier to engaging with the broader sustainability agenda at HEIs (Velazquez et al., 2005; Dyball, 2010). Indeed, this is why campus greening is often the focus of HEIs, given that a reduction in GHG emissions for example, reduces expenditure on energy, while 'sustainability' actions deliver less tangible or immediate benefits.

2.5.4 Summary

Globally, HEIs have a key role in disseminating sustainability thinking and helping to facilitate the transition to a sustainable/low-carbon economy through teaching and research, outreach and partnership and campus greening. The motivations for proactive engagement with sustainability include a moral responsibility, given that HEIs are educating future leaders and decision makers, enlightened self-interest and legitimacy.

This section has highlighted the intrinsic link between sustainability/ESD and internationalisation. One of the key aspects of ESD is promoting global citizenship and this links to the UK HE sector's internationalisation agenda, comprising a number of activities including international student recruitment, study abroad and internationalisation of the curriculum. However, the recruitment of international students and promotion of study abroad for UK students have significant carbon consequences in terms of emissions from air travel. Thus, there are conflicting priorities with regard to the sector's internationalisation and sustainability/carbon management agendas as well as between the values of global citizenship. The focus of this chapter now turns to examining the scale of this conflict, beginning with an in-depth exploration of internationalisation in HE.

2.6 Internationalisation in higher education

2.6.1 Introduction

This section explores and provides a conceptual background to internationalisation in HE including approaches to internationalisation and motivations. Specifically, the motivations for international student recruitment and study abroad are examined, as well as push and pull factors influencing potential students to study in the UK.

2.6.2 Conceptual background

Internationalisation is a term used to discuss the international dimension of HE. Interpretations of the meaning of internationalisation presented in the literature are varied, as it means different things to different people (Knight, 2004). Early definitions of the concept focused on specific activities (e.g. international student recruitment, study abroad) but now there is an acknowledgment that internationalisation is a process that needs to be integrated and sustainable at the institutional level (Knight, 2004). Indeed, the widely cited definition provided by Knight (2003: 2) reflects this, where internationalisation is "…the process of integrating an international, intercultural or global dimension into the purpose, function or delivery of post-secondary education". The term process conveys the point that internationalisation is an ongoing and continuing effort (Knight, 2003, 2004). Moreover, Bartell (2003) suggests internationalisation is a transformative process that influences the role and activities of all stakeholders including faculty, students, administrators and the community-at-large.

Over the last two decades, the concept of internationalisation in HE has moved from the peripheries of institutional interests to become a fundamental part of many universities strategies (Brandenburg and de Wit, 2011). For many HEIs, internationalisation is now highly central to their work and permeates every aspect of institutional life (Qiang, 2003). It is clear that internationalisation in the UK has become firmly embedded in institutional mission statements, policies and strategies as well as national policy frameworks (Knight, 2011). The increased emphasis on internationalisation stems from the HE sector's need to respond and adapt to an increasingly multicultural society and the unprecedented growth, complexity and competitiveness of the global economy (Bartell, 2003; Cudmore, 2005). Increased travel, global telecommunications and international trade has meant that national boundaries have lost their traditional significance and it has become important for individuals to possess firsthand experience with other cultures (Chieffo and Griffiths, 2004). This new global context is forcing HEIs to reconsider their mission, tasks and responsibilities (Gacel-Avila, 2005).

2.6.3 Approaches to internationalisation in HE

An ‘approach’ refers to the strategy adopted by leadership to promote and implement activities aimed at internationalisation (Bartell, 2003). Internationalisation can be looked at from a variety of different perspectives and Knight (2004) talks about six different approaches to internationalisation at the institutional level (Table 2.6). The activity approach is the most widely used in the description of internationalisation (Knight and de Wit, 1995), whereby internationalisation is described in terms of specific activities such as the recruitment of international students or study abroad. Nevertheless, different HEIs will have come to the internationalisation agenda from a variety of different viewpoints depending upon the views of the leadership of each. Some HEIs will present internationalisation in the form of the desired outcomes for students or the institution, or will describe the primary motivations, or view it as a process whereby an international dimension permeates all aspects of the institution’s activities. The at home approach focuses on the primary functions of the HEI including curricular, extra-curricular and organisational aspects. Finally, the abroad or cross-border approaches focuses on the linkages with overseas countries and the mobility of education across borders (Knight, 2004).

Table 2.6. Approaches to internationalisation at the institutional level (source: Knight, 2004)

Approach	Description
Activity	Internationalisation is described in terms of activities such as study abroad, curriculum and academic programs, institutional linkages and networks, development projects, and branch campuses.
Outcomes	Internationalisation is presented in the form of desired outcomes such as student competencies, increased profile, more international agreements, and partners or projects.
Rationales	Internationalisation is described with respect to the primary motivations or rationales driving. This can include academic standards, income generation, cultural diversity, and student and staff development.
Process	Internationalisation is considered as a process where an international dimension is integrated into teaching, learning, and the service functions of the institution.
At home	Internationalisation is interpreted to be the creation of a culture or climate on campus that promotes and supports international/intercultural understanding and focuses on campus-based activities.
Abroad (cross-border)	Internationalisation is seen as the cross-border delivery of education to other countries through a variety of modes (face to face, distance e-learning) and through different administrative arrangements (franchises, twinning, branch campuses, etc.).

2.6.4 The internationalised HEI

Qiang (2003: 258) provides a comprehensive list of elements of internationalisation. However, based on the wider definition of internationalisation and approaches discussed in the above section, the key elements of a fully internationalised HEI are (Fielden, 2011):

- A significant percentage of the student population would be international students.
- Transnational education provision in some form.
- International collaboration in research.
- Academic staff from many nationalities.
- An internationalised curriculum.
- Social and academic integration between home and EU/non-EU students.
- Staff and student mobility and study abroad exchanges.
- An international office, supporting and developing the internationalisation strategy.

In summary, internationalisation conveys a variety of meanings and applications ranging from a minimalist view such as study abroad programs, recruitment of international students, or conducting research internationally, to a view of internationalisation as a complex, all-encompassing and policy-driven process, integral to permeating the life, culture, curriculum and research activities of the university and its population (Bartell, 2003). The rhetoric from most HEIs suggests a desire for the latter concept, transformative internationalisation (while being driven economically). Although there remains a gap between how institutions talk about internationalisation and what policies and practices actually deliver (Robson, 2011).

2.6.5 Institutional motivations for internationalisation

At an institutional level Knight (2004) states that the emerging rationales for internationalisation include achieving a strong international profile and reputation, student and staff development, income generation, and research and knowledge production. Furthermore, as discussed in Section 2.6.3, Knight (2004) asserts that engagement with internationalisation at an institutional level differs between institutions and is contingent upon factors including mission, student population, faculty profile, level of resources, geographic location, funding sources and level of local, national and international interests.

As discussed in Section 2.5.2, in response to the sustainability agenda, as well as the globalisation of business, HEIs are placing significant emphasis on promoting global citizenship among their students. Businesses are increasingly looking for students with international and intercultural experiences and more students are seeking an international element during their time in HE (Robson, 2011; Long et al., 2014).

Economic incentives have increasingly driven the internationalisation agenda (Robson, 2011). Altbach and Knight (2007: 292) state that, “earning profit is a key motive for all internationalization projects in the for-profit sector and for some traditional non-profit universities with financial problems”. Many countries, including the UK, recruit international students to earn profits by charging high fees (Altbach and Knight, 2007) and international student tuition fee income has become a key source of revenue for institutions (Robson, 2011). Indeed, De Vita and Case (2003), argue that UK universities have needed to expand their financial base using international students as a source of income to fill the holes left by reduced government funding in recent decades. In terms of internationalisation activities abroad, the realisation of UK HEIs that their awards have significant commercial value, coupled with the fact that emerging economies are struggling to meet the demand for HE, has led to the exporting of academic programmes through various kinds of international partnerships (De Vita and Case, 2003). Healey (2008) advocates the view of De Vita and Case (2003) and argues that HE internationalisation is merely a response to government policy, which makes the unregulated international student market more lucrative and attractive to HEIs than the more tightly regulated domestic student market.

2.6.6 Strategies for the internationalising of HEIs

With respect to describing internationalisation as a series of activities, student mobility is the most visible aspect and it is clear that UK HEIs will continue to place significant importance on the recruitment of international students and study abroad schemes. The carbon implications of this are significant as the only realistic mode of transport for most students is air travel. The recruitment of international students and study abroad are discussed in more detail in this section. Moreover, transnational education (TNE), the process by which UK HEIs seek to deliver their services overseas, is also discussed, given that in theory it offers an approach for avoiding the carbon consequences of the internationalisation agenda

Recruitment of international students

The total number of students studying outside their country of domicile increased from 0.8 million in 1975 to 4.5 million in 2012, a more than fivefold increase (OECD, 2014). Increased globalisation is encouraging international student mobility, coupled with an increasing demand for HE from developing countries (Altbach, 2004; Alam et al., 2013). Consequently, international student mobility favours well-developed education systems and the majority of the world's international students move from developing to industrialised nations (Altbach and Teichler, 2001; Altbach and Knight, 2007).

The English speaking countries of the USA, UK, Australia and Canada host 40% of all international students (OECD, 2014). Europe is the top region, hosting 48% of international students followed by North America, hosting 21%. The UK has a strong share in the international student market with 435,000 studying in the UK in 2013/14 (HESA, 2015a). Indeed, the recruitment of international students is the most prominent manifestation of the internationalisation agenda in the UK HE sector. This trend looks set to remain as UK institutions continue to market themselves abroad and push forward with recruitment strategies. In the short-term, forecasts suggest annual growth in international student numbers of up to 6.7% to 2020 for the UK (DBIS, 2013). While in the long-term, demand is predicted to remain strong as middle-income countries such as Brazil, Russia, India, China, Nigeria and the Gulf States, transition to more knowledge based economic growth (DBIS, 2013).

Push-pull factors have been used to explain international student decision-making (Mazzarol and Soutar, 2002; Maringe and Carter, 2007; Wilkins and Huisman, 2011a; Wilkins and Huisman, 2011b; Wilkins et al., 2012). Push factors tend to be economic or political and have a role in influencing the choice of country (Maringe and Carter, 2007). The most common push factors identified within the literature include the difficulty of securing a place at university in students' home countries, the unavailability of certain subjects and insufficient quality of courses in the students' home country (Mazzarol and Soutar, 2002; Maringe and Carter, 2007; Wilkins and Huisman, 2011a). On the other hand, pull factors appear to exert greater influence on specific institutional choice (Maringe and Carter, 2007) and include, the institutions' reputation and quality of education, where institutions rank in league tables and the chance to get an internationally recognised, highly regarded qualification (Mazzarol and Soutar, 2002; Maringe and Carter, 2007; Wilkins and Huisman, 2011a). Wilkins and Huisman (2011b), in their study of international student destination choice found that pull factors such as the 'quality of education', had a much greater influence on the decision to study abroad than push factors such as the 'economic strength of the student's home country'.

Against a backdrop of falling home students, international students have become a key source of revenue for UK HEIs (Qiang, 2003; Robson, 2011). Many postgraduate courses at HEIs in the UK would not attract the required number of students to keep them running if it was not for international students, who account for 50% of all students on taught masters courses and 44% of full-time research masters and doctoral and students (Smith et al., 2010). Not only do international students contribute to university income through the payment of tuition fees and accommodation costs, they also have a significant positive impact on the local economy and have a secondary economic effect through the spending of visiting friends and relatives (VFR) (Bischoff and Koenig-Lewis, 2007).

However, the rationale for international student recruitment goes beyond the financial benefits. Having an international campus with a diverse population of students exposes domestic students to different cultures and helps prepare them for a much more global business world (Altbach and Knight, 2007). From the students' point of view, the ability to study in another country provides benefits including experiencing new cultures and a wide choice of universities and courses. Some international students form a very positive understanding of the UK's cultures and values and as a result return to their home countries as informal ambassadors for the UK. This cannot be delivered through TNE provision. Many alumni form educational, cultural and business links with both existing UK enterprises and new contacts made during their time at university (Mellors-Bourne et al., 2013).

Short-term study abroad schemes

Over the last thirty years, educators throughout the world have tried to help students understand our interconnectedness and enhance global citizenship by building international bridges of understanding through the promotion of study abroad (Lutterman-Aguilar and Gingerich, 2002). Research has shown that there are numerous outcomes resulting from study abroad. Following a survey of 3,400 study abroad alumni, Dwyer and Peters (2004: 56) claim that, "…studying abroad is usually a defining moment in a young person's life and continues to impact the participant's life for years after the experience". For Dwyer and Peters (2004), the outcomes of study abroad fall into three broad categories, personal growth, intercultural development, and education and career attainment. As a result, study abroad continues to gain popularity throughout much of the world. From a UK perspective, approximately 20,000 students enrolled at UK HEIs studied abroad in 2012/13 (Carbonell, 2014) and it has become an integral part of the sector's internationalisation agenda.

Transnational education

The Council of Europe (2002) defines TNE as:

All types of higher education study programmes, or sets of courses of study, or educational services (including those of distance education) in which the learners are located in a country different from the one where the awarding institution is based.

Table 2.7 presents the different forms of TNE delivery.

Table 2.7. Description of the various types of transnational education provision

Type of TNE provision	Description
International branch campus	A HEI from the source country establishes a campus in the host country to deliver its courses to students in that country (Alam et al., 2013).
Franchising/twinning programmes	With franchising, the source country HEI authorises the host partner to deliver its courses and programs. The qualification is awarded by the source country's institution. Education quality and assessments are moderated by the source HEI (Alam et al., 2013). Franchise programmes usually involve all the study taking place in the host country. Where the students completes the final year in the source country (e.g. 2+1), this is commonly referred to as a twinning programme (British Council, 2013).
Articulation agreements	A student that has completed a specified curriculum in the host country (award not of the source country) is allowed to apply to a source country programme (taught in either the source or the host country) and enrol with 'advanced standing' (British Council, 2013).
Double/dual degree programmes	Two or more partner HEIs collaborate to deliver to deliver a common programme. The student receives an award from both HEIs. Student and staff mobility between HEIs varies (British Council, 2013).
Joint degree programmes	Similar to double/dual degree programmes in that two or more partners collaborate to deliver a programme. The difference is that the student receives just one award with the badges of both HEIs on it (British Council, 2013).
Distance learning	Distance learning is an educational provision characterised by the separation of the learner from the tutor. Material is available online from the source HEI with guidance available from tutors (Hussain, 2007).

From a UK perspective, TNE provision allows HEIs to reach and target those students who are not inclined to travel to the UK to study and those students who under normal circumstance would not be able to afford the costs associated with travelling to the UK (Healey, 2008). In 2013/14, there were more students studying wholly overseas for a UK HE qualification (637,000) than international students studying in the UK (435,000) (HESA, 2015a; HESA, 2015c).

The development of internationalisation in HE has tended to follow an incremental approach, similar to the internationalisation of business. This is often referred to as the "Uppsala Internationalisation Model", which is grounded in research conducted on

Scandinavian companies in the 1970s and focuses on the gradual use of knowledge about foreign markets and on the incrementally increasing commitments to foreign markets (Johanson and Vahlne, 1977). The four phases of the model are exporting, licensing production, joint ventures and sole ventures (Healey, 2008). Exporting for business involves the sending of goods or services abroad and in the context of HE, universities have been 'exporting' educational services to foreign students who enrol on their home campuses (Healey, 2008). Licensing represents universities engaging with TNE and seeking to establish an offshore presence typically in the form of franchising and validation agreements with partner institutions. Joint and sole ventures are what Mazzarol et al. (2003) term "third wave" approaches to internationalisation in HE and entails the opening of offshore facilities or 'branch campuses' (Mazzarol et al., 2003; Healey, 2008).

2.6.7 Summary

Over the last two decades, the concept of internationalisation in HE has moved from the peripheries of institutional attention to the very core. The most fundamental aspect of this increased focus has been the recruitment of international students, driven by demand exceeding the supply of HE places in many developing countries. The economic benefits of international student recruitment is the dominant motivation for UK HEIs, however there is a realisation now that they must help prepare their students for an increasingly globalised business world and having international students on campus can contribute to this. Furthermore, HEIs are offering more study abroad opportunities, recognising that this is an increasingly popular course attribute and helps to promote global citizenship, improve language skills and increase employability. Thus, the sector has witnessed international student and study abroad numbers increase significantly over the last two decades and this growth is likely to continue in the short- to medium-term, the carbon implications of which will be profound. The following section presents an in-depth exploration of carbon management in the UK HE sector and examines the issue of international and study abroad student air travel emissions.

2.7 Carbon management in the UK higher education sector

2.7.1 Introduction

The response to climate change will have implications for all areas of the economy, and the HE sector has a crucial role to play in efforts to reduce emissions (Nhamo and Ntombela, 2014). In the same way that corporations have embraced carbon management in response to the sustainability agenda, for the majority of universities, campus greening is often the first step towards sustainability (Tilbury, 2004; Müller-Christ et al., 2014; Zhao and Zou, 2015). Although a number of tools have been developed for sustainability assessment across core HEI activities (operations, education, research, outreach), sustainability management remains in its early stages with few HEIs producing sustainability reports (Lozano, 2011; Ceulemans et al., 2015). However, HEIs are increasingly reporting their carbon footprint (the GHG emissions arising from their activities) as a measure of sustainability (Klein-Banai and Theis, 2013). While taking action on climate change is only one aspect of the sustainable development agenda, it is widely recognised that the two are intrinsically linked (Pinkse and Kolk, 2012), thus GHG emissions reporting can be viewed as an important first step for HEIs that enables identification of sustainability initiatives and ultimately improved performance (Townsend and Barrett, 2015).

2.7.2 UK HE sector GHG emissions targets and reporting

All UK HEIs are expected to contribute to the ambitious national targets to reduce emissions (see Section 2.4), although specific requirements vary across the funding councils and devolved governments.

HEFCE has set a sector wide target for academic year 2020/21 of a 34% reduction in Scope 1 and 2 GHG emissions against a 1990/91 baseline, re-expressed as a 43% reduction against 2005/6 (HEFCE, 2010a). HEIs are required to individually set targets for Scope 1 and 2 emission reductions, but are not required to individually meet the sector target (HEFCE, 2010a). In 2013/14, reported HEI commitments for 2020/21 were equivalent to a 38% reduction below the 2005/6 baseline (HESA, 2014b).

The Climate Change Scotland Act (2009) sets a more stringent Scottish 2020 target of a 42% reduction in GHG emissions against a 1990 baseline (HMSO, 2009). The Act also places duties on public bodies to act in the way best calculated to contribute to the delivery of this target, where HEIs are identified as 'major players' and are required to develop carbon management plans to measure and reduce their impact. The Scottish Funding Council (SFC) Outcome Agreements, which set out what HEIs plan to deliver in return for their funding, include carbon reduction targets, however, the baseline year, target year, and level of ambition, vary by HEI (SFC, 2015).

The Welsh Assembly Government (2010) Climate Change Strategy for Wales aims to reduce carbon emissions by 3% per annum from 2011 across all devolved areas based on a baseline of average carbon emissions between 2006-2010. The Higher Education Funding Council for Wales (HECFW) Carbon Management Policy requires HEIs to publish a carbon management strategy, including an identified target for Scope 1 and 2 emissions (HEFCW, 2014). However, the level of ambition in terms of carbon reduction and choice of baseline year are considered matters for individual institutions to establish, although in setting targets HEIs should reflect upon national policy (HEFCW, 2014).

The Northern Ireland Executive's (2011) Programme for Government commits to working towards a reduction in GHG emissions of at least 35% by 2025 against a 1990 baseline. The Executive's Greenhouse Gas Action Plan, which outlines how each department will contribute towards meeting the 2025 target, states that the HEIs have targets to reduce GHG emissions by at least 34% by 2020 (DOE, 2011).

In terms of sector reporting, HEIs in England, Wales and Northern Ireland are required to make an Estates Management Record (EMR) return to the Higher Education Statistics Agency (HESA). Making an EMR return is optional for Scottish HEIs, although in practice the majority choose to do so. Within the EMR return, it is mandatory to report all Scope 1 and 2 emissions, along with Scope 3 emissions from water supply and wastewater treatment (HESA, 2014a). Thus, the requirements extend beyond the minimum obligations of the GHG Protocol Corporate Standard (WBCSD/WRI, 2004). Introduced in the 2013/14 reporting year, HEIs can also voluntarily submit data for further Scope 3 emissions sources associated with waste, travel and procurement (HESA, 2014a). HEFCE recommends reporting against all of these Scope 3 sources, and has signalled that mandatory reporting may be extended to include these sources in the future (HEFCE, 2016).

As discussed in Section 2.4, evaluating these Scope 3 emissions is recognised as a sizeable challenge due to issues relating to boundary setting, data availability, and calculation reliability (Schaltegger and Csutora, 2012; Williams et al., 2012). With specific reference to the HE sector, a number of studies have highlighted the importance of sector level guidance to help address these issues (thus ensuring consistency and enabling comparability) by setting clearly defined boundaries and identifying appropriate calculation methodologies (Ozawa-Meida et al., 2013; Robinson et al., 2015; Townsend and Barrett, 2015). Sector guidance has been produced to assist in the consistent calculation of these emissions (HEFCE 2012a; 2012b; 2012c).

2.7.3 Carbon reduction progress

Some HEIs require vast amounts of energy and resources to sustain the services they provide due to their campus size, population and various activities taking place (Flint, 2001). HE is a fast growing sector (Ward et al., 2008), a rising consumer of resources and energy, and generator of emissions and waste (Roy et al., 2008). Consequently, many of the larger HEIs produce GHG emissions equivalent to small cities (Flint, 2001; Alshuwaikhat and Abubakar, 2008). Table 2.8 displays the mandatorily reported GHG emissions for the UK HE sector, broken down by country.

Table 2.8. Summary of the size of the UK HE sector and GHG emissions in 2013/14, for the four countries of the United Kingdom

Country	**HEIs**		**Total Students**		**Mandatorily Reported GHG Emissions (ktCO$_2$e)**				
	#	*(% UK)*	**#**	*(% UK)*	**Scope 1**	**Scope 2**	**Scope 3**	**Total**	*(% UK)*
United Kingdom	159		2,299,355		862.0	1,505.3	25.2	2,392.6	
England	130	*(82%)*	1,875,020	*(82%)*	661.9	1,232.7	20.7	1,915.3	*(80%)*
Scotland	17	*(11%)*	230,805	*(10%)*	142.3	176.3	2.8	321.4	*(13%)*
Wales	8	*(5%)*	137,135	*(6%)*	38.5	71.8	1.2	111.5	*(5%)*
Northern Ireland	4	*(3%)*	56,395	*(2%)*	19.4	24.5	0.5	44.4	*(2%)*

Over the last decade UK HEIs have been trying, with varying degrees of success, to reduce Scope 1 and 2 emissions in line with sector targets (Nhamo and Ntombela, 2014) and between 2005/06 and 2013/14 total Scope 1 and 2 emissions across the sector decreased by approximately 7% (HESA, 2014b). Although Scope 1 and 2 emissions decreased between 2005 and 2014, the rate of decrease is low and HEIs look set to fall significantly short of achieving the reduction targets discussed above. A recent report concluded that the sector would achieve a 12% reduction by 2020 based on current reduction trends, with the HE sector claiming that an unprecedented era of expansion in terms of student numbers, estates and research activity has hindered emissions reduction progress (BriteGreen, 2015). Moreover, an increasing number of students have been choosing to study degrees such as computer science, medicine and biological sciences resulting in increased use of laboratory facilities and computer equipment associated with higher energy demands (Altan, 2010).

UK HEIs are often classified according to when they were founded, and Table 2.9 presents an analysis of UK HE sector Scope 1 and 2 emissions for 2013/14 according to this classification (see Appendix 2 for the list of HEIs). Generally, the older the institutional category, the higher the emissions per student. Ancient institutions have the highest average emissions per student with the modern groupings of Post-1992 and 2nd Wave New Universities having the lowest emissions per student. This is not surprising given that Ancient, Red Brick, 2nd Wave Civic and Plate Glass institutions tend to be research-led institutions, thus are the highest consumers of energy in the UK HE sector (Ward et al., 2008). Indeed, laboratories within HEIs were found to have ten times more effect on emissions per square meter than classroom and office space (Klein-Banai and Theis, 2011). Moreover, older HEIs tend to have older buildings that do not deliver effective usage of space, are not energy efficient and are difficult to renovate.

Table 2.9. UK HE sector Scope 1 and 2 emissions for 2013/14 broken down by type of institution (ranked according to tCO_2e per student)

HEI classification	Description	No. of Institutions	Total students	% Sector emissions	tCO_2e/student
Ancient	Founded before 1800	6	115935	14.8	3.0
Red Brick	The six civic universities founded in the major industrial cities of England in the early 20th century.	6	155930	13.5	2.0
University of London Institutions	Formed in 1836 and made up of institutions founded between 1614 and 1964. Includes current institutions and institutions that have since become independent	20	149950	12.6	2.0
Plate Glass	Universities founded during the 1960s, so-called because of their architectural style.	22	284105	18.1	1.5
2nd Wave Civic	Founded between 1920 and 1960	13	200940	12.5	1.5
Post-1992	Universities founded after the passage of the Further and Higher Education Act 1992	37	644715	17.5	0.6
2nd Wave New Universities	Founded post 2001.	36	277125	7.3	0.6
Other	Includes universities founded in the 1970/80s, specialist universities and colleges of higher education	15	52435	3.9	1.7

2.7.4 Engagement with Scope 3 emissions

As with corporate responses to climate change and carbon management, HEIs have conventionally, tended to focus on Scope 1 and 2 emission reductions. However, as identified in Section 2.4, if society is to deliver the required cuts in emissions then it is important that HEIs take a 'whole systems' approach and have a comprehensive understanding of the full carbon implications of their existence. This applies not just to direct emissions but to indirect Scope 3 as well.

In the 2013/14 EMR return (HESA, 2014b), only 27 of 159 HEIs reported against all available Scope 3 sources, where the emissions reported by two HEIs appeared to have been inputted incorrectly (see Appendix 3). For the remaining 25 institutions, the voluntarily reported emissions accounted for 71% of total reported emissions (51% to 88% on an institutional basis). This clearly illustrates the significance of Scope 3 sources, where narrowly set boundaries can significantly underestimate emissions and thus provide a misleading picture of a university's climate impact (Davies and Dunk, 2016).

2.7.5 Extending the reporting boundary – the case for accounting for student air travel

Whilst extending mandatory reporting across all current EMR Scope 3 categories would clearly represent an improvement in UK HE sector reporting and management, there are other potentially significant emission sources that fall outside of this boundary. Specifically, student travel emissions are presently limited to commuting, defined as travel between the term-time address and the HEI (HESA, 2014c). Thus, emissions associated with student travel between home and term-time addresses, or to participate in study abroad programmes are not included. Although not part of the EMR return, HEFCE good practice guidance does include accounting for international and study abroad student air travel (HEFCE, 2010b), likely the most significant component of these additional emissions as well as being the most significant source of emissions for the individual students. However, according to the PPUL, only nine HEIs have included these emissions in their carbon management plans (PPUL, 2015).

Extending the reporting boundary to account for student air travel to and from the university may prove challenging for (or be challenged by) HEIs for a number of reasons. Firstly, given that there are minimal alternatives to air transport (particularly for the UK due to its island location on the edge of western Europe), these emissions will likely increase in line with the continued internationalisation of the sector and the drive to increase inbound and outbound student numbers[13] (Long et al., 2014; Townsend and Barrett, 2015). Indeed, forecasts suggest growth in international student enrolments in the UK of up to 6.7% per year to 2020 (DBIS, 2013). Secondly, questions can be asked regarding whether or not the associated emissions should be included in an HEI's GHG emissions inventory, where the guidance provided by the GHG Protocol is potentially open to interpretation regarding whether or not they are attributable to the HEIs. Thirdly, there are questions relating to who should be 'responsible' for mitigating student air travel emissions. Finally, it is a challenge for HEIs to accurately account for student and VFR flight emissions due to the reliability of data and assumptions contained within sector guidance.

[13] In this study, the term 'inbound' refers to international (both EU-28 and non-EU nationals) students coming to the UK to study, while 'outbound' refers to students from UK based HEIs studying abroad.

With respect to whether the emissions be included in an HEI's GHG emissions inventory, according to the Scope 3 Standard (WBCSD/WRI, 2011a), organisations should report downstream emissions resulting from the use of sold products (goods and services). The critical issue in setting boundaries for a service is to consider the purpose that the service fulfils, and service delivery "encompasses all operations required to complete a service" (WBCSD/WRI, 2011b: 40). It could be argued that HEIs are explicitly providing education for overseas students and study abroad opportunities as service offerings, where students are required to travel in order to access these services. Thus, at a minimum, travel between the UK and the overseas country at the start and end of the study period should be included in an HEIs Scope 3 emissions. Whether or not any additional flights that students elect to make are attributable to the HEI is debatable. It could be argued that when offering a service of overseas education that is delivered over an extended period, it is not reasonable to expect that students would not travel home during that period, and as such, additional flights form part of the service-use profile (and are therefore attributable). On the other hand, given that it is non-essential travel, the students bear responsibility for any additional flights made during the study period and these are not attributable to the HEI. Furthermore, the Scope 3 Standard states that emissions should be included if the organisation has the capacity to influence and the critical point with respect to HEIs is that they have the potential to influence the additional flights made during the year. Thus, for this reason these additional emissions are included.

Following similar reasoning, there are questions as to whether the reporting boundary should be extended further to include emissions arising from the flights of VFR. VFR trip generation has been identified as a key socio-economic benefit associated with the UK international student population, where according to Bischoff and Koenig-Lewis (2007), for 73% of VFR the sole motivation for travel was a wish to see the student concerned (with 27% holding joint motivations, combining a student visit with a holiday or event in the area). Thus if action were taken to encourage fewer student flights, it is conceivable that the number of VFR flights might increase, decreasing or negating any expected reduction in economy-wide emissions (c.f. rebound and backfire effects; Druckman et al., 2011).

2.7.6 Accounting for student air travel – calculation reliability

While HEFCE have produced accounting guidance for estimating emissions associated with inbound and outbound student air travel (HEFCE 2010b), the researcher questions the robustness of the proposed method and in particular, the assumptions made regarding trip distance and flight frequency. In the HEFCE guidance, the distance is estimated as twice the great circle distance (GCD) between London Heathrow (LHR) and the capital city of the overseas country (HEFCE, 2010b). However, if the overseas country is unknown, the GCD is assumed to be 400 miles for short-haul flights and 4000 miles for long-haul (HEFCE, 2010b). With regard to flight frequency, HEFCE assume that all inbound students from the EU make one additional flight during the academic year and all other inbound and outbound students make no additional flights (HEFCE, 2010b). However, there is no prior research on which to base these assumptions (SQW Consulting/SQW Energy, 2009), where there may or may not be differences between the travel behaviour of different student groups, and average trip distances and flight frequencies may be substantially different, particularly if both student and VFR flights are considered.

2.7.7 Responsibility for student air travel emissions

There are questions as to who bears responsibility for mitigating or compensating for student air travel emissions, where without attributing responsibility for these emissions, their mitigation will remain an arduous task (Bastianoni et al., 2004). The researcher understands 'responsibility' to mean "The state or fact of having a duty to deal with something" (Oxford Dictionaries, 2016). While this question of responsibility has not been explored in the carbon management in HE literature, a fundamental question in the literature on GHG emissions allocation is that of whether the emissions are the responsibility of those who directly produce them, or those whose consumption drives demand (Hoornweg et al., 2011). The concept of "shared responsibility" is one potential solution, whereby responsibility is assigned to both producers and consumers, in a mutually exclusive and collectively exhaustive way (Lenzen et al., 2007).

Given these considerations, there are a number of different perspectives to allocating responsibility for student air travel emissions:

- Given that the emissions are classified as the airlines' Scope 1 footprint according to the Corporate Standard, then they are the airlines' responsibility.
- It is the students' choice to study abroad and the emissions are part of their personal carbon footprint, so they should have responsibility (consumer responsibility).
- All HEIs are responsible for the emissions given that their service offering is the reason why the student is taking the flight.
- Given the high number of beneficiaries from student air travel (e.g. the student, the partner university, the airlines and the airports), is it fair to say that all the emissions are the responsibility of one party alone? Responsibility could be shared among all who benefit from the flight.
- All stakeholders who have the capacity to influence the size of the footprint should hold a degree of responsibility.

2.7.8 Mitigating and compensating for student air travel emissions

The carbon management hierarchy (see Section 2.4) prioritises efforts to avoid and reduce emissions. Table 2.10 presents a range of options available to HEIs to mitigate emissions from student air travel. Once the university has done all it can to promote carbon reduction, carbon offsetting/compensation should be considered.

Table 2.10. Potential options for mitigating student air travel emissions

Source	Proposed mitigation measures
University of Bristol (2010)	Reduce the number of flights by using methods to make staying in the UK more attractive over break periods. Projects such as integrating students with host families in the local community could avoid the need to travel home over the summer.
Caird et al. (2015)	Distance learning as a low carbon alternative to traditional face-to-face delivery
Davies (2015)	Distance learning and transnational education as a low carbon alternative to traditional face-to-face delivery
Duke University (2016)	Invest in on-site and local carbon compensation schemes
Dvorak et al. (2011)	Tapping into local immigrant populations and creating local 'study away' experiences as an alternative to study abroad, raising awareness of impacts of air travel
Hale et al. (2013)	Using alternative modes of transport where possible (e.g. train travel to destination in Europe), employing carbon offsets
Hale and Vogelaar (2015)	Choosing only single-leg flights, employing carbon offsets
Long et al. (2014)	Flying direct to destination, using carbon footprint calculators as educational tools, choosing airlines with lower emissions, longer durations abroad (fewer trips), employing carbon offsets
Miyoshi and Mason (2009)	Choosing airlines with lower carbon emissions
Roy et al. (2008)	Distance learning as a low carbon alternative to traditional face-to-face delivery
SCU (2016)	Awareness raising to reduce travel, choose non-stop flights, travel economy class, rescheduling of students breaks and orientation to reduce need for air travel, make carbon offsets a part of the study abroad cost

In theory, TNE offers a way of avoiding and reducing the need for air travel. However, the extent to which students perceive the quality of TNE in comparison to studying in the UK is less clear and there are questions as to the acceptability of TNE and the extent to which it is substitutable for studying for a full degree in the UK. Although TNE is a radical option and could have negative socio-economic impacts for the UK, humanity needs to significantly increase the rate of emission reduction and that requires radical changes and breaking away from current models (Bouvrie et al., 2014). Alternatives to UK students spending time studying abroad could involve teaching certain international content on campus and then tapping into local immigrant populations, creating local cultural immersion opportunities (Dvorak et al., 2011).

Once all options for reducing the carbon consequences of operations have been considered, carbon offsetting, as discussed in Section 2.4, is a way to mitigate ‘unavoidable emissions’ (Lovell et al., 2009). Offsetting cannot be used to meet an institution’s carbon reduction target for Scopes 1 and 2, but it may form part of an institution's carbon management strategy for mitigating the effects of activities that create emissions under Scope 3, including student flights (HEFCE, 2010b).

Alternatively, the university could "compensate" for student air travel emissions through investment in schemes such as environmental training courses for students or the local community, or in carbon reduction schemes on campus that, without the funds, would not have qualified under the normal payback period. Notable action in the field of carbon compensation has been demonstrated at Duke University, in the USA. The University has established its own carbon compensation initiative whereby individuals purchase offsets at a flat rate of $10 per tonne of CO_2e. The portfolio of schemes that the compensation initiative has includes, methane capture projects from North Carolina swine farms, community based energy efficiency projects (being piloted by Duke University staff and students), and the potential for carbon sequestration through forestry and land-conservation projects (Duke University, 2016).

According to Dvorak et al. (2011), the HE sector has made few (if any) changes to curb or account for the environmental impacts associated with student air travel. Fawcett (2005: 13) agrees with this assessment, stating "…there is little evidence that the sector has begun to acknowledge the damage to the climate involved in recruitment of international students". While Hale et al. (2013: 361) assert that the trend toward sustainability in educational travel may lag behind other areas of the general push for sustainability in HE. However, there is no empirical evidence to back up these statements and no research from a UK perspective exploring institutional responses to this conflict in terms of accounting for these emissions, perceptions of responsibility and mitigation/compensation.

2.7.9 Summary

As with the corporate response to sustainable development, HEIs have embraced campus greening and carbon management as the first step towards sustainability. Despite this engagement, many HEIs are struggling to make absolute emission reductions due to conflicting priorities including growing the size of estates, increasing student numbers and increasing energy-intensive research activity. This research has identified the potential conflict between the internationalisation and carbon management agenda as being one of the most challenging, due to issues relating to boundary setting, data availability, calculation reliability and responsibility for mitigation/compensation. However, while the Conflict has been identified in the literature, institutional awareness of the carbon implications of flying international students in to study and the extent of engagement with this issue by HEIs has yet to be examined in any systematic way. Neither has the perspective of the students.

2.8 Literature review summary

There is a recognition that current patterns of human activity and consumption cannot continue going forward, and that if we were to pursue a 'business as usual' path, this would lead to intolerable consequences for the planet. Corporations are paying increased attention to sustainable development and the concept of the 'triple bottom line', whereby a corporation's ultimate success is measured by the traditional financial bottom line and by its social and environmental performance.

Corporations have embraced carbon management in response to the sustainability agenda. Traditionally, corporations have focused on Scope 1 and 2 emissions because essentially, carbon is a cost and if the corporation can reduce its Scope 1 and 2 emissions, it reduces its operating costs. Reporting of Scope 3 is inconsistent, with many organisations not accounting for indirect emissions at all. However, there is recognition now that a robust footprint requires consideration of all three Scopes.

The responsibility of HEIs to manage the impact of their operations on the economy, society and environment is in common with corporations and they are not immune to many of the external drivers behind the corporate shift to sustainability. The motivations for HEIs to engage proactively with sustainability include a moral responsibility, given that HEIs are educating future leaders and decision makers, enlightened self-interest and legitimacy. Legitimacy theory suggests that an organisation's actions are desirable, proper, or appropriate within some socially constructed system of norms. In other words, an organisation needs legitimacy to continue operating. The public and students now expect HEIs to engage with sustainability challenges, while the UK Government sees the HE sector as key in helping to make the transition to a low-carbon, more sustainable society through teaching and research, outreach and campus greening.

This study has highlighted the intrinsic link between sustainability/ESD and internationalisation, in terms of promoting global citizenship. A fundamental aspect of the internationalisation agenda in the UK HE sector has been the recruitment of international students, driven by demand exceeding the supply of HE places in many developing countries. Furthermore, HEIs are offering more study abroad opportunities, recognising that it is an increasingly popular course attribute and helps to promote intercultural development, improve language skills and increase employability. The UK HE sector has witnessed international student numbers in particular increase significantly over the last two decades and this growth is likely to continue in the short- to medium-term, the carbon implications of which, will be profound. Thus, there are conflicting priorities with regard to the sector's internationalisation and sustainability/carbon management agendas, in much the same way that HEIs face competing interests in terms of increasing energy-intensive research activity, or increasing the size of estates, and carbon management. While previous research articles have identified the potential conflict between elements of the internationalisation and carbon management agendas (Fawcett, 2005; Roy et al., 2008; Dvorak et al., 2011; Long et al., 2014; Mazhar et al., 2014), accounting for student (and VFR) flight emissions (Section 2.7.6), attributing responsibility (Section 2.7.7), and potential mitigation and compensation measures (Section 2.7.8), have not been explored. Moreover, institutional awareness of the carbon implications of student air travel and the extent of engagement with this issue by HEIs has yet to be examined in any systematic way. Neither has the perspective of the students.

The Conflict between the internationalisation and sustainability/carbon management agendas in the UK HE sector is a prime example of the challenges that organisations across all sectors of the economy can face in responding to the sustainability agenda and the need to account for the environmental impacts of their operations alongside the economic and social benefits.

Thus, the over-arching aim addressed by this thesis is:

To critically evaluate the inherent conflict between the carbon management and internationalisation agendas in the UK HE sector.

On the basis of this, this research sought to identify elements of a framework for HEIs in engaging and reconciling the Conflict between the internationalisation and carbon management agendas, contributing practically to improved environmental sustainability across the sector and theoretically to the literature on sustainability and carbon management in HE.

This aim was achieved through the following objectives and associated research questions (RQ):

Objective 1. To evaluate the potential significance of student flight emissions to the carbon footprint of the UK HE sector.

RQ1. How robust are the assumptions within the HEFCE GHG accounting guidance?

As discussed in Section 2.7, it is important to have a comprehensive understanding of the GHG emissions associated with inbound and outbound student air travel. Robust approaches for the measurement of GHG emissions are needed to identify the best options to reduce emissions, for target setting, and to assess the impact of mitigation measures (Wright et al., 2011). However, there are associated challenges in estimating emissions from student air travel due to data availability, calculation methodology and reliability (Schaltegger and Csutora, 2012; Williams et al., 2012). While HEFCE has produced accounting guidance for estimating emissions associated with inbound and outbound student air travel (HEFCE, 2010b), the researcher questions the robustness of the methodology, particularly assumptions regarding trip distance and flight frequency and questions whether VFR emissions should be included.

RQ2. What is the scale of student air travel emissions in the UK HE sector, now and in the year 2020/21?

Once a robust methodology has been identified, this research will examine sector level emissions and project emissions into the future under a range of contrasting scenarios.

Objective 2. To critically appraise institutional awareness of and willingness to engage with the Conflict.

RQ3. What are the dominant motivations for UK HEIs to recruit international students and promote study abroad for UK students?

There are a number of approaches to internationalisation (Section 2.6). This research will examine the importance of international student recruitment and study abroad schemes in the context of the overall internationalisation strategy. Specifically, the dominant motivations for the recruitment of international student and study abroad schemes will be evaluated.

RQ4. How advanced are HEIs in engaging with the carbon management agenda?

This research will identify the prominent motivations influencing carbon management at UK HEIs as well as appraise institutional progress in reducing Scope 1 and 2 emissions.

As with corporate responses to climate change and carbon management, HEIs have traditionally focused on Scope 1 and 2 emission reductions. However, if society is to deliver the required cuts in emissions then it is important that HEIs take a 'whole systems' approach and have a comprehensive understanding of their total carbon footprint, including Scope 3 emissions. This research will explore how advanced HEIs are in engaging with Scope 3 emissions and examine the motivations and factors that influenced levels of engagement.

RQ5. How advanced are UK HEIs in engaging with the Conflict between the internationalisation and carbon management agendas and what factors influenced this?

As presented in Section 2.7, the consensus within the literature was that HEIs have yet to acknowledge the emissions associated with inbound and outbound student air travel and have made few (if any) changes to curb or account for them (Fawcett, 2005; Dvorak et al., 2011; Hale et al., 2013). However, there is a lack of empirical evidence surrounding institutional responses to this conflict. Given the likely trend of increasing emissions from student flights and the increased attention on Scope 3 emissions, this research will appraise current institutional responses particularly in terms of accounting, responsibility and mitigation/compensation. In terms of the sector's response to this conflict, contingency theory (as discussed in Section 2.3) suggests that the response or management of the Conflict in terms of accounting, reporting, and mitigation, will be based on situational disposition and dependent upon the presence of internal and external factors. This research will establish what motivations and factors influenced engagement (or non-engagement) with student air travel emissions at a number of HEIs.

Objective 3. To assess perceptions of responsibility for student flight emissions and evaluate preferences for potential mitigation and compensation options.

RQ6. How should responsibility for student flight emissions be allocated between students, HEIs and other beneficiaries?

As discussed in Section 2.7, questions can be asked regarding who has responsibility to mitigate or otherwise compensate for student air travel emissions, where a number of different perspectives could be adopted. This research will explore perceptions of responsibility from both the students' perspective and the perspective of selected UK HEIs.

RQ7. How do both students and HEIs view potential mitigation and compensation actions?

There are a number of options for reconciling the Conflict between the internationalisation and carbon management agendas (see Section 2.7.8). This research will evaluate the efficacy of TNE as a mitigation method and will explore HEIs and students' perceptions of offsetting and compensation. Moreover, this research will explore students' willingness to pay to offset or compensate for their air travel emissions.

2.8.1 Research framework

Figure 2.14 presents the research framework underpinning this study. The framework played an important role in guiding the process of the research study and aided in the interpretation of findings and relating them to the context of existing understanding. The research questions set out in the above section are highlighted on the research framework.

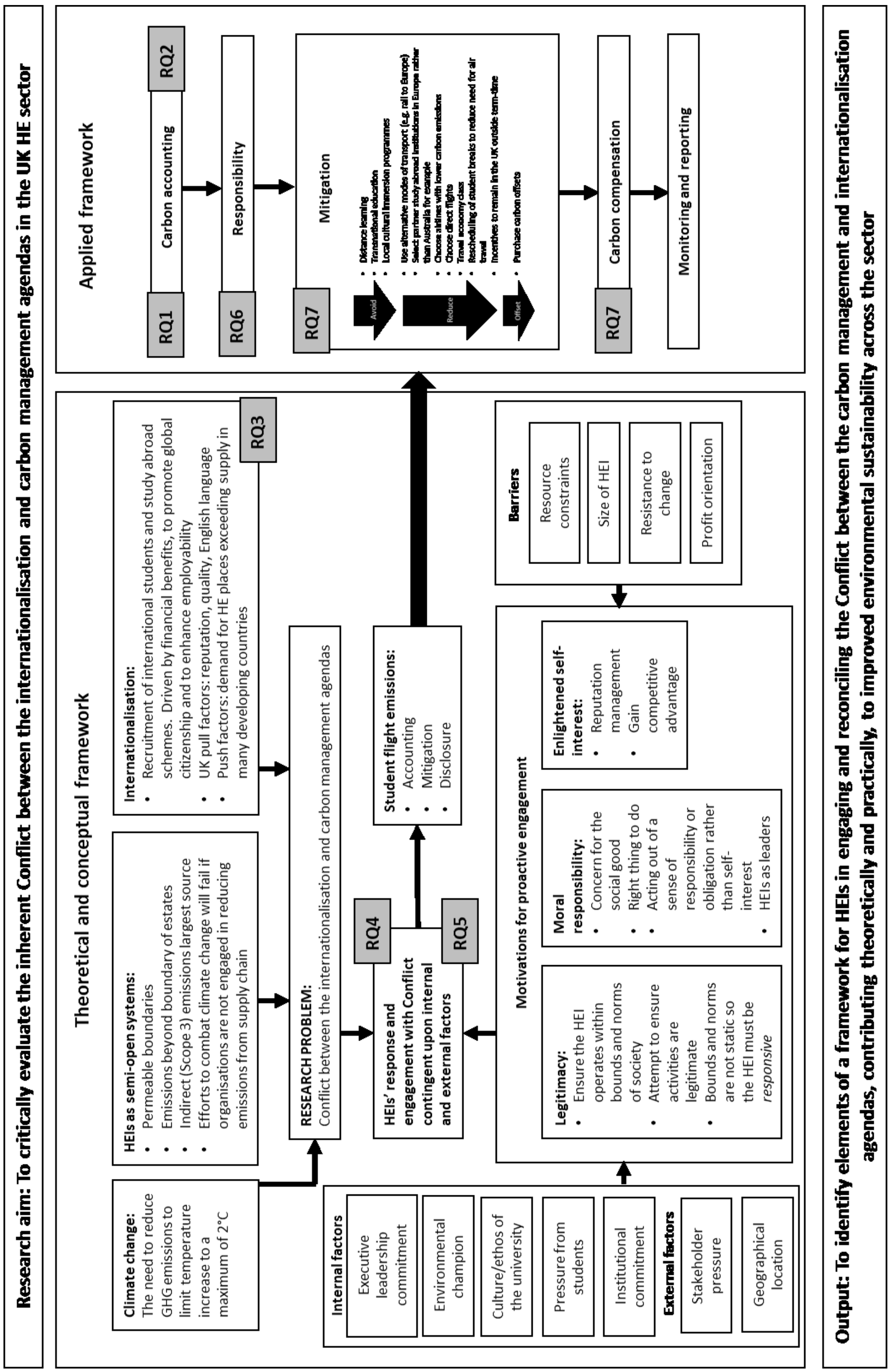

Figure 2.14. Research framework

Chapter 3. Research Methodology

3.1 Chapter outline

This chapter introduces the methods used to address the overarching research aim presented in Chapter 2 and achieve the corresponding objectives. To understand the reasoning behind the choice of research design and subsequent strategies of inquiry, a discussion of the paradigm that influences and frames the study is first presented. The subsequent sections outline the strategies of inquiry, the corresponding research methods, and data analysis, with consideration of the strengths and limitations of each.

3.2 Adopting a philosophical paradigm for the study

The philosophical paradigm has an effect on the way knowledge is studied and interpreted thus the choice of paradigm provides the basis for subsequent choices regarding research design (Mackenzie and Knipe, 2006). The term paradigm has been defined by Kuhn (1970: 175) as:

> *…a set of beliefs, values and techniques which is shared by members of a scientific community, and which acts as a guide or map, dictating the kinds of problems scientists should address and the types of explanations that are acceptable to them.*

While Guba and Lincoln (1994: 105) regard a paradigm as:

> *…a set of basic beliefs (or metaphysics) that deals with ultimates or first principles. It represents a worldview that defines, for its holder, the nature of the "world," the individual's place in it, and the range of possible relationships to that world and its parts.*

In short, a paradigm, sometimes referred to as worldview, may be viewed as a loose collection of beliefs that guide a researcher's action (Creswell, 2009), where different paradigms are underpinned by differing ontological, epistemological, axiological and methodological orientations (Guba and Lincoln, 1994). Different researchers propose a range of paradigms (Mackenzie and Knipe, 2006; Creswell, 2009; Teddlie and Tashakkori, 2009). Table 3.1 presents the basic philosophical differences between the five commonly identified paradigms.

Table 3.1. Paradigm contrast table comparing five points of view (adapted from: Teddlie and Tashakkori, 2009)

Dimensions of contrast	**Constructivism**	**Transformative**	**Pragmatism**	**Postpositivism**	**Positivism**
Epistemology (the relationship of the knower to the known; the nature of knowledge and its justification)	Subjective point of view; reality co-constructed with participants	Both objectivity and interaction with participants valued by researchers	Both objective and subjective points of view, depending on stage of research cycle	Modified dualism	Objective point of view (dualism)
Ontology (the nature of reality)	Ontological relativism - multiple, constructed realities	Diverse viewpoints regarding social realities; explanations that promote justice	Diverse viewpoints regarding social realities; best explanations within personal value systems	Critical realism (external reality that is understood imperfectly and probabilistically)	Naïve realism (an objective, external reality that can be comprehended)
Axiology (the role of values in enquiry)	Value-bound inquiry	All aspects of research guided by social injustice	Values important in interpreting results	Value in inquiry, but their influence may be controlled	Value-free inquiry
Methods	Qualitative	Both qualitative and quantitative; community of participants involved in methods decisions	Both qualitative and quantitative; researchers answer questions using best methods	Primarily quantitative	Quantitative

In reality, with regard to the distinctions between paradigms, Teddlie and Tashakkori (2009: 94) state:

> *In the real world of research, however, continua of philosophical considerations, rather than dichotomous distinctions, more accurately represent the positions of most investigators.*

Therefore, they suggest reconceptualising the five distinct paradigms as a spectrum, as opposed to definable and distinct positions, shown in Figure 3.1. In this spectrum, the position of the pragmatist and transformative scholars are located in the intermediate area somewhere in-between the constructivist and positivist/postpositivist paradigms thus a theoretically infinite number of positions rather than five, would be present (Teddlie and Tashakkori, 2009).

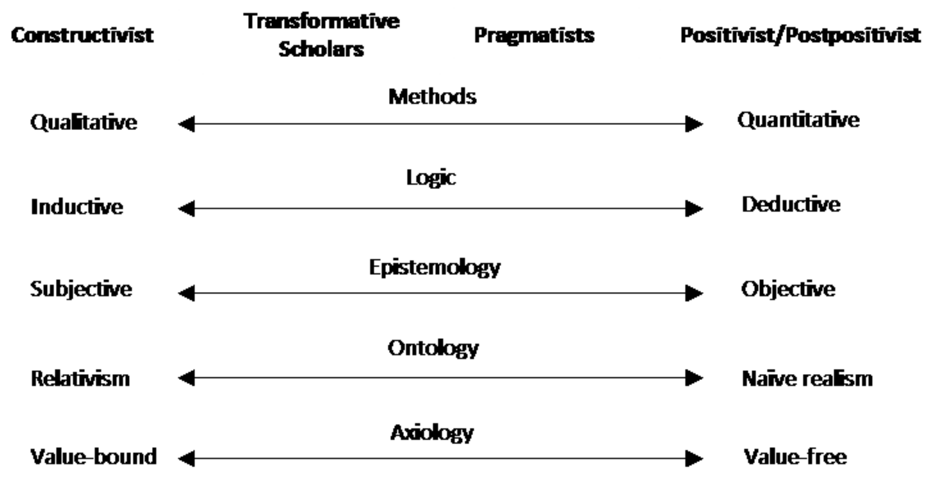

Figure 3.1. Spectrum of philosophical orientations (adapted from Teddlie and Tashakkori, 2009)

A defining distinction between an exclusively positivist/postpositivist and an exclusively constructivist approach concerns the nature of reality as perceived by the researcher (Teddlie and Tashakkori, 2009). Positivists/postpositivists believe there is an objective 'real reality' that exists independent of human perception and is 'apprehendible', or measureable (Sale et al., 2002). Given that positivists/postpositivists tend to perceive research as 'objective', they argue that the researcher is able to study the object without influencing it, or without the object influencing them (Guba and Lincoln, 1994) with the ultimate goal of science being confirmation and falsification and to produce knowledge regardless of the researcher's political background, morals, values, etc. (Johnson and Onwuegbuzie, 2004). On the other hand, constructivists believe that reality is relative and dependent upon ones perspective (Teddlie and Tashakkori, 2009), where constructivist researchers tend to rely upon the "participants' views of the situation being studied" (Creswell, 2009: 8) and are aware that their own experiences and background can have an impact on the research (Johnson and Onwuegbuzie, 2004). There are thus multiple realities that are subjective, i.e. socially constructed, and not discovered through strict scientific method (Sale et al., 2002; Mertens, 2005a). These socially constructed realities are products of human intellects and may change as 'constructors' change (Teddlie and Tashakkori, 2009). Furthermore, constructivists assume the researcher and the investigated 'object' to be interactively linked, with findings generated as the research progresses (Guba and Lincoln, 1994).

Pragmatists and transformative scholars adopt a middle ground being neither positivist nor constructivist in nature. They challenge the notion of a distinct contrast between objectivity and subjectivity with regard to the relationship between the participant and the researcher (Teddlie and Tashakkori, 2009). Pragmatists and transformative scholars view epistemological issues on a continuum rather than opposing poles. Thus, believe that at some point during the research process, the researcher and participant may have a highly interactive relationship in order to explore a complex phenomenon and at other times, interaction with participants is not necessary (Teddlie and Tashakkori, 2009).

While similar in a number of respects, the major differences between pragmatists and transformative scholars are their values, with pragmatists being guided by individual research interests, while transformative scholars approach research guided by aspects of social injustice (Teddlie and Tashakkori, 2009). Pragmatists and the transformative scholar remind us that our values are always a part of who we are and how we act (Morgan, 2007). Thus, they believe that values play a large role in the research process and in drawing conclusions (Teddlie and Tashakkori, 2009).

Pragmatism accepts that there is a single 'real world', independent of our minds, and that all individuals construct their own interpretations of that world (Morgan, 2007). Thus, "knowledge is viewed as being both constructed *and* based on the reality of the world we experience and live in" (Johnson and Onwuegbuzie, 2004: 18) and this knowledge is tentative and changes over time, therefore what we acquire day by day should be regarded as provisional truths (Johnson and Onwuegbuzie, 2004). Transformative scholars on the other hand have a slightly amended view, embracing multiple realities, believing it is necessary to be clear about the social, political, and other values that define these realities (Mertens, 2005b). For transformative scholars, "Knowledge is socially and historically located within a complex cultural context" (Mertens, 2005b: 3).

In terms of methodological distinctions, adopting a constructivist or positivist/postpositivist view has traditionally meant adopting either a qualitative or a quantitative strategy of enquiry. Both qualitative and quantitative strategies have benefits and limitations. Positivists/postpositivists tend to prefer quantitative methods employing statistical analysis with questions and/or hypotheses stated in propositional form and verified through empirical testing (Guba and Lincoln, 1994). However, these methods can lack context and the depth to form complete understandings of phenomenon (Kaplan and Duchon, 1988). Constructivist researchers tend to employ qualitative strategies of enquiry; interviews, focus groups etc., relying upon the participants' views of the phenomenon under investigation (Creswell, 2009). These latter methods offer an in-depth context-specific analysis of institutional responses to the Conflict between the internationalisation and carbon management agendas.

Pragmatism orients itself towards solving 'real world' practical issues (Feilzer, 2010). As such, pragmatists are concerned with applications and select methods that work in the specific context they find themselves in to provide useful insights and determine solutions to problems (Mackenzie and Knipe, 2006).

The researcher appreciates the advantages and disadvantages of both quantitative and qualitative approaches, recognising that no approach is superior in the context of this particular study, and that each has a specific purpose in producing new knowledge. Thus, the researcher adopted the philosophical underpinnings of pragmatism to serve as the foundation for this study, assuming a middle ground being neither fully positivist nor fully constructivist in nature and real-world practice orientated (Mackenzie and Knipe, 2006). Given the practical nature of the research problem and lack of prior research, adoption of a pragmatic approach offered the flexibility to explore convergences in stories generated from alternate paradigms, thus allowing understanding and explanation of the research problem to be enhanced (Greene et al., 1989).

Taking a non-purist, pragmatist position allowed the researcher to adopt a mixed methods approach (Johnson and Onwuegbuzie, 2004), using both quantitative and qualitative design components and facilitating three functions; corroboration (as in establishing convergence), elaboration (providing richness and detail) and initiation (new interpretations and fresh insights) (Greene et al., 1989). The following section provides an in-depth discussion of the mixed methods strategy of enquiry adopted for this study.

3.3 Mixed methods research

As introduced in the previous section, the pragmatism paradigm allows a combination of both qualitative and quantitative methods, thus freeing the researcher to choose a strategy of inquiry best suited to answering the research questions (Johnson and Onwuegbuzie, 2004; Mackenzie and Knipe, 2006). This emergent third strategy has been variously termed multi-methods, multi-strategy, mixed methods or mixed methodology research (Bryman, 2006). Here, the term mixed methods is adopted, which is defined by Johnson and Onwuegbuzie (2004: 17) as:

> *…the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study.*

While Greene et al. (1989: 256) offer the following definition:

> *…we defined mixed-method designs as those that include at least one quantitative method (designed to collect numbers) and one qualitative method (designed to collect words), where neither type of method is inherently linked to any particular inquiry paradigm.*

Mixed methods research has developed and become increasingly utilised in recent years with Bryman (2006: 97) noting that "…it has come to be seen as a distinctive research approach in its own right that warrants comparison with each of quantitative and qualitative research". Table 3.2 provides an overview of the differences between quantitative, qualitative and mixed methods research designs.

Table 3.2. Dimensions of contrast among the three methodological communities (adapted from Teddlie and Tashakkori, 2009)

Dimension of Contrast	Qualitative Position	Mixed methods Position	Quantitative Position
Methods	Qualitative methods	Mixed methods	Quantitative methods
Paradigm	Constructivism (and variants)	Pragmatism; transformative perspective	Postpositivism; positivism
Form of data	Typically narrative	Narrative plus numeric	Typically numeric
Purpose of research	(Often) exploratory plus confirmatory	Confirmatory plus exploratory	(Often confirmatory plus exploratory
Role of theory; logic	Grounded theory; inductive logic	Both inductive and deductive logic; inductive-deductive research cycle	Rooted in conceptual framework or theory; hypothetico-deductive model
Typical studies or designs	Ethnographic research designs and others	Mixed methods designs, such as parallel and sequential	Correlational; survey; experimental; quasi-experimental
Sampling	Mostly purposive	Probability, purposive, and mixed	Mostly probability
Data analysis	Thematic strategies: categorical and contextualising	Integration of thematic and statistical; data conversion	Statistical analyses: descriptive and inferential
Validity/trustworthiness issues	Trustworthiness; credibility; transferability	Inference quality; inference transferability	Internal validity; external validity

The strength of the mixed methods design is that the converging of quantitative and qualitative findings has the potential to offer insights that would not be achievable from an exclusively quantitative or qualitative study and allows the production of more complete knowledge (Johnson and Onwuegbuzie, 2004; Bryman, 2007). Moreover, mixed methods is about building an overall account of the findings, bringing together both sides of the debate, and is not simply an exercise in testing findings against each other. Therefore, mixed methods provide an opportunity for a range of divergent views, an important feature of this study (Bryman, 2007; Teddlie and Tashakkori, 2009).

Greene et al. (1989), in their review of the theory and practice of mixed method research, identified five justifications for combining quantitative and qualitative research methods

(Table 3.3). For this thesis, triangulation, complementarity and expansion are the key justifications for using a mixed methods strategy of inquiry.

Table 3.3. Justifications for mixed methods research designs (source: Greene et al., 1989)

Justification	Description
Triangulation	Seeks convergence, corroboration, correspondence of results from the different methods
Complementarity	Seeks elaboration, enhancement, illustration, clarification of the results from one method with the results from the other method
Development	Sequential use of qualitative and quantitative methods whereby the researcher looks to use the results from the first method to inform and help develop the second method
Initiation	Seeks the discovery of paradox and contradiction, new perspectives of frameworks, the recasting of questions or results from one method with questions or results from the other method
Expansion	Aims for increased scope and depth to a study by including multiple components

There are two categories of mixed methods research design; single and multiple strand (Creswell and Plano Clark, 2007). The single strand design includes both quantitative and qualitative components analysing the same data. There are several types of multiple strand designs including convergent (synonymous with a parallel design in some method textbooks), sequential, conversion, multilevel and fully integrated mixed designs (Teddlie and Tashakkori, 2009). Convergent (parallel) mixed designs have two strands, one quantitative and one qualitative, with both planned and implemented to answer related aspects of the same overarching research aim. Inferences from both strands are integrated thus forming meta-inference in the final stage of the study. Sequential mixed designs have two strands that occur chronologically, for example quantitative then qualitative, with the conclusions from the first strand influencing the formulation of the design components for the next. Conversion mixed designs are parallel strands, however, there is only one set of data analysed both quantitatively and qualitatively. Multilevel designs have two strands, with quantitative data collected at one level (e.g. individuals) and qualitative data collected at another level (e.g. organisational), with both types of data analysed accordingly. The fully integrated mixed design involves the mixing of both qualitative and quantitative approaches at each stage of the research process.

In addition, quantitative and qualitative approaches can be conceptualised along a continuum, as shown in Figure 3.2, with pure quantitative orientation at one end and pure qualitative orientation at the other. A mixed methods strategy can consider both quantitative and qualitative methods equally within a study or emphasise one approach over the other, referred to as a dominant/less-dominant design (Teddlie and Tashakkori, 2009).

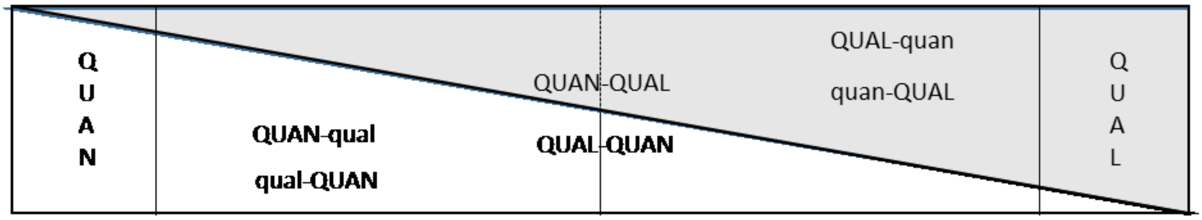

Figure 3.2. Mixed methods as a continuum of QUAL and Quan integration (source: Teddlie and Tashakkori, 2009)

Given the nature of this study, exploring the Conflict both within institutions and the student population, the researcher adopted a convergent mixed methods design (Creswell and Plano Clark, 2007; Teddlie and Tashakkori, 2009) with two parallel and independent strands. However, while each strand was predominantly quantitative or qualitative in nature, each contained elements of the other method. For example, whilst the survey was predominantly quantitative, respondents were given the opportunity to provide open comments thus requiring thematic analysis. Therefore, each strand can be considered 'integrated' and described as QUAN-qual and quan-QUAL, as shown in Figure 3.3 (Teddlie and Tashakkori, 2009), with both given equal weighting throughout the study (Creswell and Plano Clark, 2007).

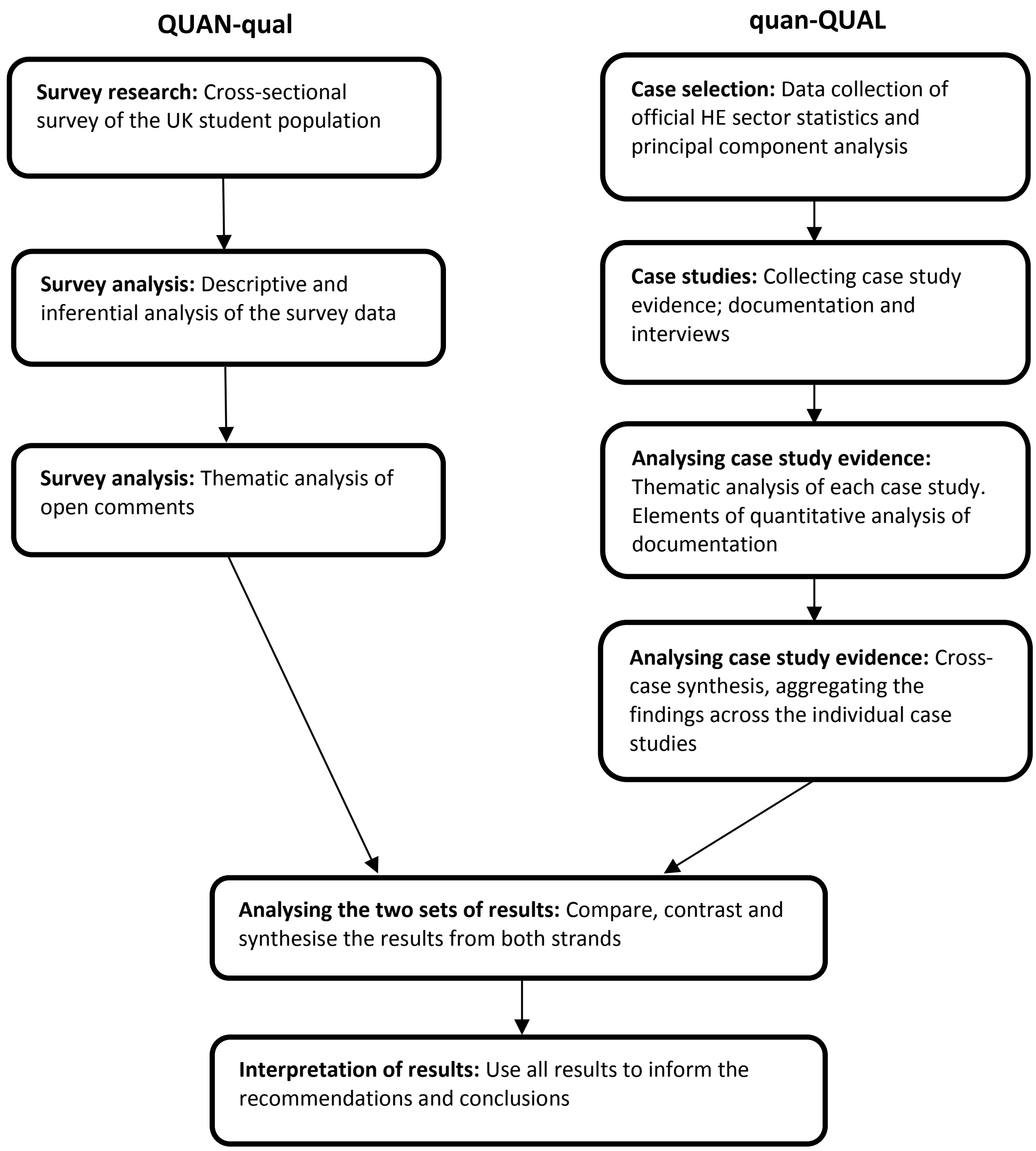

Figure 3.3. Convergent and integrated mixed methods research design used in this study

The QUAN-qual strand sought to test the assumptions within the HEFCE accounting guidance (HEFCE, 2010b), particularly with regard to the frequency with which students fly during the year, and to estimate student air travel emissions for the UK HE sector. Moreover, this strand explored students' views on the Conflict and measures designed to compensate for those emissions. The quan-QUAL strand consisted of a case study approach, examining the carbon emissions arising from student air travel and the response to the Conflict and potential mitigation measures at UK higher education institutions

(HEIs). Inferences based on the results from the QUAN-qual and quan-QUAL strands were integrated at the end of the study to form meta-inferences and to provide a comprehensive analysis of the research problem (Creswell, 2009; Teddlie and Tashakkori, 2009).

3.4 QUAN-qual strand: cross-sectional survey

A lack of quantitative data on student air travel behaviour, attitudes towards transnational education (TNE), responsibility for air travel emissions, and attitudes towards carbon offsetting and compensation, within a UK context, provided the rationale for the choice of a cross-sectional survey as a data collection mechanism. Due to the large and diverse student population in the UK, an online electronic survey was deemed the most appropriate data collection method. Evans and Mathur (2005) argue that online self-administered surveys are appropriate when a large sample is required, when respondents are spread over significant distances geographically and when there is a sample list of respondents who have access to the internet and use it frequently. Further to this, Fowler (2009) highlights the potential for high speed of returns and feasibility of asking questions with long or complex response categories.

3.4.1 Survey development

The survey instrument was an electronic, self-administered questionnaire designed specifically for this study to collect data from UK university students on attitudes towards sustainability, travel behaviour, overseas study and climate change mitigation (the survey can be found in Appendix 4). The survey was developed online using SurveyMonkey (2016) and consisted of between 13 and 24 questions, dependent upon respondent answers. Deutskens et al. (2004) found that questionnaires that were short in length had a higher response rate than those longer in length, thus the survey was designed to take approximately 10 minutes to complete. In order to reduce social desirability bias (Fowler, 2009), the introduction provided respondents with background to the survey and emphasised that there are no right or wrong answers and that responses are confidential and anonymous. Following the introduction and a qualifying question to ensure only students registered at UK HEIs participated, the survey was divided into three sections based on the research questions and topics formed from the exploratory literature review. This reflects the topics covered in the interviews with university management:

Section 1: Examining environmental awareness, attitudes and behaviour.
Section 2: Exploring student travel behaviour, perceptions of responsibility for emissions, and attitudes toward mitigation strategies and carbon compensation.
Section 3: Providing demographic questions.

Section 1

All students completed Section 1 (which were general questions on environmental awareness, attitudes and behaviour), after which, respondents were directed to further questions based on whether they were a UK national, European or non-European student. UK nationals who had not studied abroad (or were not currently studying abroad) proceeded to the final section (section 3).

Section 2

Section 2, which was specifically for students who have travelled by air either to or from the UK for educational purposes, sought to explore perceptions of the Conflict between air travel and carbon mitigation. The section was split into four subsections.

In order to achieve Objective 1, evaluating the potential significance of student flight emissions to the carbon footprint of the HE sector, Section 2.1 sought to obtain information on student and visiting friends and relatives (VFR) flight frequency. The results addressed the associated RQ1 and RQ2, allowing the researcher to test the robustness of the assumptions in the HEFCE accounting guidance (HEFCE, 2010b), and determine the magnitude of student air travel emissions for the UK HE sector.

The questions in Section 2.2 sought to achieve Objective 3, and specifically RQ6, in assessing the students' perception of who holds responsibility for mitigating and/or compensating for the flight emissions.

Section 2.3 also contributed to achieving Objective 3, in evaluating preferences for potential mitigation options, and specifically RQ7, in examining how students view carbon offsetting and carbon compensation. This research was interested in whether students would be willing to pay to offset their own flight emissions, and if they were, how much they would be willing to pay. There are two ways of measuring willingness to pay (WTP), stated preferences (SP) and revealed preferences (RP). SP serves to assess individuals' willingness to pay (WTP) for goods and services presented in a hypothetical scenario, the value of which are not accounted for in economic markets (Brouwer et al., 2008). RP infers the WTP from observing a given economic transaction, i.e. observing actual behaviour (Accent/RAND Europe, 2010; Ecosystem Valuation, 2016). In this study, the focus is on students' WTP to offset and given that there is no data on actual offsetting behaviour, the SP approach was employed. Similar studies assessing air travel passengers' WTP for carbon offsetting have utilised varieties of the SP approach (Brouwer et al., 2008; MacKerron et al., 2009; Lu and Shon, 2012). The SP methods most commonly used in WTP for carbon offsetting studies are contingent valuation (CV) and choice modelling (CM). CV involves asking respondents directly how much they would be willing to pay whereas with CM, values are inferred from hypothetical choices or trade-offs that people make (Ecosystem Valuation, 2016).

This survey adapted the payment card CV method (Accent/RAND Europe, 2010), asking respondents to state the proportion of the actual offset cost they would be willing to pay, based on a representative list of locations in regions around the world and the cost to offset a flight[14] between that location and London Heathrow. The strategy of asking the question about WTP in terms of the proportion of the assumed cost to offset rather than actual amount links to the question on responsibility, and how much responsibility the respondent placed on themselves. In addition, the payment card CV method was employed to establish the maximum WTP amount, with respondents able to select values between £0 and £50. Advantages of the payment card method over alternative CV methods, such as open response elicitation, iterative bidding and dichotomous choice, are

[14] Based on a figure of £7.50 per t/CO_2e (www.climatecare.org)

that it provides context to the bids, avoids starting point bias and the number of outliers is reduced (Accent/RAND Europe, 2010).

In Section 2.4, students were asked for their views on how HEIs can respond to this challenge, specifically, investment in alternative methods of delivering UK awards and investment in carbon offsets or carbon compensation schemes. This information would aid HEIs in formulating a response to the Conflict.

Section 3

Finally, all students answered questions in Section 3, comprising general socio-demographic questions. Demographic measures are important as they can identify key respondent characteristics that might influence opinion and/or are correlated with certain behaviours and actions and they allow the researcher to identify how closely the sample resembles the target population (Stoutenborough, 2008). Stoutenborough (2008) lists four advantages regarding the placement of demographic questions at the end of the survey (1) to engage and build rapport with the respondent by asking questions of interest earlier in the questionnaire; (2) to reduce the likelihood that asking personal questions will lead to refusal to continue; (3) to prevent priming the respondent; and (4) to allow the respondent to answer the core questions before possibly boring them with the mundane demographic questions.

3.4.2 Formulating the questions

In formulating the questions, the researcher followed guidance from Fowler (2009). Particular consideration of wording, order and the definition of terms during the development of questions, sought to increase the reliability of respondent answers. The majority of questions were 'closed questions', those for which a list of acceptable responses was provided to the respondent (Fowler, 2009). The rationale for choosing this type of question centred on reliability; the respondent can reliably answer the questions and the researcher can perform more reliably the task of interpreting the meaning of answers (Fowler, 2009). In addition, it is much easier for respondents to complete a survey by checking a provided answer (Fowler, 2009). Likert scale[15] questionnaires are commonly used in survey research (Winter and Dodou, 2010) and most questions were scored on a 5-point scale (e.g. strongly support, somewhat support, neither support nor oppose, somewhat oppose, strongly oppose) or were multiple-choice answers. Lehmann and Hulbert (1972) suggested that using a 5- or 6-point scale is necessary to obtain an accurate measure of the variable, while Cox III (1980) concluded that although there is no single number of points for a rating scale that is suitable for all situations, in general, the use of five to nine points is appropriate. Moreover, when formulating the rating scales, the researcher was careful to ensure that respondents were provided with an equal number of favourable and unfavourable choices, i.e. ensuring that the scale was balanced (Friedman and Amoo, 1999).

In order to increase the reliability and validity of answers and given that some respondents may not have had an adequate knowledge on which to base an answer, an introductory sentence was included defining unique terms such as carbon footprint and carbon offset. Moreover, surveys can be biased if respondents are forced to specify their opinion when they do not have one (Friedman and Amoo, 1999). Friedman and Amoo (1999) state that most respondents who are undecided but have no option but to offer an opinion in a survey will select a rating from the middle of the scale, e.g. “average” or “neither more nor less important”. This creates two biases by making it appear that more respondents have an opinion than actually do, and the mean and median will be shifted toward the middle of the rating scale (Friedman and Amoo, 1999). Thus, a “don’t know/unsure” option was added to all the survey questions (Fowler, 2009). Respondents were provided with the opportunity to add comments below certain questions, which allowed the researcher to obtain a deeper understanding of the reasoning behind response choices. Furthermore, having completed the survey, if a respondent had any other comments regarding the impact of overseas study and air travel’s impact on climate change they were invited to comment in a final comment box.

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[15] A Likert scale is used to measure people’s attitudes to a topic (Likert, 1932).

A progress bar positioned at the top of each page of the survey allowed respondents to visualise how close they were to completing the questionnaire, which has been shown to increase completion rates (Dillman et al., 1998). The opportunity to enter a prize draw to win an iPad Mini was available to all respondents who completed the survey. The effectiveness of using a commodity as an incentive depends on the attractiveness as well as the usefulness of that prize to consumers (Deutskens et al., 2004). Given the survey was intended for students, an iPad Mini was deemed a suitable choice of prize.

3.4.3 Procedure

Once completed, the survey instrument underwent a review by members of staff from the School of Science and the Environment at Manchester Metropolitan University and subsequent revisions were made. Following this, the survey underwent a field pretest (Fowler, 2009) and was distributed to students from Manchester Metropolitan University to ascertain whether all questions were consistently understood and ensure respondents had all the information needed to answer the questions. The researcher received written comments from 15 students and held detailed face-to-face discussions with three of the respondents; this led to some minor alterations to the wording of the survey to aid clarification.

Between December 2014 and February 2015, the survey was distributed to student email lists through the Survey Monkey email collector. Using the Survey Monkey email collector allowed the researcher to identify those students who had not completed the survey and send a follow-up reminder email. Deutskens et al. (2004) suggest reminders be sent early in order to utilise the fast turnaround times of online questionnaires. Thus, a follow-up email was sent after 1 week and 2 weeks. Upon closure of the survey, a prize winner was chosen at random.

3.4.4 Sample

The target population was all international and study abroad students enrolled at UK HEIs. The sampling frame comprised of those students to which the researcher had access. Responses were received from 663 international and study abroad students and the sample was a good representation of the UK international student population. Each region of the UK was represented with the exception of Northern Ireland, while responses were received from international and study abroad students enrolled at 26 UK HEIs (16.4% of all UK HEIs).

3.4.5 Survey data analysis

Survey responses were downloaded from Survey Monkey to Microsoft Excel where the data set was treated and coded numerically for analysis using IBM SPSS Statistics 21 (IBM, 2016).

Specific data from each of the sections were analysed using a broad range of descriptive and inferential statistics including logistic regression. The survey results chapters (Chapters 4 and 5) contain an in-depth explanation of all of the statistical tests used in this study. Analysis of the open responses followed the procedure outlined in Section 3.5.5.

3.4.6 Validity and reliability

Steps taken towards increasing the validity and reliability of the survey have been implicitly discussed throughout the previous sections. Validity answers the question "is the survey measuring what it is intended to measure?", while reliability is fundamentally concerned with ensuring consistency across respondents (Fowler, 2009; Bryman, 2012). The steps taken to increase the validity and reliability of answers included:

- Avoiding inadequate/ambiguous wording.
- Ensuring respondents had an adequate knowledge of the topic on which to base an answer.
- Using closed questions, while giving the respondent the opportunity to expand on their answer through use of an open comment box.
- Adding a "don't know" response to questions.

3.4.7 Limitations

Surveys are limited in that they collect data at a single point in time. Focusing on online surveys, technical problems can arise or the respondents may lack the necessary technological skills to complete the survey (Lefever et al., 2007). With regard to the latter, given the nature of the sample (UK registered students), this was unlikely to be a limitation.

Finally, there is a possibility of fraudulent responses with an online survey. However, the use of student email lists provided a greater level of control over the response group, reducing the likelihood of this occurring (Lefever et al., 2007).

3.5 Quan-QUAL strand: Case study strategy

The case study research strategy is a distinctive form of empirical enquiry (Yin, 2014) enabling the researcher to gain a rich understanding, through description and contextual analysis (Corcoran et al., 2004), of the complex dynamics present within single case settings (Eisenhardt, 1989). As a research strategy, a case study "investigates a contemporary phenomenon (the "case") in depth and within its real-world context" (Yin, 2014: 16). The case study is an all-encompassing method covering the logic of design, data collection techniques, and specific approaches to data analysis (Yin, 2014). It is an ideal methodology when a holistic, in-depth investigation is required and has been used previously in studies of sustainability and carbon management in higher education (Corcoran et al., 2004). Ultimately, the goal of the case study is to understand a larger class of similar units (a population of cases) through the intensive analysis of a single unit or a smaller number of units (cases) (Seawright and Gerring, 2008). Although the findings will be context specific to the higher education institutions in the study, case studies from individual institutions will be useful for other HEIs attempting reform, who can draw from the conclusions, findings and identified best practice (Corcoran et al., 2004; Hancock and Nuttman, 2014).

Given the philosophical and methodological considerations discussed in Section 3.2 and 3.3, a comparative case study research strategy was considered the most appropriate to examine institutional engagement with the Conflict (Objective 2), and to assess perceptions of responsibility for student flight emissions and evaluate preferences for potential mitigation and compensation options (Objective 3). According to Yin (2014) a case study approach should be considered when (a) "how" and "why" questions are asked; (b) the researcher cannot manipulate the behaviour of those involved in the study; (c) the focus is on contemporary as opposed to entirely historical events; or (d) the researcher believes the phenomenon under study requires appropriate coverage of contextual conditions. This last consideration is particularly relevant to this study given the diversity of the UK HE sector in terms of physical characteristics (size, type, age and geographical location) and focus (specialist areas and balance between teaching and research activities). As such, it would have been impossible to generate a true picture of institutional responses to the Conflict without considering the context in which it occurred (Baxter and Jack, 2008). This research followed the case study methodological approach proposed by Yin (2014) and is summarised in Table 3.4.

Table 3.4. Case study approach

Step	Activity
1. Designing the case study	Choosing between single and multiple case designs, and holistic or embedded units of analysis.
2. Preparing to collect case study evidence	Selecting the case(s), development of a case study protocol.
3. Collecting case study evidence	Collection of case study data from six potential sources, application of the four principles of data collection. Overlap of data collection and analysis.
4. Analysing case study evidence	Within-case analysis, detailed case study write-ups, cross-case analysis.

Yin (2014) specifies three types of case studies; explanatory, exploratory and descriptive. Based on Yin's categorisation of case study designs and given the lack of previous research concerning institutional and student responses to the Conflict between the internationalisation and carbon management agendas, this research adopted an exploratory case study design. Thus, focuses on gaining new insights to a problem that is in a preliminary stage of investigation (Yin, 2014).

3.5.1 Designing the case study

Step one of the case study approach was the design, Yin (2014) states that five components of a research design are especially important; the research questions, its propositions (if any), its unit of analysis, the logic linking the data to the propositions, and the criteria for interpreting the findings. In response to these components, the relevant research questions are:

- **RQ3.** What are the dominant motivations for UK HEIs to recruit international students and promote study abroad for UK students?
- **RQ4.** How advanced are HEIs in engaging with the carbon management agenda?
- **RQ5.** How advanced are UK HEIs in engaging with the Conflict between the internationalisation and carbon management agendas and what factors influenced this?
- **RQ6.** How should responsibility for student flight emissions be allocated between students, HEIs and other beneficiaries?
- **RQ7.** How do both students and HEIs view potential mitigation and compensation actions?

With regard to the propositions, Yin (2014) notes that exploratory studies tend not to have propositions and instead have a stated purpose and criteria by which an exploration will be judged successful. The purpose of this case study links to the overall aim of the study, in evaluating the inherent conflict between the internationalisation and carbon management agendas in the UK HE sector. Thus, the case studies will be judged successful if they provide useful insights into institutional responses to this conflict and the efficacy of a range of approaches to reconcile the Conflict. The units of analysis (the cases) are selected UK HEIs. The fourth and fifth components, the logic linking the data to the propositions, or in this case, the stated purpose, and the criteria for interpreting the findings, relate to the data analysis stage. Case study analysis techniques included pattern matching, explanation building and cross-case comparison. The researcher then sought verification for the emerging themes by reference to a spectrum of additional cases.

3.5.2 Selecting the cases

There are four types of designs for case studies according to Yin (2014), single-case designs with either single or multiple units of analysis or multiple-case designs with either single of multiple units of analysis (Figure 3.4).

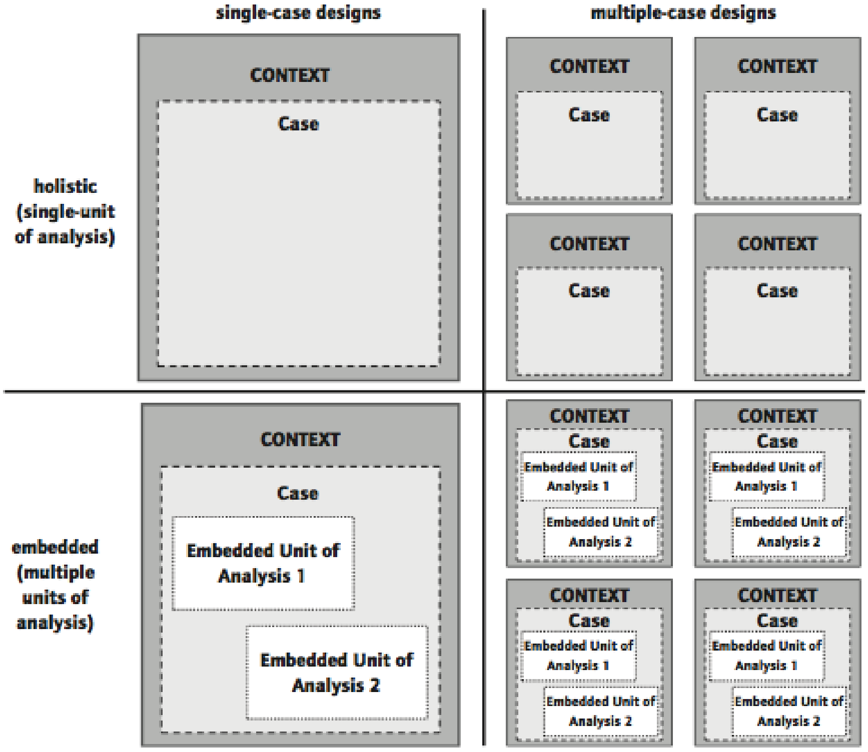

Figure 3.4. Basic types of designs for case studies (source: Yin, 2014)

Each type has strengths and weaknesses, however the analytic conclusions independently arising from two or more case studies are generally considered more compelling than single-case studies and the overall study is therefore regarded as more robust (Yin, 2014). Indeed, Onwuegbuzie and Collins (2007) state that three cases as a minimum are the recommended sample size for a case study research strategy, while Yin (2014) suggests that if it is possible to undertake more than one case study, then the larger the number, the better. Furthermore, multiple cases can both increase external validity and help to guard against observer bias (Vissak, 2010).

In regard to case selection, Yin (2014: 57) advises that "Each case must be carefully selected so that it either (a) predicts the same results (a literal replication) or (b) predicts contrasting results but for anticipatable reasons (a theoretical replication)", to enable 'analytic generalisation'. Stake (1995: 4) argues that the first criterion when selecting cases "…should be to maximise what we can learn", a point echoed by Tellis (1997: 2), "...selecting cases must be done so as to maximise what can be learned in the period of time available for the study".

With these points in mind, this study opted for a multiple-case design, where the potential case study HEIs were selected using a maximum variation sampling method. The sampling method was selected on the basis of maximising the diversity of the sample across a range of factors relevant to the research including international student population and carbon emissions, alongside other defining characteristics such as research income and total student numbers (Coyne, 1997; Flyvbjerg, 2006).

A number of operational issues limited the number of case studies the researcher could undertake, notably accessibility and as Tellis (1997) states, the period of time available for the study. Following the selection criteria, potential cases were chosen in pairs (i.e. the same geographic region but contrasting in terms of internationalisation and carbon management), with six HEIs initially selected. Of the six potential cases chosen, four HEIs agreed to take part as case studies, offering an excellent reflection of the diversity within the sector in terms of development of internationalisation and engagement with carbon management. Comprehensive data collection in the form of documentation and interviews ensured a rich description of institutional responses and the contrasting institutions chosen as cases offered alternative perspectives and contexts to which they approached the potential conflict.

However, during the coding process it was clear that theoretical saturation had not been reached (Urquhart, 2013). Thus, the researcher sought corroboration to the emerging themes by reference to a spectrum of additional cases. Following the original sampling strategy, three pairs were selected and invited to participate. Only four institutions accepted the invitation, comprising one geographical pair and two institutions located in different regions but still a contrasting pair in terms of degree of internationalisation and engagement with carbon management. The results of the case selection process can be found at the beginning of Chapter 6 and 7, while a summary of the chosen case study HEIs is presented in Table 3.5. Each HEI was given a pseudonym to preserve anonymity.

Table 3.5. Summary of the in-depth and verification case studies

		Case study HEI	**Founding classification (Section 2.7.3)**	**Mission group**	**International students as % of student population (HESA, 2015a, 2015b)**	**Emissions per student (tCO_2e; HESA, 2014b, 2015b)**
In-depth Cases	Pair 1	Saints University (SU)	Post-1992	University Alliance	6.8%	0.5
		Bank University (BU)	Red Brick	Russell Group	31.0%	2.0
	Pair 2	Talbot University (TU)	Post-1992	University Alliance	13.8%	0.6
		Highfield University (HU)	2nd Wave Civic	Russell Group	22.6%	1.9
Verification Cases	Pair 3	Newtown University (NU)	2nd Wave New University	Million+	12.5%	0.6
		Lakeside University (LU)	2nd Wave Civic	Russell Group	28.7%	1.4
	Pair 4	Parkway University (PU)	Post-1992	University Alliance	11.3%	0.6
		Woodhouse University (WU)	Red Brick	Russell Group	18.9%	1.8

3.5.3 Development of a case study protocol

The use of a case study protocol containing rules and procedures for the researcher to follow increases the reliability of the case study research (Tellis, 1997; Yin, 2014). Yin (2014) emphasises the importance of a protocol in a multiple-case study and suggests inclusion of the elements presented in Table 3.6 (see Appendix 5 for the protocol used in this study).

Table 3.6. Elements contained in the case study protocol

Element	Description
An overview of the case study project	Including project objectives, case study issues, and presentations about the topic under study
Field procedures	Reminders about procedures, credentials for access to data sources, location of those sources
Case study questions	The questions that the investigator kept in mind during data collection. These questions were posed to the investigator, not to the interviewee
A guide for the case study report	The outline and format for the report

3.5.4 Data collection

Yin (2014) has identified six sources of evidence that are most commonly used in case study research; documentation, archival records, interviews, direct observations, participant observation and physical artefacts. No single source of evidence has an advantage over the others; rather, they complement one another and are used in tandem. In order to increase the reliability of the study it was preferable to use multiple sources of evidence; documentation and archival records, and in-depth interviews (Stake, 1995; Yin, 2014). Table 3.7 presents the strengths and weaknesses of these sources of evidence.

Table 3.7. Sources of evidence and their strengths and weaknesses (adapted from Yin, 2014)

Source of Evidence	Strengths	Weaknesses
Documentation (including archival records)	• Stable – can view repeatedly • Unobtrusive – not created as a result of the case study • Exact – contains precise details • Broad coverage – long span of time (particularly for archival records), many events and settings	• Retrievability – can be difficult to find • Biased selectivity, if collection is incomplete • Reporting bias – reflecting unknown bias of the researcher • Access – may be blocked
Interviews	• Targeted – focuses directly on case study topics • Insightful – provides perceived causal inferences and explanations	• Bias due to poorly constructed questions • Response bias • Inaccuracies due to poor recall • Reactivity – interviewee gives what interviewer wants to hear

Documentation

Document analysis is an unobtrusive technique (Yin, 2014) and enabled the researcher to gain a rich understanding of each of the case study HEIs engagement with the carbon management and internationalisation agendas, due to the wealth of publicly available material.

The document analysis was a vital first step in the case study approach and the themes identified within the documentation helped to frame the interview schedules and provide in-depth context for each case study institution. In addition to the development of themes, the document analysis gave an insight into (a) the prominence of carbon management within the sustainability agenda, and (b) the prominence of international student recruitment in the internationalisation agenda. Furthermore, the document analysis provided insight regarding each institution’s engagement with Scope 3 emissions and any recognition of the potential conflicts between the carbon management and internationalisation agendas.

The principles of handling documentary data are no different to those applied to other research methods, in all cases data must be handled scientifically (Mogalakwe, 2006). The researcher used Scott's (1990: 6) quality control criteria for assessing documentary sources:

1. **Authenticity.** Is the document genuine and its origin unquestionable?
2. **Credibility.** Is the evidence free from distortion and error?
3. **Representativeness.** Is the evidence typical of its kind, or if not, is the extent of its untypicality known?
4. **Meaning.** Is the evidence clear and understandable?

An often-cited benefit of using documents of the kind discussed in this section is that because they have not been specifically created for this research, as Bryman (2012: 543) argues “…the possibility of a reactive effect can be largely discounted as a limitation on the validity of the data”.

For the purposes of this study, documentation was either contextual (i.e. enabled comparison of the individual HEI to the sector as a whole) or was HEI specific. The contextual sources are presented in Table 3.8.

Table 3.8. Contextual data sources and description

Domain	Source	Description of data
Carbon management and sustainability	HESA (2014b)	**Estates Management Statistics - Environmental information:** Scope 1 and 2 emissions for all UK HEIs (2008/09-2013/14). Scope 3 emissions for all reporting UK HEIs (2012/13-2013/14). Scope 1 and 2 emissions for baseline year (2005). Information relating to the size of the estate (2008/09-2013/14).
	PPUL (2015)	**People and Planet University League 2015:** Ranking of UK HEIs by environmental and ethical performance.
Internationalisation	HESA (2015a)	**Bespoke data request - inbound student numbers:** Number of inbound students broken down by UK HEI and country of domicile for the years 2010/11-2013/14.
	HESA (2015c)	**Bespoke data request - student numbers studying wholly overseas:** Total number of students studying wholly overseas broken down by HEI and country for the years 2010/11-2013/14.
	C-BERT (2015)	**TNE provision:** Information on the number of overseas branch campuses by HEI.
Other contextual information	HESA (2015b)	**Students in higher education:** Total number of students broken down by HEI and level of study for the years 1994/95 - 2013/14.
	HESA (2015d)	**Staff in higher education:** Total numbers of academic and non-academic staff by HEI for the year 2013/14.
	THE (2014)	**Research Excellence Framework 2014:** Overall ranking of institutions.
	Guardian (2016)	**The Guardian university league table 2016.**
	Top Universities (2015a)	**Quacquarelli Symonds (QS) World University Rankings 2015.**

With regard to the HEI specific documentation, all publicly available university documents relating to sustainability, carbon management and internationalisation were included. The researcher took a systematic approach for documentation identification and selection. Using the Google (2016) search engine the key words shown in Table 3.9 were entered along with the name of the case study institution.

Table 3.9. Key search terms used in document search

Category	Search terms	
Carbon management/ Sustainability	Sustainability strategy	Sustainability report
	Environmental strategy	Environmental report
	Sustainability policy	Sustainability meeting notes
	Environmental policy	Student air travel emissions
	Carbon management plan	Sustainable travel
Corporate	Corporate strategy	Financial statement
	Strategic plan	Financial report
Internationalisation	Internationalisation strategy	International student recruitment
	Internationalisation policy	Study abroad
	International strategy	

The snowballing technique (Bryman, 2012) was adopted to obtain further relevant documentation from any links on the university web pages that were discovered using the original search terms. The type of documents included: environmental sustainability policies and strategies, carbon management plans, annual sustainability reports, travel plans, corporate strategies, financial statements, internationalisation strategies and meeting minutes. Table 3.10 shows the documents analysed for each case while detailed information on data sources can be found at the beginning of the case study results chapters. It should be noted that whilst every effort was made to identify all relevant documentation, some older documents might not have been available.

Table 3.10. Documents analysed for each case study HEI

Case Study HEI	Number of documents	Document description			
		General	**Carbon Management**	**Sustainability**	**Internationalisation**
Saints University	20	Corporate Strategy	Carbon Management Plan	Sustainability Strategy	Internationalisation Strategy (x2)
		Financial Statement	Report on Carbon Management Plan	Environmental Sustainability Policy (x2)	
		Boardroom Meeting Notes	Scope 3 Addendum to Carbon Management Plan	Annual Sustainability Statement (x6)	
				Travel Plan (x2)	

Bank University	16	Advancing the 2015 Agenda Strategic Plan Financial Statement Annual Review Campus Master Plan Board of Governors Meeting Minutes (x5)	Carbon Management Plan	Environmental Sustainability Policy Sustainable Travel Plan Environmental Sustainability Plan	Erasmus Policy Statement Transnational Education Policy
Talbot University	12	Strategic Plan (x2) Financial Statement	Carbon Management Plan Scope 3 Annual Report Carbon Management Statement	Environmental Policy Green Impact Newsletter Environmental Objectives and Targets Transport Plan Waste Policy	Internationalisation Plan
Highfield University	13	Strategic Plan (x2) Financial Statement	Carbon Management Plan Carbon Management Plan Annual Report (x3)	Environmental Strategy University Environment Committee Meeting Notes (x2) Annual Sustainability Report	Internationalisation Strategy
Newtown University	13	Corporate Strategy Estates Strategy Financial Statement (x3) Recruitment Plan	Carbon Management Plan Reducing Energy Use and Carbon Emissions	Environmental Policy Sustainable Procurement Policy Procurement Strategy Travel Plan	Internationalisation Strategy
Lakeside University	9	Strategic Plan Financial Statement (x3)	Carbon Management Plan	Sustainability Policy Sustainable Buildings Policy Travel Plan Travel Plan Objectives	

Parkway University	15	Corporate Strategy Financial Statement (x3)	Carbon Management Plan (x2)	Environmental Policy Sustainability Strategy Sustainability Plan Annual Sustainability Report (x2) Travel Plan Waste Plan Waste Reduction Plan	Erasmus Policy
Woodhouse University	15	Strategic Plan Financial Statement (x3)	Carbon Management Plan Carbon Management Plan Progress Report Carbon Management Plan Update	Environmental Policy Sustainability Strategy Sustainability Plan Travel Plan Sustainable Construction Plan Waste Policy Purchasing Policy	Internationalisation Strategy

In-depth interviews

The themes identified from the document analysis helped frame the format of the interviews and ensured due diligence on the part of the researcher. Interviews are one of the most commonly used research methods for collecting qualitative data and can be categorised as unstructured, semi-structured, and structured (Dicicco-Bloom and Crabtree, 2006). Structured interviews robustly follow a clearly specified set of questions, while unstructured interviews tends to only have one or two prompt questions and tend to be very similar in characteristics to a general conversation (Bryman, 2012). A semi-structured interview on the other hand tends to follow a set of interview questions and all of them are usually asked but there is flexibility in terms of order and asking additional questions. A semi-structured interview method was therefore chosen to ensure cross-case comparability and to obtain rich and detailed data (Bryman, 2012). The semi-structured interview method is ideal for exploring respondents' perceptions and opinions, and allows the researcher to probe for further information and clarify answers (Barriball and While, 1994). Table 3.11 provides an overview of the strengths and weaknesses of this interview approach (Barriball and While, 1994; Bryman, 2012).

Table 3.11. Strengths and weaknesses of the semi-structured interview method

Strengths	Weaknesses
Allows the interviewees a degree of freedom to explain their thoughts and opinions	Problems with accessibility to potential interviewees
Allows for clarification of interesting and relevant points	Skill of the interviewer
Can elicit valuable and complete information	Analysis of findings must be done by the researcher
Enables the interviewer to explore and clarify inconsistencies in the respondents answers	Researcher must avoid bias in analysis
As the question order is not fixed, it allows for better flow of questions	Time consuming in terms of transcription
Enables cross-case comparability	

The researcher used an interview guide to facilitate the interview, which contained specific topics to be covered and associated questions (Bryman, 2012). The specialism of the interviewee and knowledge of both agendas drove the direction of the interview and determined the amount of time spent on each topic, thus the content of each interview varied slightly. However, the structure of each interview followed the interview guide and was split into four sections based on the review of the literature, document analysis and research questions. Each interview began with the researcher providing a brief background to the research and its intended purpose.

- **Section 1** sought to both clarify the drivers and motivations for carbon management at the interviewee's institution and put the interviewee at ease with simple questions. For those involved in the internationalisation agenda, this section also covered drivers and motivations for internationalisation and in particular, the recruitment of international students and study abroad schemes.

- **Section 2** sought to explore institutional responses to the Conflict including whether or not they accounted for international student/study abroad air travel emissions. To introduce the Conflict and potential future significance of student air travel emissions, each respondent was presented with a basic graph comparing Scope 1 and 2 emissions with international student air travel emissions in 2013/14 and 2020/21. The respondent was asked whether they thought the University was responsible for the emissions from student air travel.
- **Section 3** consisted of questions regarding potential mitigation actions (alternative models of delivery/carbon offsetting) and compensatory actions.
- **Section 4** focused on ascertaining the institutions response to this challenge going forward and sought the respondent's view on how change can be brought about in the sector.

In-depth interviews were held with nine individuals at the eight case study HEIs (see Table 3.12). Several factors dictated the number of participants in this study. The scope of the study and nature of the topic were the first factors. Morse (2000) states that if the focus of the study is clear and sufficiently narrow, then fewer participants are required, whereas if the scope of the research is broad, it will take longer to reach saturation and so a greater number of participants is required.

Table 3.12. Summary of interviewees at the case study HEIs

Case Study HEI	Interviewee	Interview date
Saints University	Head of Environmental Sustainability	Apr-15
	Deputy Vice Chancellor	Apr-15
Bank University	Head of Environmental Sustainability	Aug-15
Talbot University	Environmental Manager	May-15
Highfield University	Director of Sustainability	Jun-15
Newtown University	Environmental and Sustainability Manager	Jul-15
Lakeside University	Member of Carbon Management Group	Aug-15
Parkway University	Assistant Vice Chancellor for Environment and Sustainability	Jun-15
Woodhouse University	Environment Manager	Jul-15

The researcher took a common sense approach to identifying potential interviewees. Where possible, interviewees at a senior executive level with a broad knowledge of carbon management and/or internationalisation were sought as they would be in a position to comment on current and future university policy relating to this issue. However, access to this level of interviewee was difficult. Moreover, given the technical nature of some of the questions it was important that Directors of Sustainability (or equivalent) or Environment Managers were identified. Very few people at each institution would be in the position to comment on questions surrounding Scope 3 emissions and they were more likely to be familiar with the challenging concepts of carbon offsetting and carbon compensation, and the differences between them. Thus, the potential sample size was very small. The Directors of Sustainability were more likely to have influence within the university and insight into future responses to this challenge, while Environment Managers were in the best position to provide insights into operational matters and current response. The quality of the data is a further factor (Morse, 2000), and this links in part to the expertise of the interviewee and their position within the institution. By having an in-depth knowledge of the carbon management agenda and their institution's engagement with Scope 3 emissions, they provided sufficient richness and depth on the phenomenon of interest (Baker and Edwards, 2012).

Time and accessibility were additional factors, with accessibility perhaps being the greatest factor in this study. Some potential interviewees felt they were not in the best position to provide insight e.g. the researcher contacted the current Environment Manager at one HEI but they had only been in the role a few months thus felt they were not able to provide sufficient insight. They therefore forwarded the invitation to the Transport Manager who in turn, forwarded it to a member of a research group who was heavily involved in carbon management at that institution. At one HEI, the Head of Sustainability stated that having spoken to the Environment Manager, the researcher would have already been given a very good view that represents that within the institution. On other occasions, potential participants did not have any availability within the period of the study, while others simply did not respond to the invitation or declined in a follow-up telephone call.

Each of the potential participants received an introductory email and accompanying information sheet explaining the purpose of the interview, the interview process, why they had been selected, and confidentiality information. Appendix 6 contains an example of the introductory email and Appendix 7 presents the corresponding information (each was tailored to the institution in question). All interviews lasted no longer than one hour and took place either at the participant's institution or by telephone. Prior to commencing each interview, the researcher went through the consent form and answered any queries the interviewee had. Upon completion of the interview, each respondent was thanked and asked if they would be happy to receive any follow up questions the researcher may have.

The subsequent stage in the interview process was to transcribe recordings into written form in order to conduct thematic analysis (Braun and Clarke, 2006). Although transcribing can be a timely process, it is "an integral part of qualitative analysis" (Bird, 2005: 230), allowing the researcher to immerse oneself in the data, become familiar with the content (Braun and Clarke, 2006), and ensure validity of the interview as a research method (Easton et al., 2000). During the transcription process, the researcher followed advice from Easton et al. (2000) and Bird (2005) on avoiding common transcription errors such as missing words, misinterpreting words or punctuation errors which can alter the meaning of sentences. In order to overcome these potential pitfalls and increase the validity of the method, transcription took place shortly after each interview and transcriptions were reviewed whilst listening to the recording a second time. The researcher adopted the denaturalised transcription approach, which required a full and vigorous transcript of all verbal utterances, whilst having less to do with depicting accents, involuntary vocalisation or tone (Oliver et al., 2005; Braun and Clarke, 2006).

3.5.5 Thematic analysis

Acting on the advice of Miles et al. (2013), analysis was concurrent with data collection, allowing the researcher to cycle back and forth between thinking about the data already collected and creating additional strategies for further data collection. The researcher uploaded all documentation and transcripts to NVivo 10, a qualitative data analysis software package, to aid with the analysis (NVivo, 2016). NVivo 10 allowed the researcher to perform more easily the task of coding and then grouping coded data into themes.

Thematic analysis was the method employed to analyse the university documents and interview transcripts, following the methodological recommendations of Braun and Clarke (2006). Thematic analysis is a method for identifying, analysing, and reporting themes within data (Braun and Clarke, 2006) and is one of the most common approaches to qualitative data analysis (Bryman, 2012). Data analysis involved multiple readings and interpretations of the data, thus utilising a general inductive approach allowing themes to emerge from the data (Thomas, 2003).

This process began with the repeated reading of all documents and transcripts in order to make sense of the data and to learn 'what is going on' (Elo and Kyngäs, 2008). After this, codes were generated through open coding of the data. Miles et al. (2013: 71) define codes as "…labels that assign symbolic meaning to the descriptive or inferential information compiled during a study". Urquhart (2013: 10) describes the process of open coding as:

> *…going through the data, line by line or paragraph by paragraph, attaching codes to the data and very much staying open, seeing what the data might be telling you.*

It is through this detailed and 'open' approach to the analysis of the data that leads to unique insights (Urquhart, 2013). Codes aimed to be analytical, going beyond just a description and summary of the data. That said, descriptive codes were also used as a necessary first stage of an analytical code (Urquhart, 2013). An additional coding technique employed was 'in vivo' coding, which uses words or short phrases from the participant's own language in the data as codes (Miles et al., 2013). In vivo codes are particularly useful in that, "…in naming that code from the respondent's point of view, the point of view of that respondent is incorporated into the data interpretation" (Urquhart, 2013: 96).

The researcher also kept an annotated bibliography of all documentation. This contained any thoughts the researcher had during coding regarding trends, patterns and variation between documents/interviewees. After this open coding, during the abstraction phase of the analysis, the lists of codes were grouped by merging those that were similar or dissimilar into broader, higher categories and themes (Braun and Clarke, 2006). A theme is defined by Saldana (2009: 139) as "…a phrase or sentence that identifies what a unit of data is about and/or what it means". The themes identified formed the basis of the case study results and discussion chapters (see Appendix 8 for an example of theme relationships).

3.5.6 Case study analysis

The researcher utilised both within-case and cross-case analytical techniques to thoroughly examine attitudes and responses to the Conflict within the cases and discover contrasts, similarities and patterns. Table 3.13 presents the features of both analytical techniques employed in this study (Eisenhardt, 1989; Miles et al., 2013).

Table 3.13. Features of within-case and cross-case analysis

Within-case analysis	Cross-case analysis
• Can help the researcher to systematically manage a large volume of data	• Involves searching for similarities, contrasts and patterns between cases
• Involves detailed case study write-ups for each university	• Can result in new categories and concepts the researcher did not anticipate
• These write-ups are central to the generation of insight	• It allows data to be analysed by data source as well as by groups of cases
• Allows the researcher to become intimately familiar with each case as a stand-alone entity	• It enhances the probability that the researcher will capture the novel findings which may exist in the data
• It allows the unique patterns of each case to emerge before the researcher pushes to generalise patterns across cases	• Cross-case analysis can enhance the generalisability of the conclusions to other contexts
• It helps to accelerate cross-case comparison	

As a first step, the degree of internationalisation was examined at each HEI. UK HEIs were ranked based on the number of international students as a percentage of the total student population, and the case study HEIs given a rating attributed to their position (high, medium, low). In addition, UK HEIs were ranked based on transnational education student numbers expressed as a percentage of students studying in the UK, and the case study HEIs given a rating (see Table 3.14).

Table 3.14. Classification criteria for degree of internationalisation

		High	Medium	Low
Degree of internationalisation	% International students	Upper tertile X ≥ 25.4	Middle tertile 12.3 ≤ X < 25.4	Lower tertile X < 12.3
	TNE students expressed as a % of students studying in UK	Upper tertile X ≥ 9.0	Middle tertile 1.2 ≤ X < 9.0	Lower tertile X < 1.2

Engagement with the carbon management agenda at each of the case study HEIs was examined following the framework presented in Table 3.15. Formulation of the carbon assessment drew on previous work from Shi and Lai (2013), PPUL (2015) and Robinson et al. (2015) and an in-depth methodology is provided in Appendix 9.

Table 3.15. Carbon assessment framework

Category	Description	Weighting
Environmental Policy		**10%**
	Does the university have a publicly available environmental policy?	*10%*
Leadership commitments		**5%**
	Is carbon management a part of the corporate strategy?	*2.5%*
	Is the carbon management plan endorsed by executive leadership?	*2.5%*
Governance		**10%**
	Does the university have a dedicated environment (sustainability) team?	*10%*
Planning		**30%**
	Does the university has a reduction target for Scope 1 and 2 emissions?	*10%*
	Has the university set interim reduction targets?	*5%*
	Has the university offered a grant or loan scheme that provides up-front capital for implementing carbon reduction projects?	*5%*
	Has the university outlined projects to meet its reduction target?	*10%*
Reduction progress		**20%**
	Annual percentage reduction in emissions between baseline year (2005/06) and 2013/14	*20%*
Scope 3 emissions		**20%**
	Has the university submitted Scope 3 data to the EMR?	*6%*
	Has the university included Scope 3 emissions in the carbon management plan?	*9%*
	Has the university outlined initiatives to reduce Scope 3 emissions?	*5%*
Monitoring and reporting		**5%**
	Does the university monitor emissions annually?	*2.5%*
	Does the university produce a publicly available annual progress report?	*2.5%*

Each HEI was attributed a rating for their carbon assessment score based on British undergraduate degree classifications (1st, 2:1, 2:2, 3rd, Fail). Moreover, UK HEIs were ranked according to carbon reduction progress between 2005/06 and 2013/14, and the case study HEIs given a rating based on their position (very strong, strong, moderate, weak, and very weak) (Table 3.16).

Table 3.16. Classification criteria for carbon management rating

		1st	2:1	2:2	3rd	Fail
Carbon management rating	Carbon assessment score (%)	X ≥ 70	60 ≤ X < 70	50 ≤ X < 60	40 ≤ X < 50	X < 40
		Very strong	**Strong**	**Moderate**	**Weak**	**Very weak**
	Reduction progress between 2005/06 and 2013/14 (%)	First quintile X ≥ 25.8	Second quintile 15.5 ≤ X < 25.8	Third quintile 4.6 ≤ X < 15.5	Fourth quintile -4.8 ≤ X < 4.6	Fifth quintile X < -4.8

Each case was then analysed following an inductive strategy through coding and thematic analysis, guided by the research questions. Subsequent cross-case analysis allowed the researcher to aggregate findings across all of the individual cases. Preliminary emergent themes and conclusions were applied to the findings of further cases and revised and refined where necessary.

3.5.7 Validity and reliability

Morse et al. (2002: 14), concerning qualitative research, state that “Without rigor, research is worthless, becomes fiction, and loses its utility”. Thus, a great deal of attention was placed on ensuring validity and reliability in all research methods. Validity has long been a central issue in the debates surrounding the legitimacy of qualitative research (Maxwell, 1992). Validity and reliability are important within case study methodologies due to the subjective nature of qualitative research. Yin (2014) proposes the use of four tests commonly used to establish the quality of empirical social research; construct validity, internal validity, external validity and reliability (Table 3.17).

Construct validity is an answer to the question of whether an instrument is measuring what it is supposed to be measuring (Yin, 2014). Internal validity is the approximate truth about inferences that observed changes in a phenomenon can be attributed to the program or intervention that is the focus of the study, and not to other potential causes or alternative explanations (Yin, 2014). Thus, internal validity is not applicable to exploratory and descriptive studies (Yin, 2014). External validity involves establishing the domain to which a study's findings can be generalised, while the goal of reliability is to minimise the errors and bias within the case study and to demonstrate that when repeated, the researcher arrives at the same findings and conclusions (Yin, 2014). Case studies are one form of social research and tests for construct validity, external validity and reliability were incorporated within the research design and subsequent conduct of the case studies

With respect to construct validity, the researcher used multiple sources of evidence in a manner that encouraged divergent lines of inquiry, thus providing multiple measures with the resulting 'data triangulation' helping to strengthen the construct validity of the study (Yin, 2014). Furthermore, multiple analytical techniques were utilised during the data analysis stage. The logic of triangulation is based on the principle that no one method of data collection and analysis ever solves the problem of rival explanations and, "Because each method reveals different aspects of empirical reality, multiple methods of data collection and analysis provide more grist for the research mill" (Patton, 1999: 1192).

With respect to external validity, the exploratory nature of this study and the objective of appraising specific institutional responses to the Conflict, means that the value lies in the particular description and themes developed in context of a specific HEI rather than the generalisability of the findings (Creswell, 2009). Nevertheless, although the context-specific nature of this study might limit generalisations to different situations, the purposeful selection of multiple-cases on the basis of maximising the diversity of the sample to reflect the diversity within the UK HE sector, as well as cross-case analysis improved the generalisability of the findings to other contexts (Miles et al., 2013). Furthermore, the pragmatic approach rejects the notion of having to choose between two extremes, believing that no research is so unique it has no value to other actors or so generalised that results apply in every possible setting (Morgan, 2007). Thus, the insights and themes emerging from this research will be beneficial to all UK HEIs and to other areas of the economy where similar conflicts occur e.g. meeting customer demand and reducing carbon emissions.

In order to overcome reliability issues, the researcher utilised three techniques, which included the use of a case study protocol (discussed in Section 3.5.3), the development of a case study database and maintaining a clear chain of evidence. The development of the case study database was aided by the use of the qualitative data analysis software NVivo 10 which allowed the researcher to store all documents, reports, memos and transcripts in one area for ease case study. The goal of maintaining a chain of evidence was to move from one part of the case study to another, with clear cross-referencing to methodological procedures and the resulting evidence (Yin, 2014).

Table 3.17. Case study tactics to ensure construct validity, external validity and reliability (adapted from Yin, 2014)

Tests	Case study tactic	Phase of research in which tactic occurs
Construct validity	- Use multiple sources of evidence	Data collection
	- Establish chain of evidence	Data collection
External validity	- Use replication logic in multiple-case studies	Research design
Reliability	- Use case study protocol	Data collection
	- Develop case study database	Data collection

3.5.8 Limitations

The number of participants at each case study institution could be regarded as a limitation however, Ritchie et al. (2003) note that a small-scale sample can work if a robust purposive sampling strategy, such as the strategy adopted in this study, has taken place. Accessibility and time constraints were major factors in determining the number of participants. With regard to the “how many is enough” debate, the answer is “it depends” (Baker and Edwards, 2012). An analysis by Mason (2010) on 179 PhD theses that used a case study strategy, found that the range in the number of interviewees was between 1 and 95. Given the exploratory nature of the research and specific focus, the potential sample size was small and the researcher felt the Environmental Manager (or equivalent position) was the one person who would be in the best position to answer the technical questions and provide an overview of the institution's response to the Conflict. Indeed, the participants in this study were able to provide an in-depth account of their institution's response to this conflict and engagement with Scope 3 emissions. In addition, the large amount of publicly available documentation at each of the case study institutions provided data triangulation, and was a rich and vital source of information in its own right.

The lack of prior research on this topic could be considered a limitation as prior literature helps to lay the foundations for understanding the research problem under investigation, thus it left the researcher without any established framework to work within. Without this prior knowledge, the researcher had to define the area of investigation, which ultimately led to the exploratory research design, which can serve as a basis for further work in the field.

There is always a possibility of response bias that influences the participants in the study. These biases are especially important to acknowledge when using self-reported data such as interviews. This response bias could be in the form of selective memory, acknowledging the positive events in the HEI but ignoring or attributing the negatives to external forces and finally exaggeration, whereby the interviewee presents outcomes as more significant than actually suggested from other data (USC, 2016).

The researcher may have introduced unpredictable bias in the formation of the interview questions resulting in the questions guiding the respondent's answers. However, the researcher sought to ensure this did not occur by designing effective interview questions following recommendations from McNamara (2016):

- **Wording should be open-ended:** Interviewees should be able to choose their own terms and language when responding to a question.
- **Questions should be as neutral as possible:** Avoid wording that might influence answers, for example, evocative, judgmental wording.
- **Questions should be worded clearly.**
- **Be careful asking "why" questions.**

In addition, the researcher's own position on the topic may have introduced bias in the analysis of the results stage. Discussion of the researcher's interpretations and conclusions with the supervisory panel sought to guard against this bias.

3.6 Ethical considerations

Ethical considerations (i.e. concerns around consent, harm, confidentiality of data and privacy) were at the forefront of the research design process and an ethics checklist was completed prior to the commencement of the research project. The study posed no serious significant problems.

This study required contact with and information from people involved in the carbon management or internationalisation agendas at several case study institutions within the UK. Contact was in the form of informal meetings and semi-structured interviews. None of the participants were deemed vulnerable and prior to agreeing to partake in the study, all participants were provided with background information as to why the study was being undertaken and how the results would be used. Participants were made aware at the beginning that they could end their involvement in the study at any time. All participants were given the option of reviewing their interview transcript and amend responses; only one of the interviewees took up this offer.

The data collected on international and study abroad students along with the recorded interviews and focus groups were stored electronically on a password protected storage device that was kept within a locked cupboard that only the researcher had access to. No data was passed on to third parties. All participants were told that their responses to questions would be used anonymously within the thesis and any associated publications. This allowed participants to be candid about their respective institutions without fear of being negatively impacted through publication (Wright, 2010).

3.7 Chapter summary

Given the lack of prior research and the practical nature of the problem (the Conflict between the internationalisation and carbon management agendas), adoption of a pragmatic paradigm offered the flexibility to use a mixed methods strategy. This strategy enhanced understanding and explanation of the research problem.

This research followed a multiple strand mixed methods design with one strand predominantly quantitative utilising a cross-sectional survey of international and study abroad students and one predominantly qualitative using in-depth interviews and document analysis under the umbrella of a case study strategy. Data analysis consisted of the use of statistical tests and thematic analysis.

Chapter 4. Accounting for Student Air Travel Emissions

This chapter has been published in the peer-reviewed journal Carbon Management (see Appendix 14).

4.1 Introduction and chapter outline

This chapter presents the results of the student survey and addresses Objective 1, in evaluating the potential significance of student flight emissions to the carbon footprint of the UK higher education (HE) sector and associated RQ1 and RQ2.

In order to have an informed debate regarding responsibility for student and visiting friends and relatives (VFR) air travel emissions, and the efficacy of potential mitigation measures, it is first necessary to understand the significance of those emissions, where this requires robust accounting practices.

Guidance provided by the Higher Education Funding Council for England (HEFCE) on accounting for supply chain (Scope 3) emissions includes a methodology for estimating emissions from student air travel (F_S) which follows a standard carbon accounting approach to estimate emissions as (HEFC,E 2010b):

$$F_S = [D \times (1 + A)] \times CF$$

Where D is the return flight trip distance (Appendix 12), (1+A) is the number of return flights per year, where 1 represents the flight at the start and end of the study period and A is the number of additional flights, and CF is the appropriate conversion factor (short-haul or long-haul) as published by the UK Government (DEFRA/DECC, 2014a).

However, the robustness of the assumptions recommended in the HEFCE guidance regarding trip distance and flight frequency are questionable.

With respect to trip distance, D is estimated as twice the great circle distance (GCD) between London Heathrow (LHR) and the capital city of the overseas country (HEFCE, 2010b). However, if the overseas country is unknown, the GCD is assumed to be 400 miles for short-haul flights and 4000 miles for long-haul (HEFCE, 2010b). On the basis of an individual student trip, a change in the assumed departure or arrival airport may exert a significant difference, increasing or decreasing emissions depending on the relative position of the capital city. For example, assuming that all German students fly to the UK from Berlin will likely over estimate emissions given that Berlin is located in East Germany, while assuming all students from France fly from Paris will likely underestimate emissions given its location in northern France. However, when considering all inbound or outbound students, the net effect may be small. With regard to flight frequency, A is assumed to be one for inbound (international) students from the European Union (EU), and zero for other inbound and all outbound (study abroad) students (HEFCE. 2010b). However, there is no prior research on which to base these assumptions (SQW Consulting/SQW Energy, 2009) where there may or may not be differences between the travel behaviour of different student groups, and average trip distances and flight frequencies may be substantially different, particularly if both student and VFR flights are considered.

This chapter seeks to address these issues and to assess the significance of student air travel emissions. Section 4.2 first reports the results of a survey examining student and VFR travel behaviour. Section 4.3 then addresses RQ1 and presents a sensitivity analysis of the HEFCE (2010b) methodology to assess the appropriateness of the recommended assumptions. Following this, Sections 4.4 and 4.5 address RQ2, examining the present and potential future significance of student and VFR flight emissions. Specifically, Section 4.4 contextualises student and VFR flight emissions by examining their relative significance in comparison to GHG emissions for those higher education institutions (HEIs) who voluntarily reported against all available Scope 3 emission categories in the 2013/14 EMR return. Section 4.5 evaluates the magnitude of these emissions in comparison to mandatorily reported emissions for the entire UK HE sector in 2013/14 and estimates the potential future significance in 2020/21 under a range of scenarios. Finally, this chapter make recommendations regarding reporting of student air travel emissions.

4.2 Student travel behaviour

In total, 673 useable responses were received from students registered at 26 UK HEIs between December 2014 and February 2015. Table 4.1 presents a breakdown of respondents by study group and region in which the UK HEI of enrolment is located. An analysis of student and VFR flight frequency is provided below, and both the overseas airport and flight frequency are utilised in the sensitivity analysis presented in Section 4.3.

Table 4.1. Survey respondents by region of institution with a comparison to the 2013/14 UK international student population (HESA, 2015a)

Region	Inbound[a]			Outbound[b c]	
	n	**% Respondents**	**% All inbound students to the UK (HESA, 2015a)**	***n***	**% Respondents**
North East	39	8%	5%	6	3%
North West	62	12%	8%	5	3%
Yorkshire & The Humber	53	11%	8%	25	14%
East Midlands	14	3%	6%	2	1%
West Midlands	4	1%	8%	0	0%
East of England	75	15%	7%	70	40%
London	59	12%	23%	16	9%
South East	9	2%	11%	3	2%
South West	124	25%	6%	42	24%
Scotland	24	5%	11%	2	1%
Wales	2	0%	6%	0	0%
Northern Ireland	0	0%	1%	0	0%
Did not specify	33	7%	-	4	2%
TOTAL	**498**			**175**	

(a) Inbound students refers to all overseas students studying in the UK for a minimum of one year; (b) Outbound students refers to all UK registered students on study abroad schemes; (c) Institutional level data on study abroad numbers was not available, thus there is no comparison to the UK sector data

4.2.1 Student flight frequency

Inbound students

Table 4.2 presents the average number of additional flights made by inbound students by region of domicile and level of study. A Kruskal-Wallis test revealed some significant differences between world regions for all students (n=498, H=138.954, p<.001), for undergraduates (n=142, H=26.011, p=.001) and for postgraduates (n=324, H=95.464,

p=.001). Follow up pairwise comparisons indicated significant differences between European regions (EU-28 and Other Europe) and North America, Asia and the Middle East, Africa, South America, and Oceania. Conversely, the European regions were not statistically different to each other, nor were there any significant differences between the other world regions. It is therefore suggested that average flight frequency can be well described using domicile groups of ‘Europe’ and ‘Rest of the World’ (RoW).

Table 4.2. Average number of additional return flights made by inbound students during the academic year by region of domicile and level of study

Region of Domicile	All Students[a]				UG				PG				All Students Weighted Average[d]		
	n	Ave.	±	Std. Dev.	*n*	Ave.	±	Std. Dev.	*n*	Ave.	±	Std. Dev.	% UG	% PG	Weighted Average
All Europe	***193***	**2.4**	**±**	**1.4**	***45***	**1.8**	**±**	**1.2**	***134***	**2.5**	**±**	**1.5**	***62%***	***38%***	**2.1**
EU-28[b]	*181*	2.3	±	1.4	*43*	1.8	±	1.2	*125*	2.5	±	1.5			
Other Europe[c]	*12*	2.9	±	1.2	*2*	2.0	±	0.0	*9*	3.2	±	1.3			
Rest of the World	***305***	**1.0**	**±**	**1.1**	***97***	**0.9**	**±**	**1.0**	***190***	**1.0**	**±**	**1.1**	***49%***	***51%***	**1.0**
Central America	*5*	2.0	±	1.0	*0*		-		*5*	2.0	±	1.0			
North America	*51*	1.4	±	1.1 †,‡	*10*	1.5	±	1.4	*39*	1.3	±	1.1 †,‡			
Asia and the Middle East	*206*	0.9	±	1.1 †,‡	*81*	0.9	±	1.0 †	*113*	1.0	±	1.1 †,‡			
Africa	*23*	0.9	±	1.1 †,‡	*3*	1.3	±	1.2	*18*	0.8	±	1.2 †,‡			
South America	*14*	0.6	±	0.6 †,‡	*3*	0.3	±	0.6	*11*	0.7	±	0.6 †,‡			
Oceania	*6*	0.2	±	0.4 †,‡	*0*		-		*4*	0.3	±	0.5 †,‡			

NOTE. UG: Undergraduates. PG: Postgraduates. EU: European Union. (a) The sum of undergraduate and postgaduate students does not equal the total as some respondents did not specify degree level; (b) EU-28 refers to the 28 member states of the European Union and includes the Canary Islands, the Åland Islands and Gibraltar. Although officially part of the EU, the Overseas Departments of the French Republic have been classed here on a geographic rather than politicial basis and are included in the RoW category. (c) In line with Higher Education Statistics Agency definitions, 'Other Europe' includes the European Economic Area countries of Iceland, Liechenstein and Norway in addition to Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Cyprus (Non-European-Union), Faroe Islands, Georgia, Kosovo, Macedonia, Moldova, Monaco, Montenegro, Russia, San Marino, Serbia, Svalbard and Jan Mayen, Switzerland, Turkey, Ukraine, and Vatican Ciy; (d) Here the number of additional flights was calculated as a weighted average of the number of additional flights made by postgraduates and undergraduates based on the overall proportion of inbound students for the sector (HESA 2015b); † indicates a significant difference to EU-28 and ‡ indicates a significant difference to Other Europe ($p < 0.03$). No other significant differences were observed.

For RoW nationals there were no significant differences in the average number of flights according to level of study. However, for European nationals, postgraduates made more flights than undergraduates (n=179, U=3814.000, p=.006), where this most likely reflects the difference in typical academic year length (postgraduates 12 months; undergraduates 9 months), with both groups displaying a similar flight frequency of ~0.2 flights per month. As the proportion of undergraduate and postgraduate students in the survey sample differed from that in the UK student population, a weighted average of flight frequency was calculated, where European students made 2.1 additional flights per year, and RoW students made 1.0 additional flight per year (Table 4.2).

Outbound students

Table 4.3 presents the average number of additional flights made by outbound students by period of study and region of destination (no significant differences according to level of study, data not shown). For those studying abroad for one year, a Kruskal-Wallis test revealed some significant differences between world regions (n=107, H=28.791, p=.001). Follow up pairwise comparisons indicated significant differences between EU-28 and Oceania (p=.001) and North America (p=.007). No significant differences between world regions were found for students studying abroad for less than a year. However, nothing was found to contradict the European and RoW groupings identified for inbound students, and when these were applied, significant differences were found (one year: n=107, U=2191.000, p<.001; less than a year: n=68, U=582.000, p=.011). Thus using these destination groupings, on average students studying abroad for one year made 2.4 additional flights if studying in Europe and 0.9 additional flights if studying in the RoW, while students studying abroad for less than 1 year made 1.1 additional flights if studying in Europe and 0.4 additional flights if studying in the RoW.

Table 4.3. Average number of additional return flights per year or within the study period for outbound students by region of destination and duration of study period

Region of Destination	1 year					<1 year			
	n	Ave.	±	Std. Dev.		*n*	Ave.	±	Std. Dev.
All Students	**107**	**1.6**	**±**	**1.6**		**68**	**0.6**	**±**	**1.2**
All Europe	**50**	**2.4**	**±**	**1.7**		**18**	**1.1**	**±**	**1.4**
EU-28	49	2.4	±	1.6		16	1.2	±	1.5
Other Europe	1	5.0				2	0.0	±	0.0
Rest of the World	**57**	**0.9**	**±**	**1.3**		**50**	**0.4**	**±**	**1.1**
Central America	0		-			2	0.5	±	0.7
North America	26	0.9	±	1.2	†	9	0.9	±	1.8
Asia and the Middle East	8	0.8	±	0.7		12	0.0	±	0.0
Africa	5	1.6	±	1.5		8	0.1	±	0.4
South America	3	1.3	±	2.3		4	0.0	±	0.0
Oceania	15	0.5	±	1.3	†	15	0.7	±	1.5

† indicates a significant difference to EU-28 ($p < 0.007$)

4.2.2 VFR flight frequency

This section considers the total number of flights made by VFR, as all VFR flights can be considered additional to the return flight made by the student at the start and end of the study period.

Table 4.4 presents descriptive statistics for the number of VFR flights by study group and the domicile/destination groupings identified above (no significant differences according to level of study, data not shown). For inbound students, 77% of Europeans and 56% of RoW nationals received at least one visitor, with averages of 2.9 and 1.4 respectively (n=498, U=38,920.500, *p*=.001), where these results are comparable to previously reported values (Bischoff and Koenig-Lewis, 2007). For outbound students studying abroad for one year, 78% of those studying in Europe and 65% of those studying in the RoW received at least one visitor with averages of 4.0 and 2.2 respectively (n=107, U=1859.000, *p*=.006). For those studying abroad for less than a year, the number of visitors is considerably lower where only 43% of students received at least one visitor with an average of 1.0 (with no significant difference between students visiting Europe and the RoW).

Table 4.4. Descriptive statistics for the number of return flights made by visiting friends and relatives during the academic year

Student Group	*n*	# of VFR flights (%)							Ave. ± Std. Dev.
		0	1	2	3	4	5+		
Inbound									
All Europe	*193*	22.8	15.0	18.7	13.0	7.3	23.3	a	2.9 ± 2.9
Rest of the World	*305*	43.9	18.0	17.4	6.2	8.9	5.6	a	1.4 ± 1.9
Outbound (1 year)									
All Europe	*50*	22.0	4.0	10.0	10.0	20.0	34.0	a	4.0 ± 3.4
Rest of the World	*57*	35.1	7.0	21.1	12.3	5.3	19.3	b	2.2 ± 2.2
Outbound (<1 year)									
All Regions	*68*	57.4	16.2	11.8	7.4	4.4	2.9	c	1.0 ± 1.4

(a) maximum = 11; (b) maximum = 7; (c) maximum = 6

4.3 Sensitivity analysis of the HEFCE assumptions

This section presents a sensitivity analysis of the HEFCE (2010b) methodology for estimating GHG emissions from student air travel, where the appropriateness of the recommended assumptions relating to trip distance and flight frequency were tested against the results of the student survey. For completeness, assumptions incorporated in the conversion factors were also tested. In each test, the parameter in question was changed whilst keeping all other parameters fixed. The test parameters and results of the sensitivity analysis are presented in Table 4.5 and discussed below, where differences in estimated GHG emissions are expressed relative to the standard HEFCE estimate for the student survey sample of 1,222 tCO_2e.

Table 4.5. Sensitivity analysis of assumptions within the HEFCE methodology for estimating student flight emissions (HEFCE 2010b)

		Standard HEFCE estimate	Simple HEFCE estimate	Sensitivity Tests						
					Flight Frequency		Conversion Factor Assumptions			
				Trip Distance	Actual no. of flights	Average no. of flights	Uplift factor	Impact of emissions at altitude		
								Low	Central	High
Calculation Parameters										
Trip Distance:	**Great circle distance (one-way)**	LHR-overseas capital city	**SH = 400 miles** **LH = 4000 miles**	LHR-**actual**						
	Uplift factor multiplier	All regions = 1.08					**SH = 1.14** **LH = 1.06**			
Flight frequency:	**Inbound**	EU-28 = 2 non-EU = 1			**Actual # of flights**	**Europe = 3.1** **RoW = 2.0**				
	Outbound (1 year)	EU-28 = 1 non-EU = 1				**Europe = 3.4** **RoW = 1.9**				
	Outbound (<1 year)	EU-28 = 1 non-EU = 1				**Europe = 2.2** **RoW = 1.4**				
Effects of emissions at altitude multiplier		1.90						**1.30**	**1.95**	**2.60**
Estimated GHG Emissions (tCO_2e)										
Inbound		883	668	899	1,678	1,703	878	604	906	1,208
Outbound (1 year)		178	121	184	337	360	176	122	183	244
Outbound (<1year)		161	101	164	234	229	159	110	165	221
Total		1,222	889	1,247	2,249	2,292	1,213	836	1,254	1,673
% change from standard HEFCE estimate		**-**	**-27%**	**2%**	**84%**	**87%**	**-1%**	**-32%**	**3%**	**37%**

NOTE: All UK-Europe flights are short-haul (SH), while all UK-RoW flights are long-haul (LH).

4.3.1 Trip distance

All UK HEIs hold data on the country of domicile or destination of their students, thus for the standard HEFCE estimate the GCD between LHR and the overseas capital city was adopted (HEFCE, 2010b). However, the GCDs recommended by HEFCE (2010b) in cases where the overseas country is not known were also tested (UK-Europe = 400 miles; UK-RoW = 4,000 miles; Table 4.5, simple HEFCE estimate). It can be seen that these simplifying assumptions result in a significantly lower estimate of emissions and are thus not only unnecessary but also inappropriate. In comparison, the average GCDs for the survey sample were 725 miles for UK-Europe flights and 5,285 miles for UK-RoW flights.

The sensitivity analysis tested the impact of using the GCD between LHR and the actual overseas airport identified by each student in the survey. While a significant proportion (46% of inbound and 65% of outbound) of students did not fly to or from the capital city in their country of domicile or destination, the sensitivity of estimated emissions to this parameter was low, with a revised estimate only 2% higher than the standard HEFCE estimate at 1,247 tCO_2e.

4.3.2 Flight frequency

The standard HEFCE estimate applied the recommended assumptions that inbound EU students make two return trips during the academic year (one additional flight), while all other students make one return trip (no additional flights).

The sensitivity analysis tested the impact of using the actual number of additional flights reported in the survey by each student, where this resulted in estimated emissions of 2,249 tCO_2e, 84% higher than the standard HEFCE estimate. Using the average number of additional flights (as reported in Section 4.2) by study group and domicile/destination group was also tested. This gave excellent agreement (within 2%) to the estimate based on the actual number of flights, thus lending confidence to the use of these revised average flight frequencies in calculating emissions.

4.3.3 Conversion factor assumptions

The standard HEFCE estimate applied the recommended DEFRA/DECC (2014a) conversion factors which incorporate a distance uplift of 8% to compensate for lateral inefficiencies in flight tracks (deviations away from the GCD due to stacking, flying around military air space etc.) and a 'best-estimate' multiplier of 1.9 to account for the additional impacts of aviation emissions.

A recent analysis suggests that lateral inefficiencies as a percentage of GCD may differ substantially depending on flight route with average values of 14% for flights within Europe, 7% for flights departing Asia and arriving in Europe, and 5% for North Atlantic flights (Reynolds, 2014). Thus in the sensitivity analysis uplift factors of 14% for UK-Europe flights and 6% for UK-RoW flights were applied. Estimated emissions were 1,213 tCO_2e, only 1% less than the standard HEFCE estimate.

As noted in DEFRA/DECC (2014a), there is significant uncertainty regarding the magnitude of the additional impacts of aviation emissions. The current recommended multiplier of 1.9 is based on the radiative forcing (RF) index (the ratio of total RF to the RF from CO_2 alone) for all aviation emissions to the year 2000, and does not include aviation induced cloudiness (AIC) (DEFRA/DECC, 2014b; Sausen et al., 2005). Notwithstanding that this estimate excludes AIC and is now somewhat dated, the RF index represents a backward looking perspective that considers the present day impact of historical aviation emissions. As such, this conflicts with the forward-looking perspective typically adopted in GHG emissions accounting (and all UK conversion factors), which considers the present and future global warming potential of emissions over a 100 year time horizon (GWP_{100}). Recent estimates of an alternative multiplier including AIC and based on the GWP_{100} metric are in broad agreement, with Lee et al. (2010) reporting a range of 1.9-2.0, and Azar and Johansson (2012) reporting a range of 1.3-2.6. In the sensitivity analysis the full range of these reported values were adopted, with a central estimate of 1.95. Thus while accounting for the uncertainty in the additional impacts of aviation emissions at altitude results in estimated emissions ranging from 32% less to 37% more than the standard HEFCE estimate, the central estimate results in only a small increase of 3%.

4.3.4 Recommended assumptions

The sensitivity of estimated emissions to the choice of overseas airport is low (2%), thus given the additional complexity introduced by accounting for differences in flight route, the HEFCE assumption of a flight route between LHR and the capital city of the overseas country was found to be reasonable. Similarly, the sensitivity of estimated emissions to assumptions regarding uplift factor (1%) and the additional impacts of aviation emissions at altitude (central estimate 3%) is also low; thus, the use of the standard UK government conversion factors is recommended, in order to align with the national reporting framework. However, the HEFCE assumptions regarding flight frequency are not appropriate, where utilising the actual number of flights increases the estimated emissions by 84%. It is therefore recommend that HEIs should base emissions estimates on actual flight frequency as determined by a student travel survey, or employ the revised estimates of average flight frequency reported in this study.

4.4 The significance of inbound student air travel emissions

This section contextualises student flight emissions by examining their significance in comparison to the emissions for 25 UK HEIs (Appendix 3) who reported against all available categories in the 2013/14 EMR return (HESA, 2014b). This analysis was limited to inbound students as outbound student data by country of destination was not available at an institutional level.

The reporting HEIs spanned the continuum from research intensive to teaching-led universities, one of the key determinants of HEI emissions (Klein-Banai and Theis, 2013; Robinson et al., 2015). Collectively, these HEIs accounted for 27% of mandatorily reported emissions, and had a moderately higher mandatory emissions intensity (1.2 tCO_2e/student) and slightly higher proportion of international students (21%) than the sector as a whole (1.04 tCO_2e/student and 19%). With respect to carbon management and reduction, the range in scores awarded to these HEIs by the PPUL (2015) was comparable to the UK average. Thus, while no claim is made that this sample is statistically representative, it nonetheless provides a reasonable picture of the UK HE sector.

For each institution, emissions from student flights were calculated from inbound student data by country of domicile (HESA, 2015a) and the average flight frequencies (by domicile group) presented in Section 4.2. Results are presented in Figure 4.1 and Appendix 3.

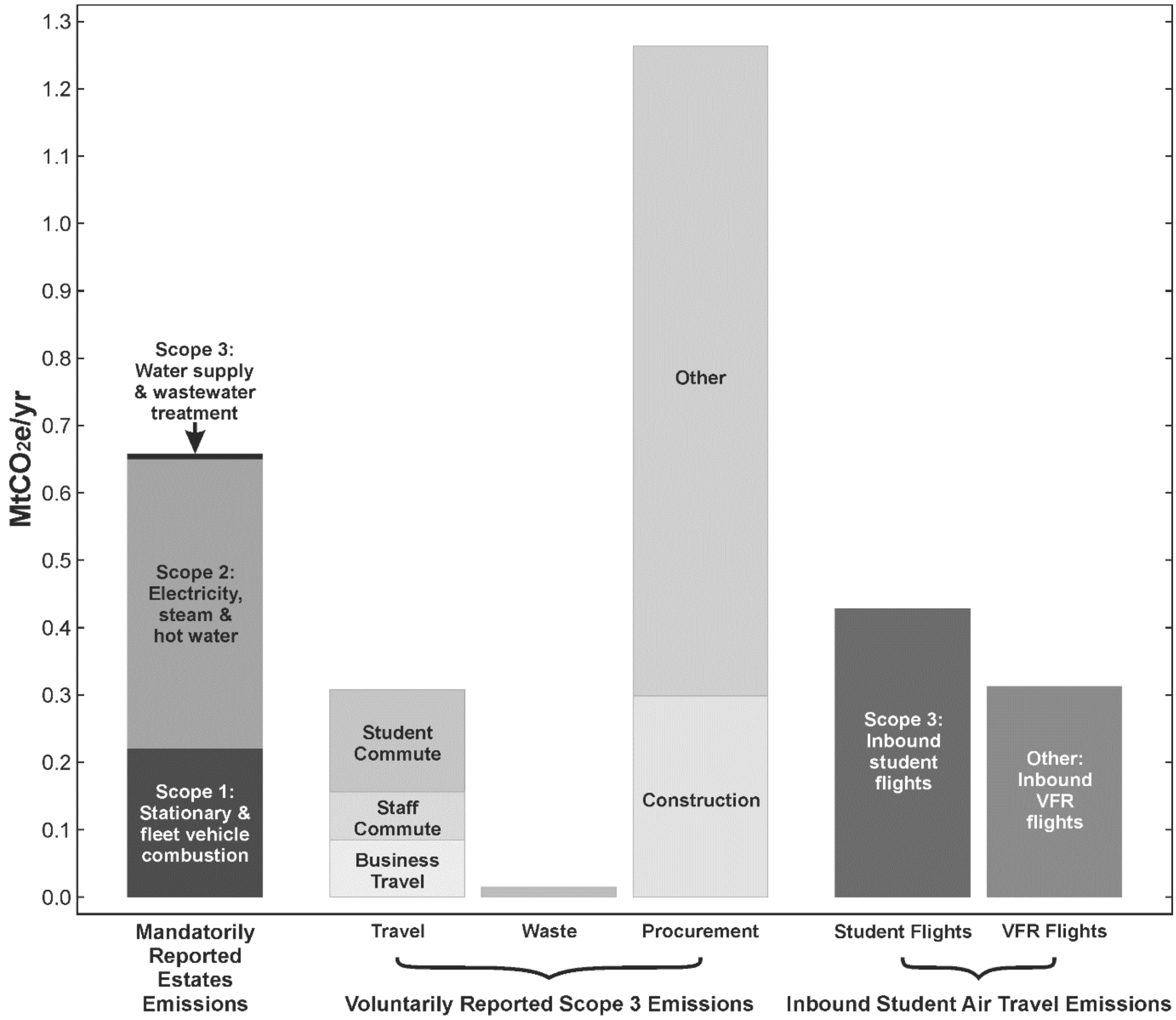

Figure 4.1. Inbound student air travel emissions in comparison to emissions reported in the 2013/14 EMR return for 25 UK HEIs

Overall, estimated inbound student flight emissions were equivalent to 65% of mandatorily, 27% of voluntarily, and 19% of total reported emissions. If VFR flights were included, this increased to 113%, 47%, and 33% respectively. This analysis clearly demonstrates the significance of student air travel in comparison to all emissions categories reported in the EMR, where student flights and VFR flights were the third and fourth most significant sources of emissions, after other procurement and Scope 2 emissions (Figure 4.1). Furthermore, emissions within all current EMR reporting categories could realistically be expected to decrease over time given both the potential to reduce emissions and sector reduction targets. Conversely, international and study abroad student numbers are expected in increase (DBIS, 2013), and there are extremely limited options to decrease the associated travel emissions through increased efficiency of aviation or substitution of flying with alternative modes of travel (Townsend and Barrett, 2015). As such, it is important to evaluate the current and potential future emissions associated with student and VFR air travel for the HE sector as a whole in order to inform debate and identify appropriate approaches to emission reductions.

4.5 The potential significance of student air travel for UK HE Sector GHG Emissions to 2020/21

This section considers the current and potential future emissions from student and VFR flights in comparison to mandatorily reported emissions (HESA, 2014b) for the UK HE sector. Emissions were estimated for 2013/14 based on inbound and outbound student data by country of domicile (HESA, 2015a) and the average flight frequencies presented in Section 4.2 above. Emissions were then estimated for 2020/21 based on three forecasts for growth in student air travel and three storylines for GHG reduction.

For forecasts of student air travel, low (0.7%), medium (3.7%) and high (6.7%) annual growth rates were used, based on projected growth in international student enrolments (DBIS, 2013) and assuming a similar growth in study abroad student numbers. As a first order estimate, it was assumed there was no change in student demographics or student and VFR travel behaviours.

For forecasts of GHG reduction, the no reduction storyline holds HEI estates emissions and aviation fuel efficiency at 2013/14 levels. In the aspirational storyline, HEIs achieve Scope 1 and 2 targets (institutional targets against the 2005/6 baseline where reported in HESA (2014b), otherwise a 3% annual reduction assumed in line with national targets) and emissions from water supply and wastewater treatment decrease by 3% per year (in line with national targets). In the realistic storyline, HEI estates reductions are equivalent to 50% of the targets, in line with a recent report assessing current progress (BriteGreen, 2015). For aviation fuel efficiency, the realistic and aspirational storylines reflect the industry target and aspirational goal respectively (1.5% and 2.0% improvement per year; ICAO, 2013).

Figure 4.2 presents average student flight emissions in 2013/14 on a per student basis. Figure 4.3 illustrates the change in sector emissions from 2013/14 to the 2020/21 central scenario (realistic GHG reduction and medium growth in student air travel), and emissions in all future scenarios are shown in Figure 4.4.

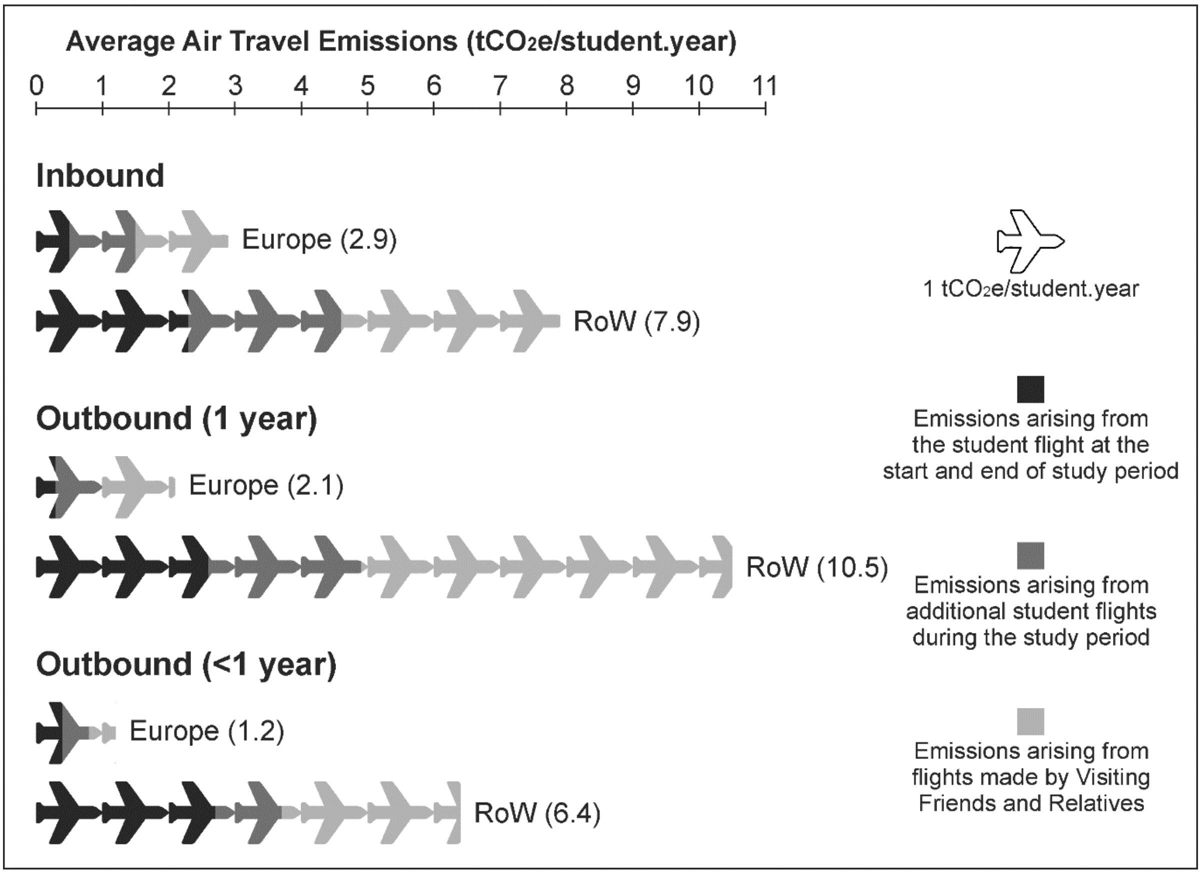

Figure 4.2. Average air travel emissions for inbound and outbound students

Inbound students and their VFRs account for 95% of estimated total air travel emissions (Figure 4.3), reflecting the much higher number of students in this group. However, if emissions are considered on a per student basis (Figure 4.2), then the highest impact is associated with outbound students studying abroad for 1 year in RoW destinations. While the emissions from student flights for this group are broadly comparable to those associated with inbound students from the RoW, the VFR emissions are much greater. This difference is mainly driven by a higher average flight frequency (as opposed to differences in average trip distance), which may reflect the relative wealth of outbound VFRs when compared to inbound VFRs.

Considering absolute emissions (Figure 4.3), in 2013/14, student flight emissions slightly exceeded Scope 2 emissions and were equivalent to 68% of all mandatorily reported estates emissions. If VFR flights are included, then total student air travel emissions exceeded estates emissions by 0.45 $MtCO_2e$, or ~19%. From 2013/14 to the 2020/21 central scenario, estates emissions decreased by 0.32 $MtCO_2e$ to 2.08 $MtCO_2e$, while student flight emissions increased by 0.26 $MtCO_2e$ to 1.89 $MtCO_2e$ (equivalent to 91% of estates emissions). Thus in this scenario, estates emissions reductions compensate for the growth in student flights. However, if estates emissions reductions are used to offset the growth in flights, then the net estates emissions reduction is only 0.05 $MtCO_2e$ (equivalent to a 2.5% reduction below the 2005/6 Scope 1 and 2 baseline). Furthermore, if emissions from VFR flights are included, then overall emissions increase by 0.14 $MtCO_2e$.

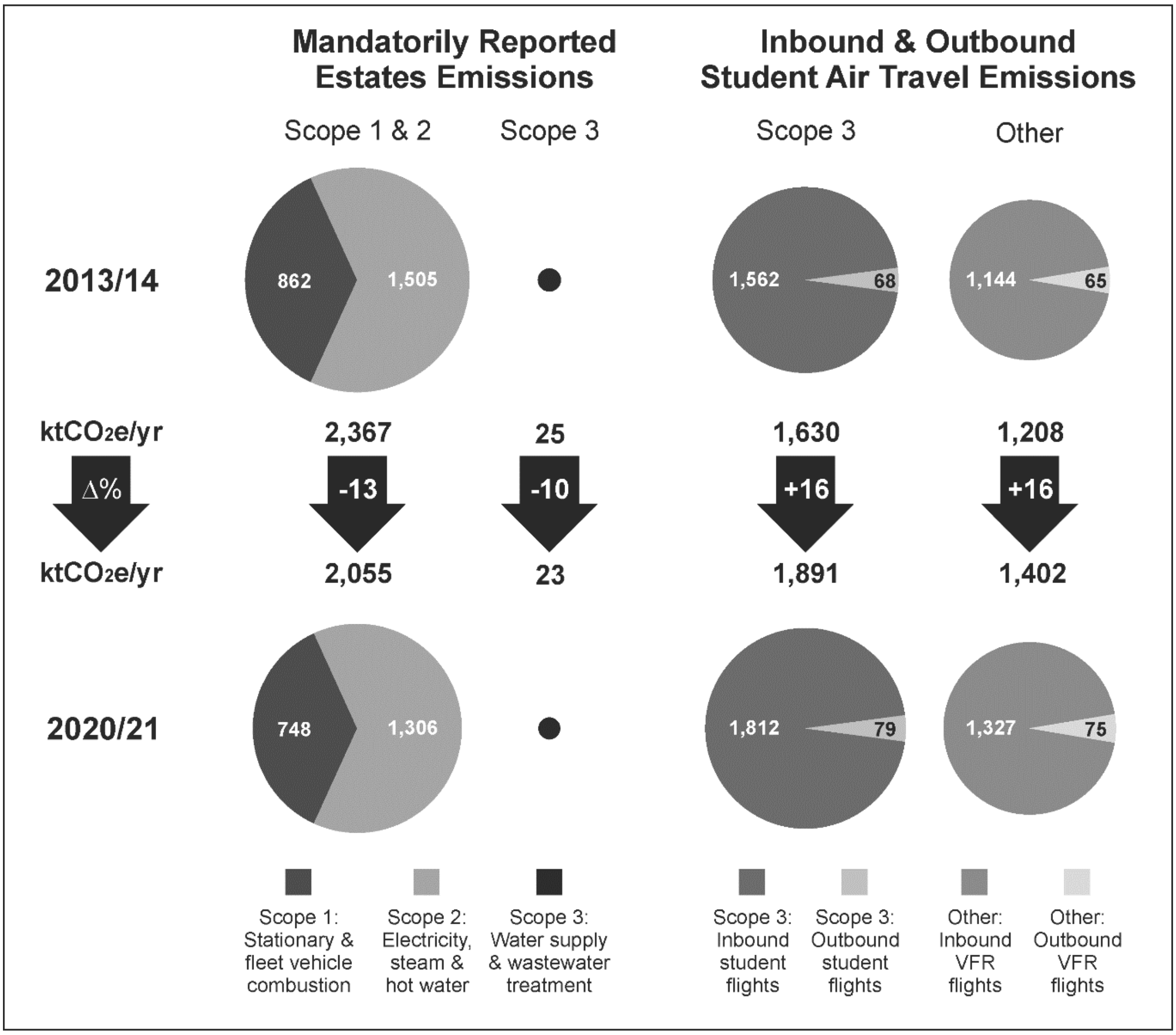

Figure 4.3. Change in HE estates emissions and student air travel emissions from 2013/14 to 2020/21 based on realistic reductions in GHG emissions and medium growth in inbound and outbound student numbers (central scenario)

In all 2020/21 scenarios the relative significance of student flight emissions increases over time, ranging from 72% (no reduction-low growth) to 136% (aspirational-high growth) of estates emissions (Figure 4.4). Reductions in estate emissions compensate for the growth in emissions from student flights in all of the aspirational scenarios and the realistic-low and –medium growth scenarios. For the remaining scenarios, the growth in student flight emissions outstrips the estate reductions, where in the realistic-high growth scenario, emissions from student flights could reach ~2.31 $MtCO_2e$ by 2020/21 (equivalent to 111% of estate emissions). If VFR flights are included, then reductions in estate emissions only compensate for the growth in student numbers in the aspirational-low and –medium and realistic-low growth scenarios, with a net increase in all other cases.

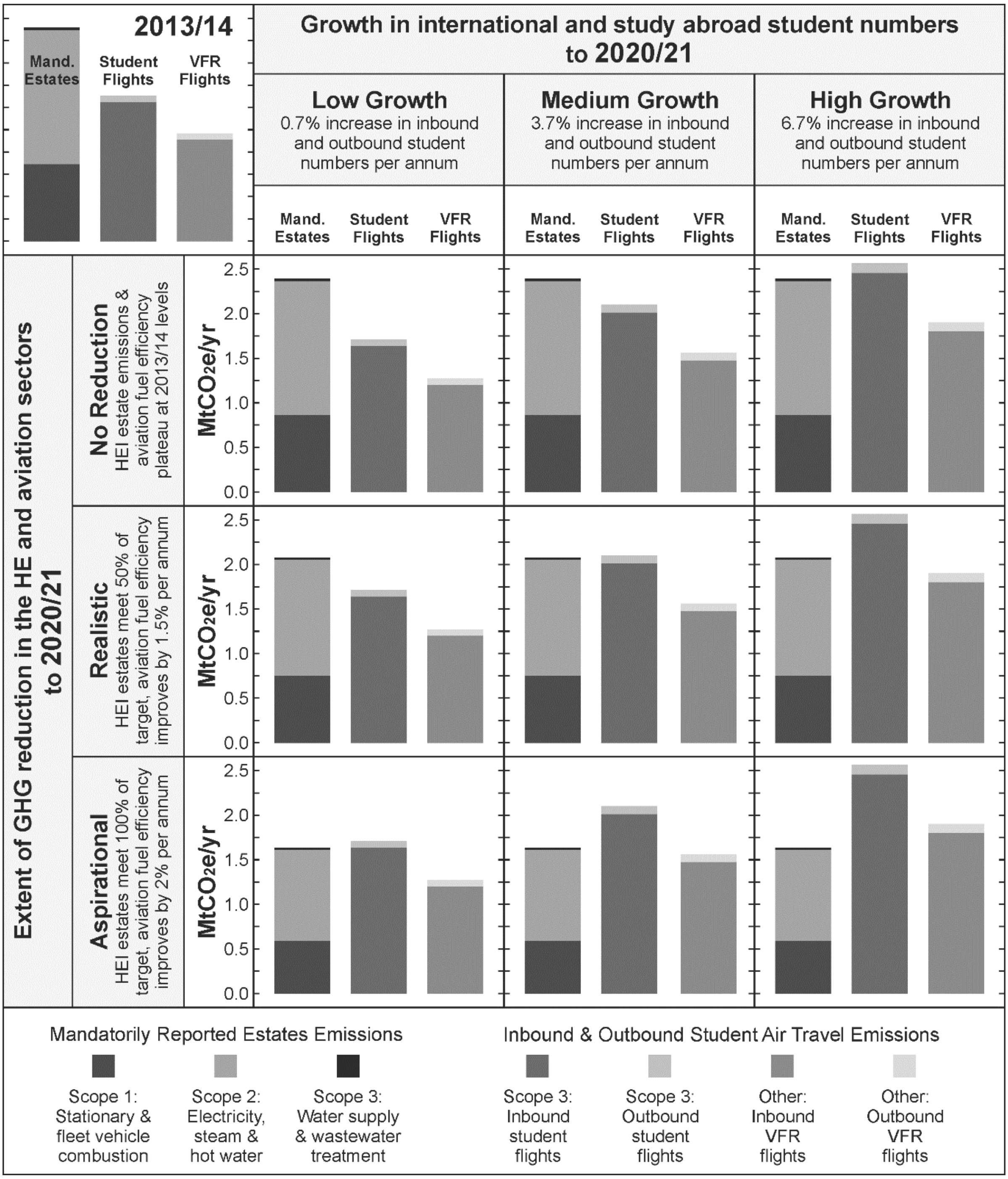

Figure 4.4. Nine scenarios illustrating the potential change in HE sector emissions from 2013/14 to 2020/21 based on the extent of GHG reduction in the HE and aviation sectors and growth in inbound and outbound student numbers

4.6 Chapter summary and conclusions

This chapter has clearly demonstrated the current and potential future significance of GHG emissions arising from the air travel of international and study abroad students and their associated VFRs when compared to other components of the carbon footprint for UK HEIs, thus addressing Objective 1. Indeed, scenario analysis suggests that by 2020/21 increases in student and VFR flight emissions are likely to exceed the reductions achieved in estates emissions unless HEIs reinvigorate efforts to achieve their ambitious reduction targets, and/or there is close to zero annual growth in inbound and outbound student numbers.

It is acknowledged that attributing all student air travel emissions to the HEI can be questioned. However, the flight made by the student at the start and end of the study period is clearly induced by HEI service offerings, and should therefore be included within Scope 3 emissions. With respect to additional flights, it is argued that when offering overseas education over an extended period, it is reasonable to expect that students may travel home during that period, and therefore additional flights should be evaluated. It is worth highlighting that if HEIs took action to encourage fewer student flights, it is conceivable that a behavioural rebound-type effect might occur, where the number of VFR flights increases to maintain a similar degree of student-VFR contact. Indeed, a backfire effect, where the increase in VFR emissions exceeds the decrease in student flight emissions, would be plausible.

Given the significance of student and VFR flights and the potential for rebound and backfire effects, it is imperative that UK HEIs develop an accurate picture of these emissions in order to identify effective reduction options (that deliver a net reduction in global emissions) and inform both their carbon management and internationalisation strategies. It is therefore recommend that funding bodies and devolved governments should encourage HEIs to estimate and report these emissions based on a survey of student travel behaviour or the estimates of average flight frequencies presented in this study.

The following chapter focuses on attributing responsibility for student air travel emissions (from the students' perspective, RQ6) as well as examining the acceptability of alternative methods of delivering UK education overseas and carbon offsetting/carbon compensation (RQ7).

Chapter 5. Student Perceptions of Options to Mitigate and Compensate for Air Travel

5.1 Chapter outline

This chapter presents the results of the student survey, assessing perceptions of responsibility for student flight emissions and evaluating preferences for potential mitigation and compensation options (Objective 3 – RQ6 and RQ7). Section 5.3 evaluates students' views on alternative service offerings that have the potential to avoid or reduce air travel and assesses willingness to reduce air travel consumption. Section 5.4 examines perceptions of responsibility for offsetting or compensating and willingness to pay (WTP) to offset/compensate. Section 5.5 examines student preferences on type of compensatory action, while Section 5.6 explores students' attitudes towards overseas study and air travel's impact on climate change. Finally, Section 5.7 presents the discussion and conclusions of the results.

5.2 Introduction

The carbon management hierarchy (Chapter 2, Section 2.4.6) aids organisations in planning and determining a starting point for engagement with carbon mitigation/compensation efforts. Avoiding emissions, as the preferred option, is followed by actions to reduce emissions and offsetting/compensation. In the context of emissions arising from international and study abroad student air travel, this would correspond to, removing the need for travel, reducing the frequency of travel or travel distance, changing the mode of transport for a less carbon intensive alternative and offsetting/compensation.

In theory, transnational education (TNE) provision, whereby higher education (HE) providers offer programmes through branch campuses and an array of collaborative arrangements to students in their home or neighbouring country (Alam et al., 2013), offers a way of avoiding or reducing air travel. However, the extent to which students perceive the quality of TNE in comparison to studying in the UK is less clear and there are questions as to the acceptability of TNE and the extent to which it is substitutable for studying a full degree in the UK.

In terms of reducing travel frequency, in order to inform the HE sector's response to this challenge it is important to evaluate students' willingness to reduce air travel consumption. Previous research on public attitudes towards aviation and climate change has shown high awareness of aviation's impact on climate change but limited behavioural response - the attitude-behaviour gap (Dargay et al., 2006; McKercher et al., 2010). A lack of commitment to reduce air travel means higher education institutions (HEIs) will need to look to incentivise staying in the UK, rather than travelling home during term time and holiday periods, as well as promoting alternative modes of transport, e.g. train travel, where practical. Moreover, it places greater significance on offsetting and alternative compensatory activities.

While HEIs cannot use offsetting to meet Scope 1 and 2 reduction targets, it can be used as part of a carbon management plan to compensate for 'unavoidable emissions' such as emissions from student air travel (HEFCE, 2010b). In terms of allocating responsibility for offsetting or compensating for student air travel emissions, the literature review presented a number of different perspectives (see Chapter 2, Section 2.7.7). Without attributing responsibility, mitigating and/or compensating for student air travel emissions will remain an arduous task (Bastianoni et al., 2004). Given the range of possible perspectives, it is helpful to explore students' views of who has responsibility for offsetting or compensating for student air travel emissions. Moreover, to inform HEIs' response to this challenge this chapter evaluates students' attitudes towards offsetting, or otherwise compensating, for flights associated with education, including WTP.

5.3 Mitigating student air travel emissions

With regard to the carbon management hierarchy and strategies for mitigating student air travel emissions, eliminating or reducing the need for travel through TNE provision is the preferred mitigation option, followed by reducing the frequency of flights. Thus, this section explores students' views on alternative methods for delivering the UK HE experience and willingness to reduce the number of flights they make.

5.3.1 Alternative methods of delivering the UK higher education experience

To assess acceptability and to understand the substitutability of alternative methods of delivering the UK HE experience, inbound students were asked closed questions regarding how much importance they placed on (a) obtaining a degree awarded by a UK University, and (b) living and studying in the UK (Figure 5.1). In addition, students were asked to assess the relative attractiveness of alternative methods of delivering UK HE (Table 5.1 and Figure 5.2), with the option to provide an associated comment.

With regard to the importance of obtaining a degree awarded by a UK HEI, 93% of students indicated that this was moderately to very important to them, with 80% identifying this as important or very important. Similarly, the results show that 90% of students place some degree of importance (moderately to very important) on living and studying in the UK, where 71% of students identified this as important or very important.

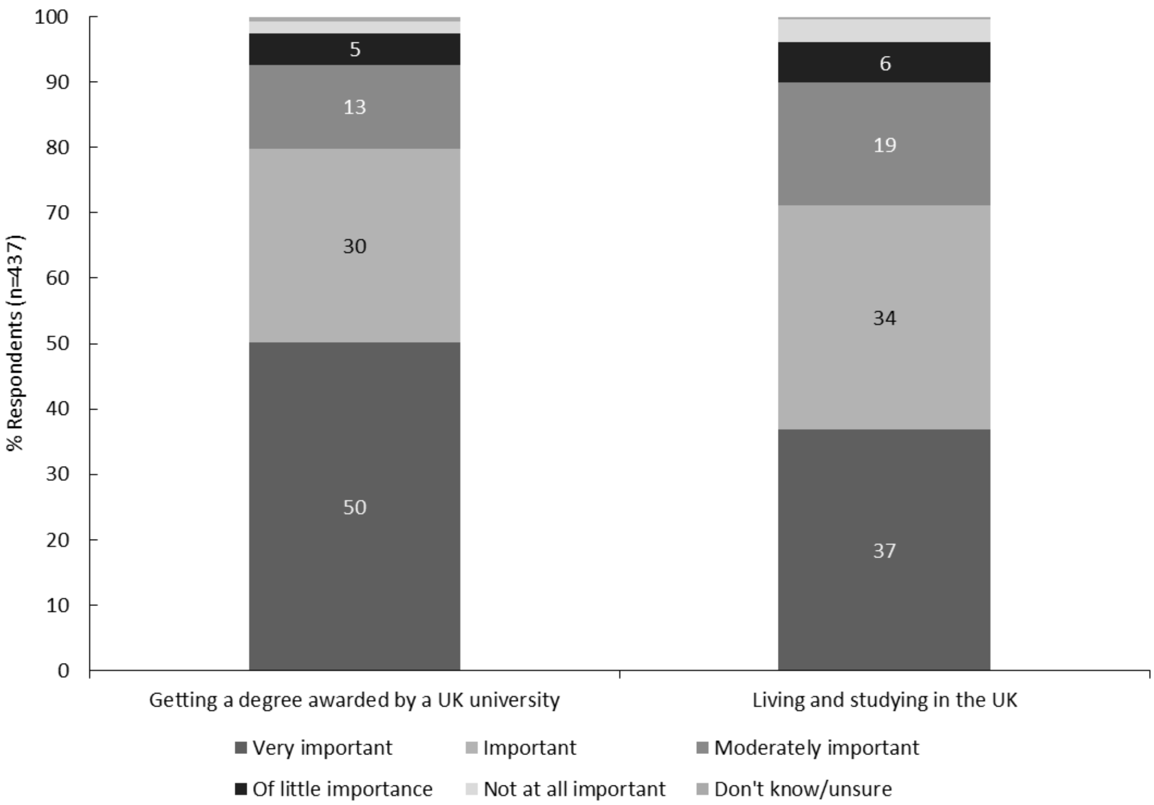

Figure 5.1. Importance placed on getting a UK degree, and living and studying in the UK by respondents

In terms of exploring the attractiveness of alternatives to studying for a full degree in the UK, the results presented in Table 5.1 and Figure 5.2 show that the two most attractive choices were the split study options that still involve spending time in the UK (reference codes (b) and (c) in Table 5.1). Distance learning was the least attractive option, with over two thirds of respondents (68%) selecting either much less attractive or somewhat less attractive.

Table 5.1. Descriptive statistics for attractiveness of alternative methods of delivering UK HE

Reference code	**Transnational education delivery method**	**n**	**Ave.**[a]		**Std. Dev.**
(a)	Study for a dual/joint degree awarded by both a university in your home country and a UK university with all of the study in your home country	418	2.57	±	1.32
(b)	Study for a dual/joint degree awarded by both a university in your home country and a UK university with study split between your home country and the UK	419	2.98	±	1.31
(c)	Study for a degree awarded by a university in your home country, which offers you the opportunity to study at a UK university for a period of up to one year	420	2.82	±	1.32
(d)	Study for a degree awarded by a UK university and delivered by a university in your home country	415	2.25	±	1.26
(e)	Study for a degree awarded by a UK university, and delivered at a branch campus located in your world region	413	2.47	±	1.24
(f)	Study for a degree awarded by a UK university and delivered via distance learning	416	1.94	±	1.19
(g)	Study for a degree awarded by a UK university, and delivered at a branch campus located in your home country	418	2.35	±	1.27

Note. Don't know/unsure answers were treated as missing and not included in the analysis; (a) measured on a five point Likert scale (5 = Much more attractive, 1 = Much less attractive)

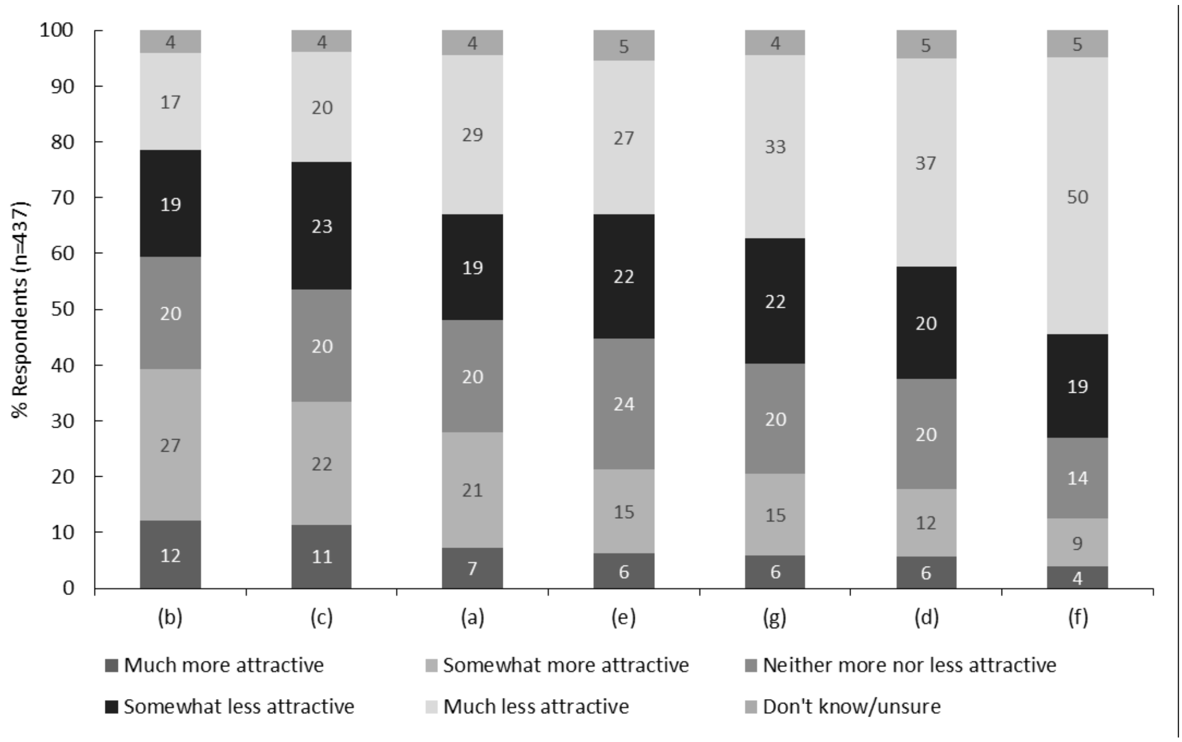

Figure 5.2. Attractiveness of alternative methods of delivering UK HE presented in ranked order, with most attractive on the left to least attractive on the right (see Table 5.1 for the reference codes and description of each option)

The results from this section indicate that respondents place equal importance on obtaining a degree awarded by a UK HEI and the experience of living and studying in the UK. In terms of the attractiveness of the alternative methods of delivering UK HE, while all of the options are seen as more attractive by some respondents, three of the options that eliminate emissions from air travel (options d, f and g) appear to be less substitutable with studying for a full degree in the UK, particularly distance learning (f). Option (a) appears to be the most favourable option that has the potential to avoid emissions from air travel. Approximately half (48%) of respondents selected neither more nor less attractive, somewhat attractive or much more attractive, for option (a).

The split delivery modes (options b and c), are the most favourable alternative delivery options. These options for delivering UK HE may be a substitutable service for 59% (b) and 53% (c) of respondents (those selecting neither more nor less attractive, somewhat more attractive or much more attractive). Although for a given student they reduce (rather than avoid) emissions, overall they may offer a viable mechanism for the greatest emissions reductions. That said, substituting three years study in the UK for one year would most likely reduce emissions to around a third, leaving some residual emissions.

Reasons for student preferences of TNE options

In the associated comments (n=43), a number of reasons for student preferences of study options emerged (Table 5.2). Several respondents indicated that the lack of specific courses in their home country was a significant push factor in their decision to study in the UK. A number of respondents stated that experiencing the UK's culture was a significant pull factor in choosing where to study, while for some, the quality of education on offer in the UK is perceived to be better than their home HEIs or branch campuses.

Table 5.2. Emergent themes in relation to alternative methods of delivering UK HE

Domain	Main themes	Typical comments
Push factor	Availability of HE	"My degree doesn't exist in Germany (MSc Microbiology)"
		"I am doing a PhD, and the centre I am located at [is] a unique research centre on migration in Africa & Asia that doesn't have any North American equivalent"
Pull factor	UK's culture	"not only achieving a degree but also living and experiencing [a] foreign country is important"; "the necessity to learn the real experiences (culture, learning atmosphere, interaction, etc.) while studying in the UK"
	Quality of education better in the UK	"It seems to me like branch campuses are often not of the same quality"; "My country's education system is nowhere close to that of the UK so I won't consider any form of study based or linked there"
	Better recognised degree	"...the reason I study internationally was to experience another learning environment, resulting in what I consider a better recognised degree"

5.3.2 Willingness to reduce air travel consumption

In order to evaluate willingness to reduce air travel in comparison to other lifestyle changes, respondents were asked what actions to reduce GHG emissions they already undertake, or would likely consider, during their time at university (Figure 5.3).

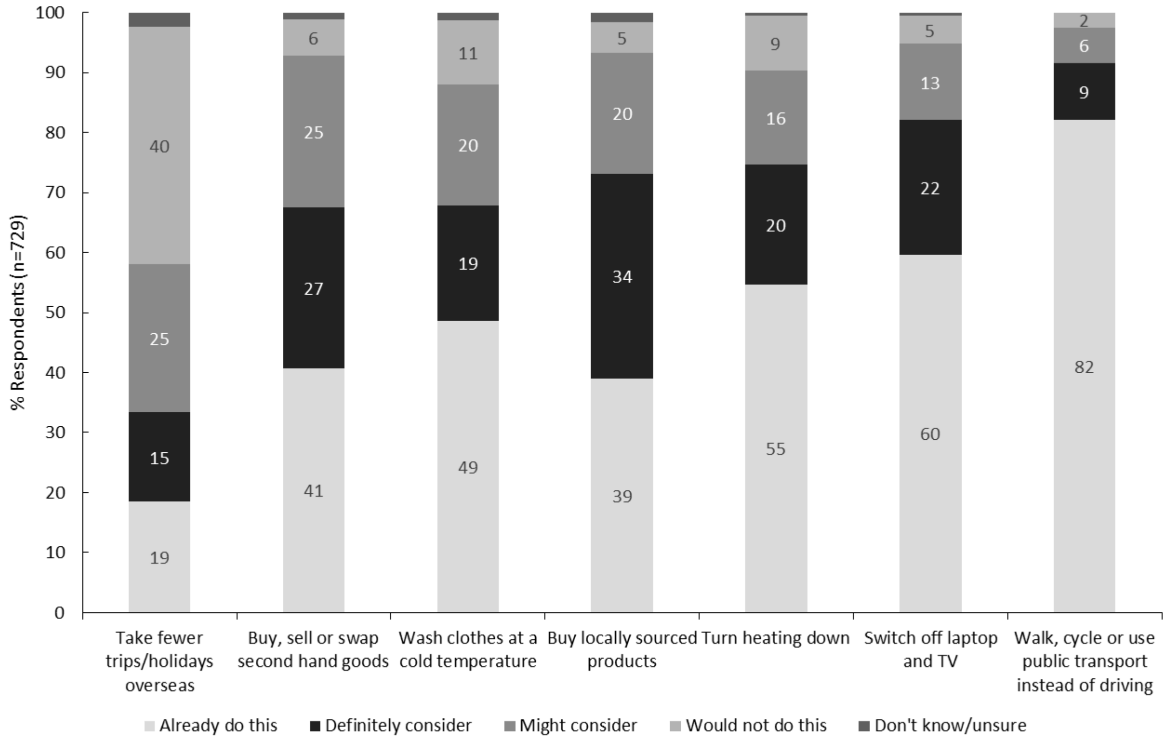

Figure 5.3. Survey respondents' consideration of actions to reduce GHG emissions presented in ranked order from least likely to adopt (left) to most likely to adopt (right)

The results show that while students are already making, or are willing to make small adjustments to reduce their carbon footprint (such as not driving and switching off appliances) they are less willing to make significant changes requiring major personal sacrifice such as making fewer trips overseas. Indeed, 40% of respondents would not consider making fewer overseas trips, which is comparable to the findings from a UK study on attitudes towards aviation and climate change, whereby 38% of leisure flyers and 43% of business flyers were not prepared to reduce their levels of air travel (Dargay et al., 2006). Only 19% of respondents in this study selected 'already do this' for the 'take fewer trips/holidays overseas' action, whereas for the other actions, the comparable figure ranged from 39-82%. In the open responses, one respondent sums up this issue:

> *I think people will always be willing to reduce their carbon footprint locally, and in ways that won't have a large impact on their day-to-day life. But when considering travel I think it is a deeper, different type of issue, of what we believe we almost*

deserve - we believe we have the right to live how we want to live, and to make the most out of life.

To summarise, the results from Section 5.3 suggest that while TNE provision may offer some scope to reduce or avoid emissions, it is likely that substantial emissions from student air travel would remain, particularly given students' apparent unwillingness to reduce personal levels of air travel consumption and the importance they place on living in the UK. This places greater significance on carbon offsetting/compensation.

5.4 Responsibility and willingness to pay

There are questions as to who bears responsibility for mitigating and/or compensating for student air travel emissions. Given the range of possible perspectives (see Chapter 2, Section 2.7.7), it is helpful to explore students' views regarding who has responsibility for offsetting or compensating for their air travel emissions. Respondents (n=658) were provided with a definition of carbon offsetting and example costs for offsetting a return flight between the UK and different regions of the world (Table 5.3) before being asked a series of questions regarding responsibility and WTP. With respect to WTP, this research was interested in examining how perceptions of responsibility (as one of a number of factors) influenced both the proportion of the actual offset cost respondents would be willing to pay, and the maximum amount.

Table 5.3. Example offset costs for a return flight between the UK and various world regions

World region	Example offset costs
Africa	£4 (Tunis, Tunisia) - £21 (Cape Town, South Africa)
Asia	£13 (Islamabad, Pakistan) - £21 (Tokyo, Japan)
Australasia	£42 (Sydney, Australia) - £48 (Wellington, New Zealand)
Central America and the Caribbean	£14 (San Juan, Puerto Rico) - £15 (Nassau, The Bahamas)
Europe	£1 (Paris, France) - £5 (Nicosia, Cyprus)
Middle East	£6 (Tel Aviv, Israel) - £12 (Muscat, Oman)
North America	£11 (Ottawa, Canada) - £12 (Washington, USA)
South America	£16 (Caracas, Venezuela) - £26 (Santiago, Chile)

5.4.1 Responsibility for student air travel emissions

In order to evaluate perceptions of responsibility, respondents were asked who (if anyone) they considered responsible for offsetting or compensating for the climate change impacts of their own air travel to and from the UK (inbound students) or study abroad destination (outbound students). Respondents were allowed to select multiple stakeholders, thus could attribute full or partial responsibility, and were invited to provide an associated comment.

Table 5.4 presents the number and percentage of respondents allocating any (full or partial) responsibility to each stakeholder, while Table 5.5 considers the impact of allocating responsibility across multiple stakeholders. A number of respondents (n=40) identified a beneficiary they deemed to be responsible and either no-one, don't know/unsure, or both of these options, indicating a degree of uncertainty in allocating responsibility. Where a respondent identified either no-one or don't know/unsure alongside a beneficiary, the selected beneficiary was retained for the analysis and the no-one or don't know/unsure were not included.

Table 5.4. Number and percentage of respondents allocating some degree of responsibility (full or partial) to each stakeholder

	Number of Respondents	No-one	Myself	Airline	Airports	UK University	Overseas University [a]	Don't Know/ unsure
All Respondents	**658**	**79**	**227**	**330**	**98**	**111**	**15**	**80**
		12%	**34%**	**50%**	**15%**	**17%**	**2% [b]**	**12%**
Inbound (full degree)	**440**	56	148	215	68	65	-	57
		13%	34%	49%	15%	15%	-	13%
Inbound (visiting)	**55**	3	17	34	11	7	4	5
		5%	31%	62%	20%	13%	7%	9%
Outbound (1+ year)	**102**	10	43	52	7	19	6	10
		10%	42%	51%	7%	19%	6%	10%
Outbound (<1 year)	**61**	10	19	29	12	20	5	8
		16%	31%	48%	20%	33%	8%	13%
Outbound (all)	**163**	20	62	81	19	39	11	18
		12%	38%	50%	12%	24%	7%	11%

Note: (a) Overseas university only presented as an option to inbound (visiting) and outbound students; (b) When considering only inbound (visiting) and outbound students, 7% identify the overseas university

Table 5.5. Number and percentage of full respondent equivalents assigning responsibility for compensation costs to each stakeholder

	No-one	Myself	Airline	Airports	UK University	Overseas University [a]	Don't Know/ Unsure
All Respondents	**79**	**152**	**234**	**39**	**69**	**5**	**80**
	12%	**23%**	**36%**	**6%**	**10%**	**1% [b]**	**12%**
Inbound (full degree)	56	103	153	28	43	-	57
	13%	23%	35%	6%	10%	-	13%
Inbound (visiting)	3	11	25	5	5	2	5
	5%	19%	45%	8%	9%	4%	9%
Outbound (1+ year)	10	30	39	2	9	2	10
	10%	30%	38%	2%	9%	2%	10%
Outbound (<1 year)	10	9	17	5	12	1	8
	16%	14%	27%	7%	20%	2%	13%
Outbound (all)	20	39	56	6	21	3	18
	12%	24%	34%	4%	13%	2%	11%

Note: (a) Overseas university only presented as an option to inbound (visiting) and outbound students; (b) When considering only inbound (visiting) and outbound students, 3% identify the overseas university

Overall, only 12% of respondents thought that no one should bear responsibility for paying to compensate for flights. The airline was deemed to have full or partial responsibility by half of respondents, while approximately a third (34%) indicated they themselves were fully or partially responsible. Only 17% of respondents felt the UK University was responsible in some way, while only 15% of respondents felt the airport should bear any responsibility.

In cases where respondents identified multiple stakeholders (27% of respondents), if it is assumed that responsibility is allocated equally between all stakeholders identified, then a first order estimate of the overall extent to which each stakeholder is considered responsible can be evaluated by determining an equivalent number of respondents attributing full responsibility to each stakeholder (Table 5.5). For example, 90 respondents attributed responsibility to the airline and one other stakeholder; in this case it is assumed the 90 respondents hold the airline 50% responsible, and the overall responsibility attributed to the airline is therefore 45 full respondent equivalents (FRE). The results indicate that overall, 36% (234 FRE) deemed the airlines to be responsible for compensation costs, followed by the respondents themselves (23%, 152 FRE), the UK University (10%, 69 FRE) and the airports (6%, 39 FRE).

With regard to similar studies, Gössling et al. (2009) asked Swedish travellers who they believed to be responsible for dealing with the environmental impacts of aviation, with respondents able to select multiple stakeholders. The study found that 32.9% of Swedish travellers attributed some responsibility for mitigation to themselves, a comparable figure to this study. However, respondents in the study by Gössling et al. (2009) put their own responsibility last after aircraft producers (65.8%), airlines (57.6%), government (50.8%) and intergovernmental organisations (44.1%). In a study by Hooper et al. (2008), passengers travelling through a UK airport were asked who they believed to be responsible for offsetting their flight, with respondents allowed to select one stakeholder. The study found that the majority of respondents attributed responsibility to government (41%) and the airlines (35%), followed by the individual passenger (15%) and airports (2%).

Reasons for attributing responsibility

In the associated comments (n=85), several themes emerged as reasons for attributing responsibility (Table 5.6). The themes ranged from attributing responsibility to the airline, as they directly profit from the flight, to attributing responsibility to the student because they are taking the decision to study abroad.

For those who identified only one stakeholder as being responsible, the primary reason given by respondents for attributing responsibility to the airline links to the argument that it is the airline that directly profits from the flight. Similarly, from a social, rather than an economic perspective, some respondents felt that they themselves are responsible given that they are the ones who directly benefit from overseas study. The fact that it is the students' decision to study abroad was another reason put forward as to why students should be responsible. However, when a period of study abroad is compulsory, respondents suggested that responsibility be attributed to the university. Four respondents felt that a stakeholder not presented in the options, the Government, should bear some responsibility for costs, given that they encourage overseas students to study in the UK.

Table 5.6. Themes regarding reasons for attributing responsibility

Responsibility for emissions	Themes	Typical comments
Airline	The airline directly profits from flights	"The airline company directly profits from me flying so they should pay"; "Airlines are making profits on their services; if those services happen to come with a carbon footprint it is the responsibility of the airline company to cover such costs"
Student	Study abroad benefits the student	"Since the study abroad program is to enhance an individual's degree then it is either for them to compensate"
	It is the students' decision to study abroad	"I would say myself because this is my choice that I made"; "I chose to study abroad in the first place so I should have to face the consequences…"
University	When study abroad is compulsory	"I think the most onus would be on the university as it is a compulsory part of my degree to study abroad"
	Students already pay high fees	"They can pay it. We have already paid so much money for fees"
Government	Encouraging students	"The government should pay part of it I think when considering they encourage the tourism industry and studying in the UK"
Shared responsibility	Responsibility shared among all who benefit	"I believe this cost should be shared between myself, the airline and the airport. These are the three subjects that wilfully decide to perform an action that has some benefit/profit to them, but results in climate change"; "Compensation payments should be shared between all who benefit from the flight"

Those who identified more than one stakeholder, thus adopting a shared responsibility approach (Lenzen et al., 2007), felt that the only fair way would be to share the burden of emissions and associated liability between all stakeholders who benefit from the flight. While 27% (180) of all respondents selected multiple stakeholders, only 3% (20) selected all the presented stakeholders. The results suggest a lack of awareness from some respondents of the role of the supply chain given that each of the stakeholders are intrinsically linked and all are supplying the demand for air travel:

> *It should be the airline as they are responsible for all hazardous emissions into the atmosphere and not the airport or university where I am studying.*

Moreover, no respondents referred to the university as providing a service, and as such, could be responsible for the negative environmental impacts resulting from students accessing that service.

A number of points emerged that were not related to attributing responsibility. Some respondents suggested that only those students who fly frequently should have to pay to offset:

> *It would be fairer that someone who travels very often ends up somehow "penalised" for travelling that much.*

Indeed, the previous chapter demonstrated that students' travel behaviour is varied and an argument could be made that the cost of climate change should be borne by those flying more frequently.

Some respondents suggested that any offset cost should be automatically incorporated into either the airfare or the tuition fees, particularly when the amounts relative to these costs are so small. Indeed, Mair (2011) suggests that offsetting must become mandatory or it will not be a viable mitigation method. Directly related to this, the final theme to emerge from the comments was that some respondents (n=7) felt no matter who they attributed responsibility to, the student would ultimately be the one to have to pay, either through increased airfares or increased tuition fees: "Whichever option I chose, I would end up paying the bill".

5.4.2 Willingness to pay for carbon offsets

This section explores respondents' WTP to offset the climate change impacts of their flights. Due to the range of offset costs associated with actual flight paths (see Table 5.3), to allow comparability it was useful to examine the proportion of the actual offset cost respondents would be willing to pay, and the maximum amount, irrespective of flight distance. Thus, this section first presents the results from both the WTP questions, followed by a comparison of both. Finally, an exploration of the relationships between potential influencing variables and willingness to pay is presented.

Willingness to pay question one: proportion of total offset cost

Respondents were asked what proportion of the total offset cost they would be willing to pay. Table 5.7 presents WTP broken down by type of student (inbound or outbound), Table 5.8 explores WTP amount (proportion), while Table 5.9 presents a cross tabulation of respondents' perceptions of responsibility and WTP amount (proportion). Of the 658 respondents, 66% (431) indicated they would be willing to pay either the full cost or a proportion of the cost to offset the emissions from their flight (Table 5.7).

Table 5.7. Willingness to pay by type of student (Question 1)

Type of student	Number of respondents	Not willing to pay	Willing to pay	Unsure
All respondents	**658**	**27%**	**66%**	**7%**
Inbound (all)	495	28%	64%	8%
Inbound (full degree)	*440*	*30%*	*64%*	*7%*
Inbound (visiting)	*55*	*20%*	*65%*	*15%*
Outbound (all)	163	24%	71%	6%
Outbound (1+ year)	*102*	*19%*	*77%*	*4%*
Outbound (<1 year)	*61*	*33%*	*59%*	*8%*

Table 5.8 shows that 92% (396) of all respondents stated they would be willing to pay either 25%, 50%, 75% or 100% of the total offset cost, 8% (33) stated 'other amount' with a range of 3% to 33%, while 0.5% (2) stated 'other amount', but did not specify an amount.

Of those students who were willing to pay, a Mann-Whitney U (MWU) test revealed no significant difference between inbound students studying for a full degree in the UK and inbound students visiting the UK, in terms of the proportion they were willing to pay (n=314[16], U=4,271.500, p=0.135; Table 5.8). Likewise, for outbound students, there was no significant difference between those studying abroad for one year or longer and those studying abroad for less than one year (n=115, U=1,293.500, p=0.406). On average, inbound students were willing to pay 63% of the actual offset cost, while outbound students were willing to pay 52%, where the difference was statistically different (n=429, U=20,919.000, p=0.008).

[16] Please note, two respondents indicated they were willing to pay but had not stated an amount

Table 5.8. Proportion of the total offset cost respondents were willing to pay

Type of student	Number of respondents willing to pay	WTP %						Ave. WTP %
		25%	50%	75%	100%	Other	Other - not stated	
All respondents	**431**	**36%**	**20%**	**3%**	**33%**	**8%**	**0%**	**55%**
Inbound (all)	316	37%	23%	3%	28%	9%	1%	52%†
Outbound (all)	115	33%	14%	3%	45%	5%	0%	63%

Note: † indicates a significant difference to outbound (all) (*p*=.008)

Focusing on perceptions of responsibility and WTP amount (Table 5.9), respondents were categorised according to who they considered responsible for compensating for the climate change impacts of their own air travel to and from the UK (inbound students) or study abroad destination (outbound students). Those respondents who identified no beneficiary as responsible were categorised as 'no one', while respondents who only identified beneficiaries other than themselves were classified as 'others only'. Those who identified themselves as responsible were categorised as either 'myself only' or 'myself and others'.

Table 5.9. Respondents' perception of responsibility and proportion willing to pay

Responsibility category	Number of respondents	% WTP							Ave. % WTP
		0%	25%	50%	75%	100%	Other	Unsure/ not stated	
No one	79	71%	10%	4%	0%	8%	1%	6%	13%
Others only	272	33%	28%	17%	0%	13%	3%	6%	30%[a]
Myself only	102	5%	27%	11%	2%	47%	5%	3%	63%[a b c]
Myself and others	125	2%	25%	14%	5%	37%	13%	5%	59%[a b c]
Unsure	80	33%	16%	13%	4%	8%	3%	25%	28%[a]

Note: (a) indicates a significant difference to 'no one' (*p*<.05); (b) indicates a significant difference to 'others only' (*p*<.001); (c) indicates a significant difference to 'unsure' (*p*<.001). No other significant differences were observed

Table 5.9 highlights that those who attributed some responsibility to themselves were likely to be willing to pay a higher proportion than those attributing responsibility to other beneficiaries only or no one. Indeed, respondents categorised as 'myself only' and 'myself and others' were willing to pay on average 63% and 59% respectively, where these were significantly different to respondents categorised as 'no one' (13%), 'others only' (30%) and 'unsure' (28%).

Willingness to pay question two: maximum amount

Respondents were asked the maximum amount they would be willing to pay to offset the climate change impacts of their flight. Table 5.10 presents WTP by type of student, Table 5.11 explores the maximum WTP amount, while Table 5.12 presents a cross tabulation of respondents' perceptions of responsibility and maximum WTP amount. Of the 658 respondents, 68% (447) indicated they would be willing to pay to offset the emissions from their flight (Table 5.10).

Table 5.10. Willingness to pay by type of student (Question 2)

Type of student	Number of respondents	Not willing to pay	Willing to pay	Unsure
All respondents	**658**	**27%**	**68%**	**5%**
Inbound (all)	495	29%	66%	5%
Inbound (full degree)	*440*	*30%*	*65%*	*6%*
Inbound (visiting)	*55*	*24%*	*75%*	*2%*
Outbound (all)	163	21%	75%	4%
Outbound (1+ year)	*102*	*17%*	*80%*	*3%*
Outbound (<1 year)	*61*	*30%*	*66%*	*5%*

Table 5.11 shows that 91% (407) of all respondents stated they would be willing to pay either a maximum of £5, £20 or £50, 6% (27) stated 'other amount' with a range of £1 to £100, while 3% (13) stated 'other amount', but did not specify an amount.

Of those students who were willing to pay, a MWU test revealed no significant difference between inbound students studying for a full degree in the UK and inbound students visiting the UK, in terms of the maximum amount they were willing to pay (n=317[17], U=4,770.000, p=0.126; Table 5.11). Likewise, for outbound students, there was no significant difference between those studying abroad for one year or longer and those studying abroad for less than one year (n=117[18], U=1,570.500, p=0.762). On average,

[17] Please note, eight respondents indicated they were willing to pay but had not stated an amount

[18] Please note, five respondents indicated they were willing to pay but had not stated an amount

inbound students were willing to pay a maximum of approximately £17 to offset the climate change impacts of their flights, while outbound students were willing to pay approximately £24, where the difference was statistically different (n=434, U=22,897.500, p<0.001).

Table 5.11. Maximum amount respondents were willing to pay by type of student

Type of student	Number of respondents willing to pay	Maximum amount willing to pay (£)					Ave. maximum amount willing to pay
		£5	£20	£50	Other	Other - not stated	
All respondents	447	37%	40%	15%	6%	3%	£18.67
Inbound (all)	325	40%	40%	11%	6%	2%	£16.61†
Outbound (all)	122	27%	39%	25%	5%	4%	£24.26

Note: †indicates a significant difference to outbound (all) students (p<.001)

Focusing on perceptions of responsibility and maximum WTP amount (Table 5.12), using the ranges and possible offsetting costs from the region in which they are from (or studying in) (see Table 5.3), respondents were categorised according to whether their maximum WTP amount was below, within, or above the given range. For example, one respondent indicated they would be willing to pay a maximum of £20, where this was above the range of offsetting costs for the region in which they were located (Europe, £1 - £5), thus they were categorised as 'above'.

Table 5.12. Respondents' perceptions of responsibility and maximum amount willing to pay

Responsibility category	Number of respondents	Maximum amount willing to pay					Ave. maximum amount willing to pay (£)
		Not willing to pay - £0	Below	In range	Above	Unsure/not stated	
No one	79	70%	10%	13%	4%	4%	£2.92
Others only	272	34%	21%	22%	19%	5%	£9.86
Myself only	102	5%	17%	21%	54%	4%	£21.28
Myself and others	125	2%	15%	25%	47%	10%	£22.38
Unsure	80	28%	15%	23%	18%	18%	£11.14

A chi-square test revealed a significant association between perception of responsibility and categorisation of maximum amount (n=658, X^2=201.835, p<0.001). Of those respondents who attributed responsibility to themselves and themselves and others, 75% and 72% respectively were willing to pay a maximum amount 'in range' or 'above' their actual offset cost. Less than half (41%) of respondents who attributed responsibility to others only, or were unsure, were willing to pay a maximum amount 'in range' or 'above' their actual offset cost.

Respondents who allocated responsibility to themselves and others and themselves only, were on average willing to pay the highest maximum amount, £22 and £21 respectively. Indeed, these respondents were significantly more likely to be willing to pay a higher maximum amount ('above') than those who deemed that no one or others only were responsible. Respondents who deemed no one to have responsibility were significantly more likely to be unwilling to pay.

Cross comparison of willingness to pay questions

A similar percentage of respondents reported that they were willing to pay to offset when the question was presented in terms of the proportion of the actual costs (66%) or in terms of the maximum amount (68%). These results are comparable to similar offsetting studies, where both Hooper et al. (2008) and Gössling et al. (2009) report 70% of respondents willing to pay to offset.

The results from both questions revealed that outbound students were willing to pay more than inbound students, which may reflect the relative wealth of outbound students compared to inbound students, and those respondents who attributed some degree of responsibility to themselves were more likely to be willing to pay a higher proportion/maximum amount. It is interesting to note that while only a third of respondents attributed full or partial responsibility for offsetting/compensation costs to themselves (Table 5.4), approximately two thirds were willing to pay. One possible explanation for this paradoxical result could be the relatively low cost of offsetting in comparison to the airfare. However, it is important to note that expressing a WTP may not necessarily translate into action.

To assess internal consistency, Table 5.13 presents a comparison of the respondents' WTP proportion to the maximum amount they were willing to pay. Of the 658 respondents' answers, 62 were found to be internally inconsistent, where they had indicated that they were not willing to pay in one of the questions and willing to pay in the other.

It is possible that some respondents misinterpreted WTP question 1, believing that it was asking them to state what percentage of the airfare cost they would be willing to pay. Of the 33 respondents who selected 'other percentage', 23 were willing to pay only 10% or less of the actual offset cost where for some respondents this equated to a WTP of less than £0.20. Furthermore, the average WTP percentage for those respondents who selected 'other percentage' in question 1 was 12.6%. Thus, for 15 (45%) of these respondents to then state a maximum amount above the actual range of offsetting costs for their region in question 2, compared to 30 (19%) of the 155 respondents who were willing to pay 25% of the cost, further suggests they may have misinterpreted the question 1. Therefore, if HEIs were to consider an offsetting/compensation scheme, actual costs (to the extent possible) should be presented to students, given that terminology such as 'percentages' and 'proportions' appears to have added confusion for some.

Table 5.13. Cross comparison of respondents' answers to WTP question 1 and 2

		Total respondents	WTP Question 2				
			Not willing to pay - £0	**Below**	**In range**	**Above**	**Unsure/ not stated**
WTP Question 1	**0%**	180	140	17	13	7	3
	25%	155	13	59	48	30	5
	50%	88	6	21	32	26	3
	75%	12	1	0	2	8	1
	100%	141	5	7	28	91	10
	Other %	33	0	6	7	15	5
	Unsure/not stated	49	12	3	9	5	20

Factors influencing willingness to pay

In order to determine the relationship between a number of potential influence factors (general characteristics, travel behaviour, perception of responsibility, and environmental attitudes) and the respondents' WTP to offset their flight emissions, a logistic regression was completed. The respondents' WTP was based on the results of both the WTP questions from Section 5.4.2. Due to the internal inconsistency within 62 respondents' answers to the WTP questions, three logistic regression models were completed where inconsistent responses were classified as willing to pay in model 1, not willing to pay in model 2, and unsure (and therefore excluded from the analysis) in model 3.

Table 5.14 presents the results of the three models, where each model was statistically significant ($p<0.001$) and correctly classified 82.3% of the cases (model 1), 76.5% of the cases (model 2) and 82.4% of the cases (model 3). Thus, the explanatory variables reliably distinguished between those willing and those not willing to pay across all the models.

Table 5.14. Logistic regression model results for the relationship between WTP and explanatory variables

Explanatory variable	Description	Model 1 - combined WTP (internally inconsistent = Yes)		Model 2 - combined WTP (internally inconsistent = No)		Model 3 - combined WTP (internally inconsistent = unsure)	
		OR	95% CI	OR	95% CI	OR	95% CI
Constant	-	1.94	-	1.02	-	1.35	
General characteristics							
Age	Linear scale (1 = 18-20; 2 = 21-24; 3 = 25-29; 4 = 30-40; 5 = 41-54; 6 = 55+)	0.65**	(0.49-0.86)	0.69**	(0.53-0.89)	0.62**	(0.46-0.83)
Gender	Dummy variable (1 = male)	0.56**	(0.35-0.89)	0.68*	(0.44-1.05)	0.56**	(0.34-0.92)
Level of study	Dummy variable (1 = respondent is a postgraduate)	1.04	(0.55-1.98)	0.93	(0.52-0.89)	1.00	(0.50-1.98)
Type of student	Dummy variable (1 = respondent is an outbound student)	1.65*	(0.91-3.00)	1.48	(0.88-2.52)	1.84*	(0.98-3.46)
Travel behaviour							
Number of additional flights	Linear scale (0-5 additional flights during the academic year)	1.07	(0.91-1.26)	1.01	(0.87-1.17)	1.08	(0.90-1.28)
Responsibility							
No one	Dummy variable (1 = respondent indicated that no one is responsible for emissions)	0.18***	(0.08-0.39)	0.22***	(0.10-0.49)	0.18***	(0.07-0.37)
Others only	Dummy variable (1 = respondent indicated that someone else holds responsibility for emissions - e.g. airline, university, airport)	1.24	(0.66-2.36)	1.22	(0.68-2.20)	1.26	(0.65-2.48)
Myself only	Dummy variable (1 = respondent indicated that they alone are responsible for emissions)	16.58***	(4.50-61.04)	17.99***	(6.23-51.98)	22.02***	(5.87-82.63)
Myself and others	Dummy variable (1 = respondent indicated that they themselves and another beneficiary are responsible for emissions)	49.35***	(6.31-386.28)	48.24***	(10.73-216.97)	63.27***	(8.01-500.05)
Environmental attitudes							
Importance of reducing own carbon footprint	Linear scale (5 point; 1 = not at all important; 5 = very important)	1.39**	(1.07-1.79)	1.10	(0.87-1.40)	1.34**	(1.02-1.77)
Consideration of climate change as a problem	Linear scale (5 point; 1 = not at all a problem; 5 = very serious problem)	1.03	(0.80-1.32)	1.22	(0.98-1.55)	1.11	(0.84-1.47)
N		599		599		545	
Log-likelihood		459.12		527.62		407.70	
X^2 (d.f.)		194.64 (11)***		228.29 (11)***		215.46 (11)***	
Pseudo R-squared		0.28		0.32		0.33	

Note. OR, odds ratio; CI, confidence interval. *p <0.1; **p <0.05; *** p <0.001.

With respect to the general characteristics, gender and age were found to affect the likelihood of WTP to offset across all three models, with females more likely to be willing to offset than males, and younger respondents more likely than older respondents, in agreement with findings from MacKerron et al. (2009) and Lu and Shon (2012). With regard to travel behaviour, there was no association between WTP and flight frequency.

The results suggest that respondents' perception of who has responsibility for the emissions has the greatest influence on WTP with those respondents who perceived themselves, or themselves and others as responsible for the emissions significantly more likely to be willing to pay. Conversely, those respondents who stated no one should be responsible were significantly less likely to be willing to pay. Those who attributed responsibility to someone else occupied a middle ground, being neither more nor less likely to be willing to pay.

With respect to environmental attitudes and WTP, students were asked two questions regarding the importance placed on reducing their own carbon footprint, and consideration of climate change as a problem. The results show that consideration of climate change as a problem is not a predictor of WTP. The importance students placed on reducing their own carbon footprint and WTP was significant and positive in model 1 and model 3, indicating that the more a student is concerned about their personal carbon footprint, the more likely they are to be willing to pay to offset emissions. While only a small percentage of pro-environmental behaviour can be directly attributed to environmental attitudes (Kollmuss and Agyeman, 2002), the findings associating increased environmental concerns with increasing likelihood of WTP corresponds to similar studies examining WTP for carbon offsets (Brouwer et al., 2008; Hooper et al., 2008; MacKerron et al., 2009). The carbon footprint variable was found to not affect the likelihood of WTP in model 2. Indeed, further analysis found that internally inconsistent respondents place a level of importance to reducing their carbon footprint (3.8) similar to those who were willing to pay in both questions (3.7). Thus, when internally inconsistent respondents were included in the not willing to pay group, it distorted and raised the average of this group making it no longer significantly different to respondents who were willing to pay.

Reasons for respondents being unwilling to pay

Of those who were unwilling to pay, 15 provided some explanatory comment. Examination of these comments provided some insights as to reasons for an unwillingness to pay. The first reason links to a lack of trust in where the money is going, indeed one respondent stated:

> *I think the carbon offset model is great. But I have never paid - always switched off the option to do so. Why? Because I do not trust these companies with my money.*

While another respondent stated, “I can't imagine the money being put to any real use”. That said, three respondents suggested that as long as there was transparency and they knew the money was going where to it was supposed to go, they would be more willing to pay.

Some respondents perceived offsetting to be an unviable solution in that it does not tackle the root cause of the problem - reducing consumption of air travel. However, given that students appear to be less willing to reduce air travel consumption in comparison to other behavioural changes (see Section 5.3.2, Figure 5.3), offsetting is the only remaining option (a point which does not seem to have been recognised here). Finally, some respondents raised the issue of fairness, arguing that only those who are frequent flyers should have to pay. In addition, some felt it was unfair to penalise those who rely heavily on air travel e.g. those living on small isolated island states:

> *Why should travellers from island countries be penalised for using airlines? This is not the same issue as choosing to use a car inland as other modes of transport are available, such as public transport.*

5.5 Compensating for student air travel emissions

As an alternative to conventional carbon offsets (which have a number of criticisms – see Chapter 2, Section 2.4.6), HEIs can look to fund a carbon compensation scheme, i.e. actions to compensate for student air travel emissions. In order to evaluate student preferences for alternative carbon compensation schemes, respondents were presented with list of different types of projects that a university could fund or invest in (see Appendix 4) and asked to indicate their level of support or opposition to each (Table 5.15).

Overall respondents indicated a preference for investment in carbon reduction projects either on campus or in the local community, with 86% and 84% supporting or strongly supporting these options respectively. This suggests a preference for schemes that provide quantifiable reductions in the locality of the HEI, rather than those where the impact of the scheme is difficult, if not impossible, to quantify. That said, the proportion of respondents opposing/strongly opposing any of the schemes is low (between 2.5% and 8.4%). Purchasing carbon offsets from a conventional offset provider had more support from outbound students than the two schemes that would see the university fund an educational charity overseas or provide grants for students to come to the UK to attend a sustainability related course. For inbound students, providing a grant for a student to attend a course in the UK received more support than offsetting.

Table 5.15. Respondents' support/opposition for alternative carbon compensation schemes

[redacted]

In the associated comments (n=6), some respondents suggested the university use the money to fund research on clean energy solutions, while one respondent spoke of the importance of ensuring the chosen project was fully supported:

> *The most important thing would be the rigour and importance attached to the projects. If the free online course was actually considered and planned as a proper course, or if the local community projects were taken seriously, that would be good. I would be concerned that projects like this are often quite flippant, making them either under-resourced or relatively pointless.*

Given that only a small proportion of respondents oppose or strongly oppose each of the schemes, suggests that any of them could be deemed acceptable/unlikely to be opposed. Nevertheless, respondents indicated a preference for schemes with quantifiable reductions. However, for the amount of money involved, any investment in carbon reduction projects on campus or in the local community (the most popular approaches) would be unlikely to deliver significant reductions. Indeed, the cost to offset the HE sector's student air travel emissions in 2013/14 is approximately £12 million[19], 0.33% of the £3.6 billion total capital expenditure (HESA, 2015e) in the same year. Moreover, the relative impact of money spent in developing countries would be greater compared to the same amount invested in the UK, a point that does not feature in student responses.

5.6 Students' attitudes towards overseas study air travel

Respondents had the opportunity at the end of the survey to provide any additional comments regarding the impact of overseas study and air travel's impact on climate change. Table 5.16 reports the main themes to emerge from the analysis of the comments (n=146).

[19] Based on the total inbound and outbound student air travel emissions in 2013/14, calculated in Chapter 4, Section 4.5 and a figure of £7.50 per t/CO_2e (www.climatecare.org).

Table 5.16. Emergent themes from analysis of the final open comments

Domain	Theme	Sub-themes
Air travel	Focus on other sources of emissions/environmental problems before air travel	Mitigation efforts should focus on other larger sources
		There are more significant environmental problems to focus on first
		Air travel accounts for a small fraction of global emissions
	Own 'sacrifice' has no value	Flight scheduled anyway
		Any change needs to happen at a global level
	Socio-economic benefits outweigh environmental costs	Air travel is crucial to the UK economy
		Stronger ties between countries
	Unaware of environmental impacts of air travel	Little information
		Never thought about this before
	Lack of understanding of the relative impact of air travel	Small changes in other areas of daily life can offset any air travel
Educational air travel	Socio-economic benefits outweigh environmental costs	International students contribute to the UK economy
		International travel important to foster collaboration
		Promotes students' personal development
	Socio-economic benefits versus environmental costs dilemma	Does study abroad contribute enough to personal development to justify emissions?
		Study abroad is a great opportunity yet has significant environmental impacts
		Unavoidable for PhD students
	Students account for a small proportion of air passengers	Minor issue as students are a small percentage of air customers
		Efforts should focus on reducing business and leisure air travel first
	Environmental costs outweigh socio-economic benefits	Unjustifiable mode of transport
		Do people need to study abroad?
Mitigation	Consider alternative modes of transport	Universities should encourage alternative travel arrangements
		European students should consider using trains
		Reduce rail prices
	Education	Education can have a significant impact
		Educate air travel passengers on the flight
	Reduce	Reduce frequency of flights during the year
		Stay at destination for longer periods of time instead of numerous short trips

The results suggest a general awareness of aviation's impact on climate change (only four respondents indicated they were unaware of the environmental implications of air travel) and a general concern, but limited behavioural response. This corresponds to the results from Section 5.3, whereby students were already making, or demonstrated a willingness to make small adjustments to reduce their personal carbon footprint but were less willing to commit to taking fewer overseas trips, consistent with findings from McKercher et al. (2010). Therefore, there is an attitude-behaviour gap in relation to air travel consumption (Becken, 2007; Higham and Cohen, 2011).

No general theory can adequately explain the attitude-behaviour gap (Stern, 2000), possibly because the reasons are manifold and highly contextualised (McKercher et al., 2010). This lies at the heart of the challenge of addressing the climate threat. However, people tend to alleviate the inconsistencies between attitude and behaviour through denial, as one of a number of possible defence mechanisms (Becken, 2007). Indeed, a number of respondents felt that their own 'sacrifice' (reducing personal air travel consumption), would have no value unless followed by others:

> *…any change needs to be done on a world level. me [sic] changing just affects me everyone else keeps having nice holidays.*
>
> *I don't think refraining from travelling overseas would make a big impact: aircraft would still be flying regardless.*
>
> *…the flight would have been scheduled long before I would have decided to book it and would have flown from the UK to that location with or without me as a passenger…*

However, there were 436,880 international students studying in the UK in 2014/15 (HESA, 2015a), using the revised estimates for flight frequency for European and non-European nationals (see Chapter 4, Section 4.2), this equates to approximately two million individual journeys per year. If visiting, friends and relatives (VFR) are included, this equates to approximately 3.7 million individual journeys. That is 26 flights per day supported by international students and their VFR (based on a Boeing 777 with a 396 seat configuration;

Boeing, 2016). Thus, these respondents fail to consider their role in creating demand for flights and the feeling of insignificance can be viewed as an additional denial mechanism.

Some (clearly well informed) respondents felt that because aviation accounts for a relatively small proportion of anthropogenic emissions at a global level, we should be focusing efforts on other large sources, particularly road transport, shipping and energy generation:

> *Air travel produces approximately 5% of human CO_2 emissions as opposed to the approximately 40% which is produced road transportation. Reducing use of and making road transportation more efficient would have a greater impact than focusing on air travel.*

While these respondents are correct in stating that aviation is a smaller contributor to global emissions than road transport, this neglects the fact that aviation is the fastest growing source of emissions globally and a mode of transport where no significant technological advancements are on the horizon. Moreover, this comparison does not hold for an individual who engages in flying, particularly for those who fly frequently. Some respondents demonstrated this lack of understanding of the relative impact of air travel at an individual level, with one student stating:

> *I would imagine that the fact that I don't drive and very rarely use taxis (I cycle and walk by preference, and use public transport when necessary) outweighs the fact that I fly relatively frequently (in 2014 I took a total of 7 short-haul flights).*

However, comparing the total annual emissions for the average UK car with seven short-haul flights reveals that the respondent's emissions are 42% higher[20]. Thus, these everyday behavioural changes do not achieve carbon savings of the magnitude required to 'compensate' for air travel emissions. This corresponds to findings from Randles and Mander (2009) in their study exploring frequent flyers' attitudes towards aviation

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[20] The total GHG emissions for the average UK petrol car, driving the average number of miles in a year (7,900 – DfT, 2015) is 2.01 tCO_2e. The total emissions for seven short-haul flights (2454km return - DEFRA/DECC, 2014a), assuming an economy class ticket, is 2.86 tCO_2e.

consumption and climate change. They note that interviewees in their study offered "…very broad and often disconnected activities […] to provide general 'compensation' to society and the atmosphere for flying trips taken" (Randles and Mander, 2009: 110). However, the activities presented by the interviewees bore little resemblance to the emissions associated with flying, for example, cycling to work and recycling (Randles and Mander, 2009). This links to the theme on education, with some respondents in this study (n=9) suggesting more information and awareness of the impact of air travel on the environment would result in students changing behaviour, e.g. reducing flight frequency or seeking alternative modes of transport.

Some respondents did recognise the significant impact of air travel on their individual carbon footprint, highlighting the disparity in level of understanding among students:

> *[Air travel] is becoming an increasingly unjustifiable mode of transport in my opinion. Discovering that a family who endeavoured to reduce their carbon footprint would blow their carbon 'budget' for three years on one return flight from the UK to Brittany really opened my eyes to the enormous outlay air travel causes.*

Others suggested that any focus on air travel passengers should target business and leisure passengers before students:

> *Surely this is a minor issue? Students must be a mere fraction of the % of air-customers?*

> *I don't see overseas student as a major cause of climate change. Travel attached to UK related business and tourism is certainly far greater contributing factor.*

Some stated that the socio-economic benefits of air travel/educational air travel outweigh the environmental costs, thus was too important to be restricted. Responses included:

> *The ability to travel is an exciting opportunity that can positively affect life experiences, not only in the job market, but in terms of character building advantages of long distance travel for personal development and stronger ties between countries are way more important than the CO_2 emitted by the plane.*

I am very in favour of overseas study; it has some negative impact on climate change (in particular if flying) but huge positive social benefits.

Others found the Conflict problematic and were caught in the environmental costs versus socio-economic benefits dilemma:

I feel it is a difficult issue to consider. It can be argued that study abroad is necessary to inspire minds and cultivate understanding of ecological and environmental issues and without this, we would be unable to address climatic issues. However, at the same time, does studying abroad contribute enough to that development of new minds and skills to validate the pollution and consumption of fuel.

I am aware of the damage it causes but I am also aware of the great knowledge and experience gained from travelling. Swings and roundabouts.

I'm conflicted because studying abroad is such a great opportunity but air travel is so bad for the environment.

…it's a difficult one for me, I love to travel and yet understand it has negative environmental impacts.

5.7 Discussion and conclusions

The results of the survey show how multi-dimensional and contested the acceptability of air travel has become, in the context of climate change. While the results indicate increasing awareness of the impact of air travel on global climate change (the flyers' dilemma), this is coupled with an apparent reluctance to reduce personal levels of air travel consumption (as found by, Becken, 2007; Hares et al., 2010; McKercher et al., 2010; Higham and Cohen, 2011; Higham et al., 2014). This highlights the point that far fewer people appear willing to make profound changes to their lifestyle, with students more willing to make smaller, everyday changes as shown in the results of Section 5.3.2 (McKercher et al., 2010). Therefore, there is an attitude-behaviour gap in relation to air travel consumption (Becken, 2007; Higham and Cohen, 2011) in that the majority of students know the environmental impacts associated with air travel, but this does not induce behavioural changes. Other studies have shown this is also the case for the general population (Barr et al., 2010). People try to seek consistency between attitudes and behaviour and when there is inconsistency, either attitudes or behaviour must change to eliminate the dissonance (Festinger, 1957).

People often look to alleviate inconsistencies between attitude and behaviour through denial, as one of a number of possible defence mechanisms (Becken, 2007). Students in this study demonstrated denial by highlighting aviation as a small source of emissions, by noting sources of emissions perceived to be of greater concern, by highlighting that the benefits of air travel outweigh the costs and by alluding to 'compensatory actions' in other areas of their lives. Becken (2007) states that denial can also be at a collective level, rather than an individual level, with Shaw and Thomas (2006: 213) suggesting that:

> *…air travel is a very good example of the 'tragedy of the commons'; i.e. [respondents] believe that their own 'sacrifice' (reducing personal benefits for the greater good) on behalf of the environment would have no value unless followed by others*.

Indeed, some respondents believed that their individual decision to not travel by air would have no impact on emissions, as the flight would be departing anyway.

Furthermore, several barriers to mitigating student air travel emissions were identified. Firstly, this study adds additional evidence to the point that air travel consumption is deeply embedded in some societies (see also, Becken, 2007; Higham et al., 2014) or as Shaw and Thomas (2006) suggest, air travel is considered a 'right'. Secondly, there are push and pull factors (Table 5.2) with regard to UK HE that act as a barrier to reducing air travel for educational purposes such as, specific courses that are only offered in the UK and the perceived quality of UK HE. Moreover, while alternative methods of delivering UK HE have the potential to avoid and reduce air travel, it is likely substantial emissions will remain as the majority of respondents felt living and studying in the UK was just as important as getting a degree awarded by a UK HEI. Finally, as identified by Hares et al.

(2010), for many students air travel it is the only viable mode of transport, especially for those students from island nations. Thus, the reality is that voluntary reduction in air travel consumption is unlikely to happen and would not be a successful option in reducing the carbon consequences of the UK HE sector's internationalisation agenda. At the moment, there are no incentives for students to curtail air travel consumption and HEIs should consider schemes that incentivise staying in the UK during holiday periods e.g. provide free accommodation, provide tours and activities, or integrate students with host families. However, as noted in Chapter 4, if HEIs took action to encourage fewer student flights, a behavioural rebound-type effect might occur, where the number of VFR flights increases to maintain a similar degree of student-VFR contact.

The results of this chapter suggests that, (a) there is not enough information available for students regarding aviation's impact on climate change and (b) some students thought they were well informed but actually do not understand the relative impact of aviation. HEIs should educate their students and increase general information about the climate change implications of air travel in comparison to other forms of transport. Indeed, the less information that people have, the more likely that they are to act in their own self-interest (McKercher et al., 2010).

Given the general reluctance to curtail air travel consumption, carbon offsetting and/or compensation takes on greater importance. In terms of attributing responsibility for these costs, the airline was deemed to be most responsible followed by the students. A low percentage of respondents selected the HEIs and airports suggesting a lack of awareness of the role of the supply chain and the role of HEIs in creating demand.

Mair (2011) suggests that offsetting must become mandatory or it will not be a viable mitigation method. Furthermore, in line with some of the respondents' comments, Mair (2011) suggests building in the price of the offset in the ticket price, or in the case of HEIs, the tuition fee. The results of the survey suggest the majority of students would accept an additional cost with a small minority potentially resistant. While around 27% of students were not willing to pay, a number of themes emerged to suggest it was the principles of carbon offsetting, rather than the practicalities (Hooper et al., 2008) (i.e. cost) which acted as a barrier. Some students adopted a defensive position, arguing that offsetting does not address the root cause of the problem. However, there is an apparent reluctance to avoid or reduce air travel consumption, leaving offsetting/compensation as the only remaining options. To overcome potential resistance to a compulsory cost, HEIs need to be transparent about where the money is going if they are to administer such schemes themselves. Higham and Cohen (2011) state that a lack of information poses a barrier to the uptake of offsetting and some respondents indicated that they were not willing to pay as they lacked trust in where the money was going. In terms of the type of scheme, while local projects are more visible and transparent, overseas projects would be more impactful and HEIs could consider such schemes as part of their internationalisation strategy. The HE sector as whole could also explore the possibility of a sector-wide offset/compensation scheme.

5.8 Chapter summary

This chapter sought to assess students' perceptions of responsibility (Objective 3, RQ6) and attitudes towards mitigation and compensation activities (Objective 3, RQ7). The findings of this chapter show how multi-dimensional and contested air travel has become in the context of the climate threat. Despite high levels of awareness of the environmental impacts of air travel, there is an apparent unwillingness to reduce personal levels of air travel consumption. Furthermore, the alternative methods of delivering the HE experience are not fully substitutable for studying for a full degree in the UK. Thus, offsetting and compensation takes on greater importance. In terms attributing responsibility for these costs, the airline was deemed most responsible followed by the student, the university and the airport. Of the respondents, 16% felt they themselves were solely responsible, while 19% felt they themselves were responsible along with other stakeholders. That said, over two thirds of respondents indicated a WTP to offset or compensate, perhaps attributed to the low-cost in comparison to the airfare. If HEIs were to incorporate a flat rate compensation charge in tuition fees, given the low cost it is likely that the great majority of students would accept it and it would not influence their decision to study at the university. The next chapter moves to the QUAL-quan strand of the study in appraising institutional awareness and response to the Conflict.

Chapter 6. In-depth Case Studies

6.1 Chapter outline

This chapter presents the results of the case studies, critically appraising institutional awareness of and willingness to engage with the Conflict (Objective 2 - RQ3, RQ4 and RQ5); assessing perceptions of responsibility for student flight emissions (Objective 3, RQ6); and evaluating preferences for potential mitigation and compensation options (Objective 3, RQ7). Section 6.2 outlines the case selection process. Sections 6.3 - 6.6 report the results of the four in-depth case studies, while Section 6.7 presents the cross-case analysis.

6.2 Case study selection and presentation

6.2.1 Selection of case studies

This study opted for a multiple-case design and the potential case study higher education institutions (HEIs) were selected on the basis of maximising the diversity of the sample across a range of variables relevant to the research (see Chapter 3, Section 3.5.2). These included international student numbers and carbon emissions, as well as defining characteristics (student numbers [taught and research], total income, research income and research student numbers) (Coyne, 1997). Secondary data for 150 HEIs in the UK was retrieved from the Higher Education Statistics Agency (HESA) for the year 2012/13 (HESA, 2014b; HESA, 2015a) (see Appendix 10). Due to the large number of HEIs and variables, the dataset was analysed using principal component analysis (PCA) in IBM SPSS version 21 (IBM, 2016). PCA is a variable reduction procedure, producing a smaller number of principal components (PCs) that account for most of the variance in the original variables (Jolliffe, 1990; Suhr, 2005). Thus, PCA helped to identify which of the original variables accounted for differences between HEIs.

All variables were normalised to academic staff numbers, e.g. international students/staff, carbon emissions/staff, research income/staff, to ensure that the variables had similar variances. If one or two variables have very large variance, PCA, which maximises variance, will load on the large variances (Jolliffe, 1990). The appropriateness of the original variables for PCA was then examined. Several criteria for the factorability of correlation were used (Costello and Osborne, 2005; Williams et al., 2012). Firstly, the Kaiser-Meyer-Olkin test measured the sampling adequacy of the data and a result of 0.604 satisfied the minimum requirement for use of PCA (Williams et al., 2012). Secondly, Bartlett's test of sphericity, which tests for equality of variances across the groups of data, was significant ($X^2 = 308.513$, $p < .001$). Finally, the communalities were all above 0.5, confirming that each of the variables shared some common correlation with other variables (Costello and Osborne, 2005; Williams et al., 2012). Given the results of these tests, the data was deemed suitable for PCA.

Principal components were retained with an eigenvalue greater than, or approximately equal to 1, and variable loadings (the correlation between a variable and a component) were deemed significant if greater than 0.6 (Kaiser, 1960; Costello and Osborne, 2005). Two components were retained, accounting for 69.2% of the total variance explained by the model. A scree plot, which presents the eigenvalues graphically and can be used to visually determine where the smooth decrease of eigenvalues appears to level off (Costello and Osborne, 2005), provided further confirmation that two components should be retained.

The first component, explaining 35.5% of the variance, included three variables; income, the number of international students and carbon emissions (Table 6.1). Component 2 included the remaining three variables; research income, the number of students and the number of research students. This component accounted for a further 33.8% of the variance.

Table 6.1. PCA results based on six HE sector variables (n=150)

	Component 1	Component 2
Component 1: Income, international students and carbon		
Income	0.868	
Number of international students	0.740	
Carbon emissions	0.699	
Component 2: Research and teaching intensity		
Research income		0.901
Number of students		-0.787
Number of research students		0.681
Eigenvalue	2.13	2.03
Variance (%)	35.46	33.78
Cumulative variance (%)	35.46	69.24

Note: Each variable standardised to staff numbers

Where possible, cases were identified in pairs, with each situated in the same geographical region (to normalise for local factors); both affiliated to contrasting mission groups; and contrasting based on the component matrix. Thirty HEIs formed a provisional list of potential case studies and an extended analysis of the potential cases sought to ensure diversity across the following additional factors that were not included in the PCA:

- **Type of campus:** either single campus, multi-site campus or non-campus.
- **Campus location:** either city or countryside campus, or both if multisite.
- **Transnational education (TNE) provision:** number of TNE students expressed as a percentage of students studying in the UK. Form of TNE delivery, such as branch campuses and franchising agreements.
- **People and Planet University League (PPUL):** position of the university.

Following this extended analysis, (see Appendix 11) six potential cases (three pairs) were selected and invited to participate in the study. However, two of the HEIs (one pair) declined the invitation to participate, thus four in-depth cases are presented. Figure 6.1 presents the selected case study HEIs on a component matrix based upon their score on PC1 and PC2, categorised by mission group. Table 6.2 presents summary information for the HEIs including degree of internationalisation and engagement with carbon management (for details on internationalisation and carbon management ratings please see Chapter 3, Section 3.5.6). Each of the case study HEIs was given a pseudonym to preserve anonymity.

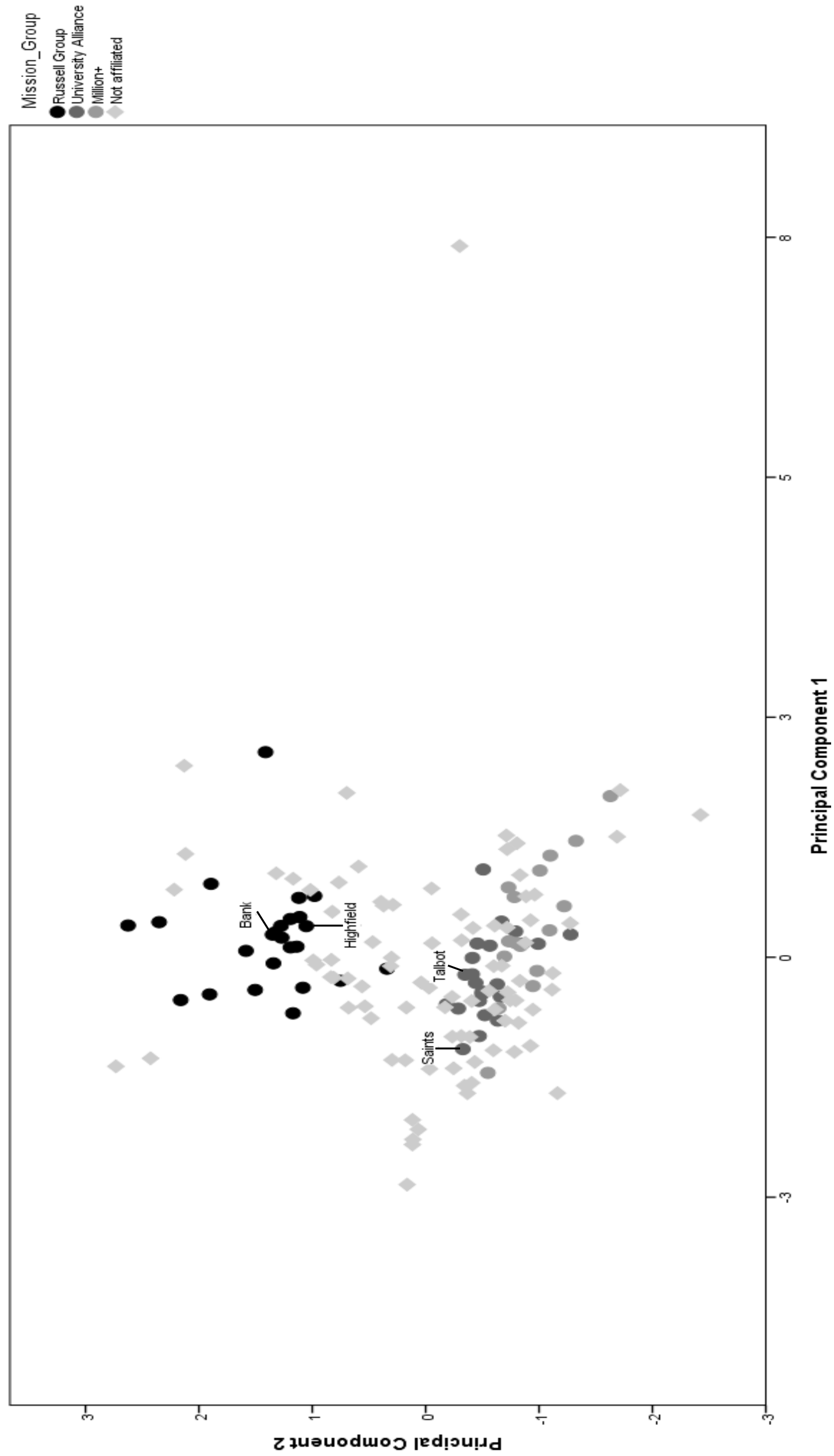

Figure 6.1. Component matrix with case study HEIs identified

Table 6.2. Summary information for the selected case study HEIs (see Chapter 3, Section 3.5.6 for details on ratings methodology; HESA, 2014b; HESA, 2015a; HESA, 2015c)

University	Data source reference	Mission Group	Degree of internationalisation		Carbon management		
			International student numbers	TNE student numbers	Emissions per student (tCO_2e)	Carbon assessment classification	Scope 1 and 2 emissions reduction progress (2005/06-2013/14)
Saints University (SU)	**A**	University Alliance	Low	Medium	0.5	1st	Strong
Bank University (BU)	**B**	Russell Group	High	High	2.0	2:2	Weak
Talbot University (TU)	**C**	University Alliance	Medium	High	0.6	1st	Strong
Highfield University (HU)	**D**	Russell Group	Medium	High	1.9	2:2	Weak

6.2.2 Case study presentation

Each case study follows a consistent format. Section one provides information on the documents used in the content analysis and the interviewees from the HEI. Section two provides context to the HEI, while section three explores engagement with the internationalisation agenda. Section four focuses on carbon management, presenting the results of the carbon assessment (see Chapter 3, Section 3.5.6), including carbon reduction progress and engagement with Scope 3 emissions, and an evaluation of the current and potential future emissions arising from inbound student air travel. The fifth section then considers institutional awareness and engagement with the Conflict, perceptions of responsibility for student flight emissions, and preferences for potential mitigation options.

6.3 Saints University case study

6.3.1 Data sources and interviewees

The document search strategy identified 20 documents (Table 6.3). In addition, two face-to-face interviews with the Deputy Vice Chancellor for student success and Head of Environmental Sustainability provided insight into the internationalisation agenda and current and future response to the Conflict between the internationalisation and carbon management agendas.

Table 6.3. Data sources for SU case study

Code	Documents/interviewees	Date
A01	Carbon management plan	2006
A02	Corporate strategy	2012-2017
A03	Environmental sustainability policy	2014
A04	Annual sustainability statement	2008/2009
A05	Annual sustainability statement	2009/2010
A06	Annual sustainability statement	2010/2011
A07	Annual sustainability statement	2011/2012
A08	Annual sustainability statement	2012/2013
A09	Financial statement	2014
A10	Internationalisation strategy	2014-2025
A11	Report on carbon management plan	2011
A12	Boardroom meeting notes	2014
A13	Boardroom meeting notes	2013
A14	Environmental sustainability policy	2010
A15	Environmental strategy	2008
A16	Internationalisation strategy	2013-2017
A17	Travel plan	2000
A18	Travel plan	2013
A19	Annual sustainability statement	2013/2014
A20	Scope 3 addendum to carbon management plan	2013
RA1	Interview with Head of Environmental Sustainability	Apr-15
RA2	Interview with Deputy Vice Chancellor	Apr-15

6.3.2 Saints University context

SU is located in the same geographical region as BU. With origins dating back to the first half of the 19th century, SU was one of a number of polytechnics granted university status in 1992, and is a member of the University Alliance mission group (University Alliance, 2016).

With respect to the estate, SU completed a campus consolidation programme in 2015, investing in a number of new buildings, and reducing the number of sites from which it operates from seven to two (A02; RA2). SU is one of the largest UK HEIs by gross internal area (GIA; HESA 2014b). The University has more than 2,200 academic staff and 30,000 students, although student numbers decreased by 6.3% between 2008/09 and 2013/14 (HESA, 2015b; HESA, 2015d).

The University is in a strong financial position, based largely on undergraduate recruitment with tuition fees accounting for approximately 70.7% of total income in 2013/14 (A09). Funding council grants accounted for 19.6% of income, while research grants and contracts accounted for just 1.6% (A09).

The University rose 20 places between 2010 and 2016 in the Guardian university league table, but remains in the bottom half (Guardian, 2016). In terms of research, the University has 0.2 research students per academic staff member (HESA 2014b; HESA, 2015d) and in the latest Research Excellence Framework (REF), ranked in the top 70 for both research quality and power (THE, 2014). SU's overall ambition is to be a top 50 research university (A02).

6.3.3 Internationalisation (Low/Medium)

International students accounted for 6.8% (Low) of the total student population at SU in 2013/14, which is significantly below the sector average (20.3%) (HESA, 2015a; HESA, 2015b). The University has recently reviewed its internationalisation strategy (A16). The strategy embeds itself within the strategic vision of the University and focuses on five key areas; TNE, research and knowledge exchange, student experience, international student recruitment and staff experience. The core of the strategy is the establishment of partnerships, which begin with one strand, for example TNE, then expand into a hub for student recruitment, study abroad, and research and knowledge exchange (A10).

One of the main drivers for the development of the internationalisation strategy is to increase the University's overseas brand. SU recognises that there is significant scope for international growth and the development of the institution's profile overseas (A10). A more visible profile overseas is fundamental to attracting international students and staff, to increase international research collaborations and to access international sources of funding (A10). Moreover, internationalisation is viewed as a fundamental contributor to the University's goal of achieving a place amongst the UK's top 50 universities (A10).

Although the internationalisation strategy focuses on a number of areas, international student recruitment is a central theme with the University setting a target to increase overseas fee-paying student numbers (non-EU) to 12% of the student population by

2024/25, from a baseline of 4% in 2013/14 (A10). This is certainly the most ambitious target within the internationalisation strategy, particularly when international student recruitment had not been as strong as expected for the academic year 2014/15 (A12).

In terms of SU's engagement with TNE provision, it has a number of validation, franchising and joint delivery agreements with partner institutions in 17 countries around the world. However, the number of TNE students expressed as a percentage of students studying in the UK in 2013/14 was 4% (Medium), significantly below the sector average (10.8%) (HESA, 2015c). The University has a target to increase the number of students registered on its degrees overseas by approximately 13% by 2025 (A10).

Recruitment of international students and study abroad schemes

Table 6.4 presents the themes that emerged from the analysis of the documents and interviews, regarding the drivers and motivations for international student recruitment and study abroad.

Table 6.4. Drivers and motivations for recruitment of international students and study abroad schemes at SU (A10; A16; RA2)

Drivers and motivations identified	Documentation	Interviews
Financial	Income generation	Income diversification
	Income diversification	Local economy
	Reduce dependency on 'home' undergraduates	
Student experience and employability	Promote global citizenship	Promote global citizenship
	Compete in global labour market	Compete in global labour market
	Global experiences and perspectives	Stimulate regional change
	Operate in diverse cultures	
	Global network of contacts	
Brand awareness	Raise the profile of University abroad	Raise the profile of University abroad
	Ambassadors for the University	Ambassadors for the University

The recruitment of international students to increase financial resilience through income diversification is a significant motivation for SU, given that it has a high reliance on home undergraduate students (A09; A10). Indeed, RA2 asserted that due to Government policy changes, income diversification is now more important than ever. In 2013/14, non-EU students accounted for just 5% of total income (C10).

The documentation underlines the importance of international students acting as ambassadors for the University thus contributing to the development of the University's profile overseas (A10). A further motivation for international student recruitment and study abroad is to enhance home student experience and employability. The University recognises the need for home students to have the skills and knowledge to be able to compete and succeed in the global labour market and operate effectively in diverse cultures (A10).

A further motivation for increasing study abroad numbers is to expose outbound students to new/other ideas, and thereby stimulate positive changes for the local economy. This demonstrates that although SU aspires to greater internationalisation it remains committed to the local region. This is especially important for SU as a high percentage of students come from and return to the same region in which the institution is located. RA2 sums up this argument for study abroad:

> *…if you are getting people from the region who have never been out of the region just going straight back into the region you don't get any new ideas, you don't get anything that will stimulate the massive change as a region, we need (RA2).*

6.3.4 Carbon management (1st/Strong)

Carbon assessment

The results of the carbon assessment are presented in Table 6.5, where overall engagement with carbon management achieves a 'First' rating, with reduction progress rated as 'strong'.

Table 6.5. Carbon assessment results for SU

Category	Description	Score (%)
Environmental policy		
	Publicly available environmental policy	10/10
Leadership commitments		
	Carbon management a part of the corporate strategy	2.5/2.5
	Endorsement from executive leadership	2.5/2.5
Governance		
	The establishment of an environment (sustainability) team	10/10
Planning		
	Carbon reduction target (Scope 1 and 2)	10/10
	Interim target	5/5
	Access to funding	5/5
	Carbon management projects outlined to meet target	5/10
Reduction progress		
	Percentage reduction	16/20
Scope 3 emissions		
	Submitted Scope 3 data to EMR reporting system	6/6
	Scope 3 emissions included in the carbon management plan	8/9
	Initiatives to reduce the Scope 3 footprint	5/5
Monitoring and reporting		
	Annual monitoring of emissions	2.5/2.5
	Publicly available annual progress report	2.5/2.5
TOTAL		**90% (1st)**

Drivers and motivations for carbon management

Table 6.6 presents the themes that emerged from the analysis of the documents and interviews, regarding the drivers and motivations for carbon management at SU. Reputation and sector leadership in carbon management is a significant motivation for SU. Indeed, RA1 stated if the University did not proactively engage with the carbon management agenda, it would not achieve a sector leading position or be at "…at the front end of the pack". The reputational benefits accruing from this proactive and successful engagement with carbon management and sustainability are a significant and recurring theme in the interviews and documentation. Moreover, the University recognises the need to carve out a niche market and differentiate itself from peer group institutions and it sees good performance in environmental metrics such as the PPUL and EMR as a way of achieving this (RA1).

Aside from the reputational benefits, rising energy prices and legislation (e.g. CRCEES) have acted as significant financial drivers for SU, while the Estates Master Plan was timely as the University was able to exploit it as a new opportunity to implement the carbon management agenda (A01). Furthermore, the University believes it has a societal responsibility to ensure that its activities do not create adverse environmental impacts at both a local and a global scale:

> *The University's activities affect the environment on both a local and global scale – and for that reason, it is important to reduce our negative impacts (A18).*

Finally, what emerged from the interviews was the significance of University leadership acting as a driver for the sustainability and carbon management agendas. Indeed, it was the personal concerns of the Vice Chancellor that initially led to the strategic focus on the sustainability/carbon management agenda and inclusion of a carbon reduction target in the Corporate Strategy (A02).

Table 6.6. Drivers and motivations for carbon management at SU (RA1; RA2; A01; A02; A03; A08; A11; A18)

Drivers and motivations identified	Documentation	Interviews
Financial	CRCEES	CRCEES
	Rising energy prices	Financial sustainability
	HEFCE funding	
Legislative	CRCEES	CRCEES
Sector and national targets	HEFCE targets	HEFCE targets
	Climate Change Act (2008)	
Reputational	PPUL	PPUL
	EMR	EMR
		Gaining competitive advantage
		Sector leading
Environmental	Climate change	Climate change
	Impact of transport	
Moral responsibility	Corporate social responsibility	Ethos of the University
		Altruism
Leadership		Visionary leadership
		Environmental champion
Estates Masterplan	Opportunity though Estates Masterplan	Opportunity though Estates Masterplan

Scope 1 and 2 carbon reduction target and progress

SU has proactively engaged with the carbon management agenda and made it a strategic business priority. Indeed, the University's carbon reduction target is included within the Corporate Strategy as a key performance indicator (KPI):

> *…35% reduction of Scope 1 and 2 carbon emissions by 2016 with a stretch target of 50% by 2020 (set against a 2005 Baseline) (A02).*

Thus, SU's Scope 1 and 2 reduction target exceeds both the HEFCE reduction target (43%) and the average reduction target for UK HEIs (35.2%) (HEFCE, 2010a; HESA, 2014b).

Progress against the reduction target is reported in the annual environmental sustainability statement (A04; A05; A06; A07; A08; A19). By academic year 2013/14, the University achieved an absolute reduction in Scope 1 and 2 emissions of 21% (Strong) from the 2005/06 baseline, which is significantly better than the average institutional reduction in emissions for the sector (7%) (HESA, 2014b). Scope 1 and 2 emissions per student decreased from 0.7 tCO_2e in 2005/06, to 0.5 tCO_2e in 2013/14 (HESA, 2014b; HESA, 2015b). This is significantly less than the average emissions of 1.2[21] tCO_2e/student for the sector in 2013/14 (HESA, 2014b; HESA, 2015b).

Notwithstanding the above sector average emissions reduction performance, the University's updated projections (A20) suggest it is not on track to meet its internal interim Scope 1 and 2 emissions reduction target in 2015/16 due to an increase in the size of the operational floor area of the estate and student accommodation. Indeed, the one area of the carbon assessment in which the University scored poorly (5/10) was in outlining a reduction roadmap and detailing projects to show how it will meet its 2020/21 reduction target.

The University's approach to Scope 1 and 2 emissions reduction has focused on four key areas; reducing energy consumption, renewables and energy infrastructure, campus

[21] Note the average excludes The Open University, The Institute of Cancer Research and The University of London (institutes and activities) as these were identifiable as outliers.

consolidation and behavioural change initiatives (A01; A15; A20). The University's campus consolidation programme presented an opportunity to significantly cut carbon emissions by selling off older, less efficient buildings and ensuring new buildings exceeded energy efficiency and CO_2 emissions performance requirements set out in current building regulations and planning guidance (A01; A02; A08; A09).

Scope 3 emissions

SU scored highly in the Scope 3 emissions category of the carbon assessment (19/20), and can be considered sector leading in terms of Scope 3 reporting. In 2013, the University incorporated all the EMR Scope 3 sources as an addendum to its carbon management plan (CMP), and voluntarily reported against all Scope 3 emissions sources in the 2013/14 EMR return (HESA, 2014b). Furthermore, the University went beyond HESA requirements and incorporated emissions from international student air travel from home to term-time address, and UK student travel from home to term-time address, within the operational boundary (A20).

Table 6.7 presents a breakdown of SU's GHG emissions for the year 2013/14 based on the EMR data (HESA, 2014b) and incorporating inbound student air travel emissions. The inbound student air travel emissions were estimated using the methodology presented in Appendix 12 and data from HESA (2015a), and as such differ from the figure reported by SU, which was based on the HEFCE methodology (HEFCE, 2010b). Scope 3 emissions accounted for 78% of the total carbon footprint in 2013/14. Of the Scope 3 elements, procurement emissions were the largest source (32.3%), followed by construction (16.7%) and student commuting (15.7%). Inbound student air travel accounted for 9% of the total carbon footprint in 2013/14. Given the year on year variability in construction related emissions, if these emissions are excluded, inbound student air travel accounted for 11% of the footprint in 2013/14.

Table 6.7. Breakdown of SU's emissions in 2013/14

HESA EMR/Additional Reporting Category	Emissions Scope		t/CO_2e	% Footprint
HESA EMR[a]	Scope 1		4,786	5.9
	Scope 2		12,770	15.9
	Scope 3	Total	62,919	78.2
		Business travel	*1,250*	*1.6*
		Staff commuting	*2,303*	*2.9*
		Student commuting[c]	*12,607*	*15.7*
		Waste	*33*	*0.0*
		Water supply	*58*	*0.1*
		Wastewater treatment	*110*	*0.1*
		Procurement (construction)	*13,412*	*16.7*
		Procurement (other)	*26,014*	*32.3*
Additional		*Inbound student air travel*[b]	*7,132*	*8.9*
	Total		**80,474**	-

Note. (a) Data retrieved from HESA (2014b); (b) Inbound student air travel emissions were estimated using the methodology presented in Appendix 12; (c) Daily commute from term-time address to the University. UK student travel (home to term-time address) was not included as data for 2013/14 was not available.

There is a further pledge to undertake work to categorise and quantify Scope 3 sources not currently included in the management plan and further develop initiatives to reduce emissions from these sources once the full campus consolidation programme is complete (A20).

The University has adopted a sector-leading position and set targets for a number of Scope 3 elements, with the exception of student air travel emissions, where it acknowledged that they are an inevitable consequence of the University's internationalisation strategy and will increase in line with recruitment targets (A20).

6.3.5 Institutional response to the Conflict: the need for a sustainable business model

The scale of the Conflict at SU is illustrated in Table 6.8, which presents a comparison of inbound student air travel emissions to Scope 1 and 2 emissions for 2013/14 and forecasts the potential changes in the magnitude of these emissions by 2020/21. This information was presented to RA1 and RA2 during the interviews. The 2020/21 scenario assumes the University achieves both its Scope 1 and 2 emission reduction target and its non-EU/EEA student recruitment target, with EU and EEA student numbers (no specific SU target) increasing by 3.7% annually, in line with projected growth rates for the sector (DBIS, 2013). In 2013/14, inbound student air travel emissions were equivalent to 41% of Scope 1 and 2 emissions, rising to 168% in the 2020/21 scenario. Thus, should SU meet all its targets, student air travel emissions will wipe out the Scope 1 and 2 emission reductions and overall emissions increase by approximately 5,000 tCO_2e.

Table 6.8. SU's Scope 1 and 2 and inbound student air travel emission in 2013/14 and projected emissions to 2020/21

Emissions source		**Emissions (tCO_2e)**		
		2013/14		**2020/21**
Scope 1 and 2		**17,556**	**50% reduction below 2005/06 baseline by 2020/21**	**11,084**
Inbound student air travel	*EU and EEA*	*1,834*	3.7% increase in EU and EEA student numbers per annum	*2,365*
	Other Europe	*113*	Non-EU and EEA students account for 12% of the student population in 2020/21	*347*
	RoW	*5,185*		*15,918*
	Total inbound student air travel	**7,132**		**18,630**
Total Scope 1, 2 and inbound student air travel emissions		**24,688**		**29,714**

Both interviewees acknowledged that a conflict between the internationalisation and carbon management agendas exists, with RA2 describing it as a "complex picture", where in terms of student air travel, emissions would increase and run counter to the University's low-carbon vision:

> *Where the difficult areas come, are we also have a very active internationalisation strategy […] internationalisation is likely to increase the carbon footprint and that's the downside (RA2).*

With respect to the internationalisation strategy, RA2 noted that:

...we have some strategic reasons for wanting to do this [recruitment of international students] that are much more than about the carbon footprint (RA2).

RA1 acknowledged an increased awareness of the issue not only at an institutional level, but also at a sector level:

The focus on this issue in the sector is a growing one and when you go out to conferences and hear about these business driven strategies, you know, a few years ago there wouldn't even be the whiff of any sort of concern about carbon emissions but now you are hearing well, crickey […] that's going to be. What are we going to do about our essentially, air travel emissions from that business strategy? (RA1).

In response to the Scope 1 and 2 and inbound student air travel emissions projections (Table 6.8) RA1 recognised the increasing focus on student air travel emissions and the size of the challenge facing the University in the future. The University has a target to triple the number of inbound international students and if it was to achieve fully its international student recruitment targets, along with its Scope 1 and 2 reduction targets then, as RA1 observes:

When you put the size of our utility emissions against these emissions [international student air travel], it says that by 2020/21 essentially, we're burning as much carbon, sorry, creating as much carbon, in terms of atmospheric pollution by bringing students to the University as we are using in energy (RA1).

A prominent theme to emerge from the interviews was the agreement of the need for the University to have a sustainable business model. RA2 realised that there was a need for the University to have an internationalisation policy in order to achieve its academic vision, whilst trying to be compliant with its environmental commitments.

Both RA1 and RA2 identified that the University must accept some responsibility and internalise the external environmental costs associated with the University's internationalisation strategy. This position of responsibility is also evident in the University's CMP, which states, "The University is indirectly responsible for emissions associated with the transport of these students to/from [the University]" (A20). Moreover, the University's Vice Chancellor stated in the CMP that:

> *The University has developed plans to reduce the current footprint and to comprehend [the University's] wider carbon impacts such as international student commuting (A01; A11).*

The University has made a number of commitments to attempt to reduce the carbon intensity of the internationalisation agenda:

- Sector-leadership in the provision of distance and online learning alternatives to traditional teaching methods (A20).
- The University is raising awareness around the variation in emissions associated with the fleets maintained by different airline operators (A20).

Offsetting or compensating for inbound student flight emissions

On the subject of offsetting or otherwise compensating for student air travel emissions, RA1 expressed opposition to conventional offsetting arguing that it is too easy and the University would just be buying its way out of the problem. In addition, they identified that "…it's almost like paying a tax and you don't see the benefit of that tax" (RA1). Instead, SU has opted to compensate for these emissions through investing in an environmental education fund. The fund will support delivery of training to students to enhance their carbon literacy. The choice of compensation scheme was based on input from different stakeholder groups within the institution and considered both the expected impact of the scheme and the ease with which it could be implemented (RA2). To determine the level of compensation, the University has estimated emissions using the HEFCE methodology (HEFCA, 2010b) and adopted the CRCEES carbon price, which in 2014/15 was £16.35 per tonne CO_2 (applied to CO_2e). Based on SU's internal estimate of student air travel emissions, this amounts to £76,000 to compensate for current students and rising to a predicted maximum of £313,144 in 2020/21 if the University were to meet its recruitment targets. RA1 highlighted the low cost in comparison to the University's annual gas and electricity bill:

£70k over £5.95 million is a little over 1%, so actually the argument made over how big the investment is, it isn't very big […] but we are prepared to make it for our utilities, we should be prepared to be able to make it for this (RA1).

In justifying the decision to fund carbon literacy training, RA1 argued that a £76,000 investment in energy efficiency interventions on campus would not result in a significant reduction in estate emissions. RA1 further asserted that investing in skills and knowledge made more financial sense and will have benefits for wider society, as well as indirect reputational returns for the University.

The University hopes the scheme will give students the skills and knowledge to enable them to become more carbon literate graduates and enhance their employability (RA1). Thinking specifically about international students, RA1 suggests that the University is creating a powerful model by:

…giving them these skills, knowledge and innovation powers […] we are actually firing them back out being a better, more rounded global citizen than they might have been (RA1).

Thus, turning the Conflict into a positive, a point echoed by RA2:

Now everyone who comes here will be aware that we are environmentally aware, so everybody who leaves here, back to their home country, will be influencers […] they will go back, changed, with different attitudes and behaviours that will influence their lives later on (RA2).

The scheme that SU has proposed to compensate for student air travel emissions is a demonstration of its commitment to maintaining a sector leading position in the sustainability/carbon management agenda. However, while the proposed compensation scheme is a novel and promising option, it has the drawback that the emission reductions, if any, that result from increased knowledge of carbon are all but impossible to quantify. Nevertheless, SU has acknowledged the environmental impacts associated with the internationalisation strategy and included the GHG emissions within its operational boundary. Moreover, SU has sought to internalise the negative environment impacts voluntarily through investment in an internal carbon compensation scheme, thus demonstrated proactivity over induced carbon over which it has an influence.

The motivations for commitments around student travel emissions are comparable to the general motivations for the University in engaging with the carbon management agenda. SU recognises the likelihood of an increasing focus on its student air travel emissions as they rise in line with recruitment targets and account for a larger proportion of the footprint in the future. Thus, SU has taken a proactive rather than a reactive approach, influenced by a number of factors; leadership commitment, the ethos and culture of the University, an environmental champion, the new internationalisation strategy, and the financial position of the University.

The influence of an environmental champion, in this case the Head of Sustainability, was instrumental in engaging with the potential conflict for they brought the issue to the attention of the executive leadership. Indeed, RA1 was extremely motivated to adopt a proactive position in relation to this conflict and somehow turn it into a positive.

The University leadership acknowledged the need to internalise the significant environmental costs of the new internationalisation strategy, thus showing that environmental concerns are becoming a major consideration during the decision-making process at SU. This factor links to the ethos of the University and all factors link to the significant motivation of achieving a sector leading position in the sustainability/carbon management agenda and carving out a niche in the market for the University. Certainly, the University recognises there are reputational benefits to engaging with this conflict and demonstrating a willingness to compensate for student flight emissions.

6.3.6 Summary

SU is identifiable as a leader in carbon management and a University that is below average in terms of the development of internationalisation. The University has proactively engaged with Scope 3 emissions, reporting against all components in the 2013/14 EMR and setting reduction targets in an addendum to its CMP. This commitment is in keeping with its position of wanting to be at the forefront of the sustainability/carbon management agenda, and it recognises the reputational benefits of this proactive engagement (gaining competitive advantage).

The University is actively trying to increase the number of international students on campus and the number of home students studying abroad. Consequently, emissions from student flights are highly likely to increase and account for a much larger proportion of the carbon footprint in future. The University has recognised the Conflict between the internationalisation and carbon management agendas and has endeavoured to estimate the emissions associated with inbound student air travel. Furthermore, the University is compensating for student air travel emissions through an educational fund into which it is investing equivalent to the current CRCEES carbon price.

Nevertheless, SU is still pursuing the internationalisation strategy and emissions will increase. SU attempts to reconcile the Conflict by investing in compensatory actions, according to its sector leading position.

6.4 Bank University case study

6.4.1 Data sources and interviewees

The document search strategy identified 16 documents (Table 6.9). In addition, a face-to-face interview with the Head of Environmental Sustainability provided insight into the current and future response to the Conflict between the internationalisation and carbon management agendas.

Table 6.9. Data sources for BU case study

Code	Documents/interviewee	Date
B01	Advancing the 2015 Agenda	2011/12
B02	Strategic Plan	2012
B03	Erasmus Policy Statement	2014
B04	Carbon Management Plan	2010
B05	Sustainable Travel Plan	2013
B06	Environmental Sustainability Policy	2013
B07	Financial Statement	2013/14
B08	Annual Review	2013/14
B09	Transnational Education Policy	2012
B10	Campus Master Plan	2012-2022
B11	Environmental Sustainability Plan	2013
B12	Board of Governors Meeting Minutes	Oct-09
B13	Board of Governors Meeting Minutes	Mar-10
B14	Board of Governors Meeting Minutes	Sep-10
B15	Board of Governors Meeting Minutes	Jul-14
B16	Board of Governors Meeting Minutes	Nov-14
RB1	Interview with Head of Environmental Sustainability	Aug-15

6.4.2 Bank University context

BU is a large institution situated in the same geographical region as SU. BU was established under its current name in the early 2000s, where its predecessors date back to the early 19th century, and is a member of the Russell Group of British research-intensive universities (Russell Group, 2016).

The University is one of the largest in the UK by GIA (HESA, 2014b) and is currently in the middle of a ten-year campus masterplan that will see it spend over £1 billion on new builds and refurbishments (B10).

BU has nearly 5,000 academic staff and 35,000 students, with student numbers in 2013/14 similar to those in 2008/09 (HESA, 2015b; HESA, 2015d). The University maintains a healthy financial position, with tuition fees accounting for 39.6% of total income, and research grants and contracts accounting for 24.1% of total income (B07).

BU is in the top 40 universities in the Guardian league table, maintaining a steady position between 2010 and 2016 (Guardian, 2016), and is a top 100 institution in the 2016 QS World University Rankings (Top Universities, 2015a).

In terms of research, BU has 0.8 research students per academic staff member (HESA, 2014b; HESA, 2015d) and in the latest REF, ranked in the top 20 for both research quality and power (THE, 2014). Indeed, 83% of research was judged 'world-leading' or 'internationally excellent', where the University had one of the broadest submissions of any UK HEI.

6.4.3 Internationalisation (High/High)

BU is a highly international institution, with international students accounting for 31% of the total student population (High) in 2013/14, above the sector average of 20% (HESA, 2015a; HESA, 2015b). In addition, 25% of staff are non-UK nationals, 25% of research output is co-authored with international collaborators, and BU has a global alumni population of approximately 250,000 people (B03). The University has committed to building upon this foundation and ensuring that internationalisation is further embedded in its approach to research, teaching, the student experience, business engagement and social responsibility (B03). The University wishes to further strengthen the power of its brand internationally to recruit the highest calibre of academic staff and students and maintain its reputation for world-leading research. Indeed, the desire to achieve a top 25 position in the Academic World Rankings of Universities is evident throughout the documentation (B01; B02; B03). The University already has strong collaborative research links with a number of institutions around the world and aims to increase the proportion of funding derived from international sources over the coming years (B02).

The University has a strong position overseas, with a number of transnational education programmes delivered through collaborative arrangements, online and sole ventures via a number of offshore facilities in a variety of locations around the world (C-BERT, 2015). These TNE initiatives contribute to the University's goal to increase its brand power across the world and support income diversification (B09). In 2013/14, the number of TNE students expressed as a percentage of students studying in the UK was 11.0% (High), directly comparable to the sector average (10.8%) (HESA, 2015c).

In support of the University's vision, it has prioritised certain countries and regions when assessing the opportunities for increased study mobility, partnerships and research/teaching collaborations. The selection of partner institutions is based on historical links, reputation, academic compatibility in teaching or research, country risk, and student interest. Most of the prioritised countries are located in Asia, Latin and North America and the Middle East (B03).

Recruitment of international students and study abroad schemes

Table 6.10 presents the themes that emerged from the analysis of the documents, regarding the drivers and motivations for international student recruitment and study abroad.

Table 6.10. Drivers and motivations for recruitment of international students and study abroad schemes at BU (B01; B02; B03)

Drivers and motivations identified	Documentation
Financial	Income generation
	Income diversification
	No growth in 'home' students
Student experience and employability	Promote global citizenship
	Internationally mobile professionals
	Global experiences and perspectives
	Enhance employability
	Development of language skills
	Development of intercultural competence
	Provide an insight into international business and academic environments
	Compete in diverse job market
Global reputation	Strengthen international standing
	Strengthen brand

Despite its existing large international student population, BU has placed emphasis on increasing international student numbers, driven in part by a desire for increased income diversification (B02). The University notes that the greatest opportunity for increasing income with the least risk possible to its brand is through international student recruitment (B09). Moreover, the University predicts little to no growth in home student numbers over the next few years, in part due to impending decline over the next few years in the UK population cohort aged 16-21 years old, thus is doing everything possible to compensate for this decline and maximise growth in international student numbers (B01). Indeed, the income from non-EU students' tuition fees accounted for approximately 17% of total income in 2013/14 (B07).

The University recognises the importance of having international students on campus to expose home students to new languages, cultures, and ways of thinking, aiding the development of intercultural competence and providing an international experience (B03). Likewise, the University is committed to providing study abroad opportunities for home students (B01) to improve foreign language skills and enhance employability by producing students who are internationally mobile professionals, able to compete in diverse, global job markets (B02).

6.4.4 Carbon management (2:2/Weak)

Carbon Assessment

Table 6.11 presents the results of the carbon assessment for BU, where overall engagement with carbon management achieves a 2:2 rating, with reduction progress rated as 'weak'.

Table 6.11. Carbon assessment results for BU

Category	Description	Score (%)
Environmental policy		
	Publicly available environmental policy	10/10
Leadership commitments		
	Carbon management a part of the corporate strategy	2.5/2.5
	Endorsement from executive leadership	2.5/2.5
Governance		
	The establishment of an environment (sustainability) team	10/10
Planning		
	Carbon reduction target (Scope 1 and 2)	4/10
	Interim target	0/5
	Access to funding	5/5
	Carbon management projects outlined to meet target	5/10
Reduction progress		
	Percentage reduction	4/20
Scope 3 emissions		
	Submitted Scope 3 data to EMR reporting system	6/6
	Scope 3 emissions included in the carbon management plan	5/9
	Initiatives to reduce the Scope 3 footprint	3/5
Monitoring and reporting		
	Annual monitoring of emissions	2.5/2.5
	Publicly available annual progress report	0/2.5
TOTAL		**59.5% (2:2)**

Drivers and motivations for carbon management

Table 6.12 presents the themes that emerged from the analysis of the documents and interviews, regarding the drivers and motivations for carbon management at BU. It is noted that while multiple motivations were identified from the documentation, the interviewee highlighted only three of these.

Table 6.12. Drivers and motivations for carbon management at BU (B04; B05; B11; B14; RB1)

Drivers and motivations identified	Documentation	Interviews
Financial	Linking capital funding to carbon reduction performance	
	Rising energy costs	
National and sector targets	UK Government targets	HEFCE targets
	HEFCE targets	
Legislative	CRCEES	
Moral responsibility	The right thing for a socially responsible university to do	Responsibility to have a sustainable as possible, low carbon institution
Risk management	Volatile energy markets	
Reputational	PPUL	
	Student and staff recruitment	
Environmental	Climate change	
	Impact of transport	
	City of Manchester's low carbon vision	
Campus Masterplan	Opportunity for carbon reduction through Campus Masterplan	Opportunity for carbon reduction through Campus Masterplan

The HEFCE was a significant driver for carbon management at BU. The University was approached by HEFCE to be one of the first universities to develop a CMP, in collaboration with the Carbon Trust, and to set a reduction target for Scope 1 and 2 emissions (RB1).

Aside from the reduction target, the documentation highlights the financial drivers for engagement with the carbon management agenda. Expected increases in the cost of energy, coupled with mandatory participation in the CRCEES and financial penalties for failure to reduce emissions (e.g. HEFCE Capital Investment Framework), led the university to recognise the need to engage with carbon management (B04; B14). Moreover, the beginnings of the carbon management agenda occurred at the same time as the development of the Estates Masterplan, thus presented an opportunity for significant reductions to be realised:

> *…the [Estates] Strategy also takes account of the urgent need to reduce dramatically the University's carbon emissions over the next decade (B14).*

From a reputational perspective, the University recognises the need to be seen as an environmentally responsible institution (B04) and acknowledges that students are now placing more emphasis on HEIs' environmental performance when choosing where to study (B05). However, the University was one of 69 HEIs that boycotted the PPUL in 2015 (PPUL, 2015), which could suggest that the University wants to undermine the credibility of the PPUL and thereby make it a less significant driver. Indeed, older, research-intensive HEIs are concerned that the PPUL does not distinguish between them and more modern HEIs.

The documentation reveals moral responsibility as a driver for carbon management, particularly responsibility for reducing local environmental impacts (B04). Moreover, the University is aware that it needs to minimise the impact of its operations on the external environment and support efforts in society to restrain accelerated global warming:

> *The urgent need to reduce global emissions of greenhouse gases (principally carbon dioxide) in order to prevent an excessive increase in mean global temperature is almost universally accepted by those who study the scientific data and is the context in which this plan is based (B04).*
>
> *It is the right thing to do. As the pace of globalisation accelerates, Universities must be foremost in responding to the major challenges that threaten our fragile world (B04).*

Scope 1 and 2 carbon reduction target and progress

The University has set itself a target to reduce Scope 1 and 2 emissions by 40% by 2020 from a 2008/09 baseline (B04). Thus, BU's Scope 1 and 2 reduction target does not meet the HEFCE reduction target (43%), but exceeds the average reduction target for UK HEIs (35.2%) (HESA, 2014b). This target has been made a strategic objective for the University (B12) and it is embedded within the strategic plan (B01).

While the University has had marginal success in reducing emissions, having decreased Scope 1 and 2 emissions by 4% between 2005/06 and 2013/14 (HESA, 2014b), this is somewhat below the average institutional reduction for the sector (7%) (HESA, 2014b).

Furthermore, emissions per student have remained constant over this period at 2.0 tCO_2e (HESA, 2014b; HESA, 2015b), and are significantly higher than the 2013/14 sector average (1.2 tCO_2e/student). At present, BU is not on course to meet its 2020 reduction target and RB1 noted that:

We've got carbon targets but we're currently in a transition stage at the moment, so we're currently reviewing the carbon targets we've given.

Concerns about carbon reduction progress were raised during an update on risk matters and compliance at two Board of Governors meetings in 2014 (B15; B16). In the first instance, there was a discussion on measurement issues facing research active institutions, where increased research activity would be likely to increase carbon emissions in delivering that research (B15). In the second discussion, it was noted that the absolute target set by HEFCE was proving challenging to achieve, alongside significant growth in terms of both the estate, and research activity within the institution (B16). The University acknowledged the possibility of negative press reporting, indicating that it is concerned about the reputational impacts of failing to meet reduction targets and has set about revising them to account for recent growth.

Whilst acknowledging the need to reduce carbon as much as possible, RB1 emphasised that achieving reductions in a growing research-intensive institution is challenging and presented a justification for high levels of emissions, in that the research side of the University's contribution to making the transition to a more sustainable society is often ignored:

…but the priority for the institution is its research and its students, so sometimes there is conflict there because we are a research intensive university so some of the research that we do conduct can be quite energy intensive. As a result of some of that research we are helping to tackle some of the global problems, so sometimes people just look at…they don't actually look at the outcomes of that research, they just look at what that research is using in terms of carbon and energy. Which is right, you need to reduce that as much as possible but just as a consequence of the

activities that happen at the University, some of the buildings do use a lot of energy (RB1).

Scope 3 emissions

BU scored 14/20 in the Scope 3 emissions category of the carbon assessment and can be considered sector leading in terms of its reporting. The University voluntarily submitted data to the 2013/14 EMR return for all Scope 3 components (HESA, 2014b). The University reports emissions from waste, water supply and treatment and business travel in its CMP and emissions from business travel, staff commuting and student commuting in its Travel Plan (B04; B05). BU does not measure and report emissions from inbound or outbound student air travel.

Table 6.13 presents a breakdown of BU's GHG emissions for the year 2013/14 based on the EMR data and incorporating inbound student air travel emissions, estimated using the methodology from Appendix 12 and data from HESA (2015a). In total, Scope 3 emissions accounted for 79.2% of the total carbon footprint in 2013/14, with procurement the largest source of emissions (38.4%), followed by construction (17.8%) and Scope 2 emissions (13.8%). Inbound student air travel emissions accounted for approximately 13% of emissions. However, construction emissions in 2013/14 were high as the University was in the middle of phase one of its Estates Masterplan (B10). Given the year on year variability in construction related emissions, if they are excluded, inbound student air travel accounted for 15.7% of the footprint in 2013/14.

Table 6.13. Breakdown of BU's emissions in 2013/14

HESA EMR/Additional Reporting Category	Emissions Scope		t/CO_2e	% Footprint
HESA EMR[a]	Scope 1		25,989	7.0
	Scope 2		50,989	13.8
	Scope 3	Total	293,615	79.2
		Business travel	*15,677*	*4.2*
		Staff commuting	*9,828*	*2.7*
		Student commuting[c]	*4,823*	*1.3*
		Waste	*6,510*	*1.8*
		Water supply	*294*	*0.1*
		Wastewater treatment	*605*	*0.2*
		Procurement (construction)	*65,915*	*17.8*
		Procurement (other)	*142,211*	*38.4*
Additional		*Inbound student air travel[b]*	*47,751*	*12.9*
Total			**370,593**	-

Note. (a) Data retrieved from HESA (2014b); (b) Inbound student air travel emissions were estimated using the methodology presented in Appendix 12; (c) Daily commute from term-time address to the University.

RB1 stated that the University approached the Scope 3 footprint with a view to focusing on "…where our biggest impacts are and where we can have the biggest impact ourselves". Thus, it has actively engaged in reduction initiatives surrounding procurement and waste, given that they are large sources of emissions where the University feels it can have a significant influence (RB1). Furthermore, RB1 stated that because the University is so large they have had to pick their battles and prioritise, stating:

> *…if you can look at your institution, see where your strengths, your weakness, your opportunities, your constraints, your barriers are, then you can develop a strategy accordingly and then build from that. If you're going all guns blazing wanting to do everything or tackle some of the problems for which there's no foundation for doing then you kind of set yourself up to fail.*

With regard to more challenging areas of the Scope 3 footprint, such as staff business travel, the University has taken an incremental approach, beginning with small steps by sharing best practice. RB1 stated that you cannot really tell anyone to do anything, so it is about gathering case studies and sharing best practice, presenting the opportunities available for staff to avoid travel in the first place or reduce the carbon impact of travel e.g. through videoconferencing or taking the train to Europe instead of flying (RB1).

The University is currently in the process of producing a revised CMP incorporating a change to reduction targets to take account of the University's growth (RB1). However, this will not include Scope 3 emissions (RB1). This is despite numerous references in the documentation indicating that Scope 3 emissions were to be included in a revised and updated CMP and some targets to be set (B05; B15).

RB1 was of the opinion that Scope 3 emissions should be included in the CMP plan and stated that, moving forward, they would be making a recommendation for them to be included. However, the environment team does not have the final say over setting the operational boundary of the CMP. It must go through a series of approval processes and through the Carbon Leadership Group, which includes executive leadership (RB1). Thus, a resistance and a lack of institutional support for inclusion of Scope 3 is evident at this moment in time. Moreover, RB1 noted that in relation to Scope 3, "If HEFCE did show stronger leadership or there was stronger leadership from Government that would help all our jobs." Thus highlighting a perceived lack of support surrounding Scope 3 emissions at a sector level.

6.4.5 Institutional response to the Conflict: awareness but lack of action

The scale of the Conflict at BU is illustrated in Table 6.13, which presents a comparison of inbound student air travel emissions to Scope 1 and 2 emissions for 2013/14 and forecasts the potential changes in the magnitude of these emissions by 2020/21, where this information was presented to RB1 during the interview. The 2020/21 scenario is based on the University achieving its Scope 1 and 2 reduction target and in the absence of an institutional target, assumes annual growth in international student numbers of 3.7% (DBIS, 2013). In 2013/14, inbound student air travel emissions were equivalent to 62% of Scope 1 and 2 emissions, rising to 127% in the 2020/21 scenario. Table 6.14 shows that overall emissions decrease by 2020/21 but this is contingent on BU achieving its Scope 1 and 2 reduction target, which is looking highly unlikely (see Section 6.4.4).

Table 6.14. BU's Scope 1 and 2 and inbound student air travel emission in 2013/14 and projected emissions to 2020/21

Emissions source		Emissions (tCO_2e)		
		2013/14		**2020/21**
Scope 1 and 2		**76,978**	**40% reduction below 2008/09 baseline by 2020/21**	**48,330**
Inbound student air travel	*EU and EEA*	*3,819*	3.7% increase in international student numbers per annum	*4,925*
	Other Europe	*922*		*1,189*
	RoW	*43,010*		*55,465*
	Total inbound student air travel	**47,751**		**61,579**
Total Scope 1, 2 and inbound student air travel emissions		**124,729**		**109,909**

While there is a recognition of the Conflict at BU, to date the University has not estimated the emissions associated with student air travel, nor does it plan to include it in the CMP (RB1). As such, the University has not demonstrated a willingness to engage in either understanding or resolving the Conflict. As with the debate at BU surrounding the inclusion of other Scope 3 emissions in the CMP, RB1 stated:

> *…at the moment we don't calculate it and we don't have a target for it, but I know other universities do include it in their carbon footprint […] it's something I'll be raising in the future.*

RB1 went on to say:

> *…personally I do think we should be looking at it, just so, from my own approach, I like to be able to monitor and to look at the data and see if there are any changes or interventions that work better.*

Further adding:

> *But I don't think we could use it to restrict travel, but it is good to be able to understand what the impact is and then maybe in other areas of the institution, you might be able to ask them for further improvements to at least counter [student air travel emissions].*

RB1 stated that there had been discussions with those in charge of the internationalisation agenda surrounding carbon management and international students. However, this was limited to on-campus initiatives during the students' time at the University (e.g. communicating energy saving strategies). Thus, the University is again focusing on areas where it feels it can have a visible impact and influence. RB1 asserted that discussion surrounding student air travel had not taken place as it is not part of the current CMP and it has not been measured or any targets set.

With regard to the possibility of offsetting emissions from student air travel in the future, RB1 was sceptical as to whether offsetting was the right approach to take stating that BU did not want to get into the habit of pursuing a certain activity and continuing business as usual because emissions can simply be offset. Furthermore, RB1 stated that offsetting is a bit like pushing the problem into the corner and letting someone else worry about it. RB1 noted that there had been discussions surrounding an internal compensation scheme so that the money stays within the University and people are able to see visible results from targeted reduction initiatives. However, it appears this is still a long way off given that student air travel emissions will not be included in the CMP and the University has yet to measure them.

6.4.6 Summary

BU is a highly internationalised institution that has had some success in reducing its Scope 1 and 2 emissions but is limited in what it can do due to the nature of its estate and high level of research activity. There is the view at BU that the benefits of its research activities are often ignored and may outweigh its direct environmental impacts.

The University has adopted a sector-leading position by reporting Scope 3 emissions and has targeted areas for reduction, particularly procurement, business travel and commuting. However, no Scope 3 emissions are to be included in the revised CMP and no targets set. Therefore, it is backing away from engagement with Scope 3 and is publicly doing the minimum in its new CMP by not including and setting targets for Scope 3 emissions. The University may be wary of doing so given its experience with Scope 1 and 2 emissions and concerns regarding reputational damage arising from missing targets.

There is a realisation of the importance of the Conflict at BU, but to date, while RB1 felt the University should be accounting for student air travel emissions, the institution has not been willing to engage with the issue and has not included these emissions within its operational boundary.

6.5 Talbot University case study

6.5.1 Data sources and interviewees

The document search strategy identified 12 documents (Table 6.15). In addition, a face-to-face interview with the Environmental Manager provided insight into the current and future response to the Conflict between the internationalisation and carbon management agendas.

Table 6.15. Data sources for TU case study

Code	Documents/interviewee	Date
C01	Strategic Plan	2010-2015
C02	Internationalisation Plan	2012-2015
C03	Environmental Policy	2015
C04	Carbon Management Plan	2012
C05	Scope 3 Annual Report	2012/13
C06	Green Impact Newsletter	2011
C07	Environmental Objectives and Targets	2011
C08	Transport Plan	2015
C09	Carbon Management Statement	2010
C10	Financial Statements	2014
C11	Waste Policy	2015
C12	Strategic Plan	2015-2020
RC1	Interview with Environmental Manager	May-15

6.5.2 Talbot University context

TU is located in the same geographical region as HU. With origins dating back to the middle of the 19th century, TU was one of a number of polytechnics granted university status in 1992, and is a member of the University Alliance mission group (University

Alliance, 2016). TU is a multiple campus university and is slightly larger than the average UK HEI by GIA (HESA, 2014b).

TU has approximately 1,500 academic staff and 25,000 students (HESA, 2015b; HESA 2015d), where total student numbers increased by approximately 8% between 2008/09 and 2013/14 (HESA, 2015b). The University has a relatively healthy financial position with the majority of its income coming from tuition fees (70.3%) and funding council grants (18.4%) (C10). Research grants and contracts accounted for just 2.1% of income in 2013/14 (C10).

TU ranks highly in the Guardian university league table in comparison to other post-92 HEIs, being in the top 60, and rose six places between 2010 and 2016 (Guardian, 2016). In terms of research, TU has 0.4 research students per academic staff member (HESA, 2014b; HESA, 2015d) and in the 2014 REF, ranked in the top 90 universities for research quality and top 70 for research power (THE, 2014).

6.5.3 Internationalisation (Medium/High)

Until recently, the internationalisation strategy was dominated by the recruitment of international students (from 124 countries), who accounted for 13.8% (Medium) of the total student population in 2013/14 (which is below the sector average of 20.3%) (HESA, 2015a; HESA, 2015b) (C02). More recently, this has been extended to include a number of additional themes such as internationalisation of the curriculum, international teaching partnerships, internationalisation of the faculty, and research (C01; C02; C12). Nonetheless, international student recruitment remains a cornerstone and key approach for the internationalisation agenda (C12).

A key factor for the development of internationalisation at TU is to increase the strength of the University's overseas brand (C02). Furthermore, the University recognises the need to internationalise the curriculum in order to enhance global citizenship and prepare students for a much more global and connected business world (C02).

In terms of TNE provision, the University has collaborative partnerships with a number of HEIs around the world (23 countries). These partnerships are in the form of validation agreements, joint and dual delivery, franchising and articulation agreements (C02). In 2013/14, TU had approximately 4,600 students registered on courses overseas, equivalent to 17% (High) of students studying in the UK (HESA, 2015b; HESA, 2015c). This is significantly higher than the sector average (10.8%) (HESA, 2015c).

Recruitment of international students and study abroad schemes

Table 6.16 presents the themes that emerged from the analysis of the documents and interview, regarding the drivers and motivations for international student recruitment and study abroad schemes.

Table 6.16. Drivers and motivations for recruitment of international students and study abroad schemes at TU (C01; C02; C12; RC1)

Drivers and motivations identified	Documentation	Interviews
Financial	Income generation	Income generation
	Income diversification	Subsidise 'home' students
Student experience and employability	Succeed in global labour market	
	Development of intercultural competence	
	Enhance employability	
	Promote global citizenship	
	Development of language skills	
Reputational	Enhance international reputation	
	Build brand awareness overseas	

Two prominent themes emerged as the motivations for the recruitment of international students. Firstly, the University recognises the importance of international students in enhancing the home student experience (C01; C02; C12). Graduates are working in an increasingly borderless world and to succeed must be able to work alongside colleagues from a range of cultural, ethnic, linguistic and religious backgrounds (C02). Secondly, international students are a vital income source helping to subsidise domestic students' education and diversify income streams (RC1; C01; C02; C12). Indeed, non-EU students accounted for 12% of total income in 2013/14 (C10).

Study or work abroad opportunities are seen as an additional way of internationalising the curriculum and are offered as they enhance the student experience and employability, in addition to offering students an international perspective on their discipline (C01; C02).

6.5.4 Carbon management (1st/Strong)

Carbon Assessment

Table 6.17 presents the result of the carbon assessment for TU, where overall engagement with carbon management achieves a 'First' rating, with reduction progress rated as 'strong'.

Table 6.17. Carbon assessment results for TU

Category	Description	Score (%)
Environmental policy		
	Publicly available environmental policy	10/10
Leadership commitments		
	Carbon management a part of the corporate strategy	0/2.5
	Endorsement from executive leadership	2.5/2.5
Governance		
	The establishment of an environment (sustainability) team	10/10
Planning		
	Carbon reduction target (Scope 1 and 2)	10/10
	Interim target	5/5
	Access to funding	5/5
	Carbon management projects outlined to meet target	5/10
Reduction progress		
	Percentage reduction	16/20
Scope 3 emissions		
	Submitted Scope 3 data to EMR reporting system	6/6
	Scope 3 emissions included in the carbon management plan	6/9
	Initiatives to reduce the Scope 3 footprint	4/5
Monitoring and reporting		
	Annual monitoring of emissions	2.5/2.5
	Publicly available annual progress report	0/2.5
TOTAL		**82% (1st)**

Drivers and motivations for carbon management

Table 6.18 presents the drivers and motivations for carbon management at TU. TU aims to achieve sector leadership in sustainability and carbon management, and a high position in environmental league tables (RC1; C04). Aside from the reputational benefits, the financial benefits of reducing Scope 1 and 2 emissions is a significant motivation at TU (RC1; C04). Indeed, with regard to senior management and in particular the Chief Financial and Operating Officer, RC1 stated:

> *… [they] see carbon, carbon management, as just a huge opportunity to make us more robust financially. Which probably to you, certainly to me, makes absolute sense but not to a lot of people so we're quite lucky that we've got a couple of really important internal people that just see it as just really really sensible business practice […] We're very very fortunate that we've got people that sort of understand it. As long as there's sensible payback periods we are generally able to put projects through.*

Thus highlighting the commitment to carbon management from senior leadership within the University.

Table 6.18. Drivers and motivations for carbon management at TU (C03; C04; RC1)

Drivers and motivations identified	Documentation	Interviews
Environmental	Climate Change	
Financial	Financial resilience	Financial savings
	HEFCE funding	
	CRCEES	
Energy security	Ensuring energy security	
Sector and national targets	HEFCE sector targets	Climate Change Act (2008)
Reputational	PPUL	PPUL
	Estates Management Statistics	Sustainability leader
Legislative	CRCEES	
Leadership		Executive management commitment

Scope 1 and 2 carbon reduction target and progress

The University's CMP set out a carbon reduction roadmap to meet a declared target of a 48% reduction in Scope 1 and 2 emissions by 2020/21, from a 2005/06 baseline (C01; C04). Thus, TU's Scope 1 and 2 reduction target exceeds both the HEFCE reduction target (43%), and the average reduction target for UK HEIs (35.2%) (HEFCE, 2010a; HESA, 2014b).

TU scored highly for emission reduction progress (16/20). Indeed, the University has decreased emissions by 18% (Strong) between 2005/06 and 2013/14 (HESA, 2014b). This is significantly better than the average institutional reduction in emissions for the sector (7%) (HESA, 2014b). Moreover, emissions on a per student basis have decreased from 0.8 tCO_2e in 2005/06 to 0.6 tCO_2e in 2013/14, and are significantly below the 2013/14 sector average of 1.2 tCO_2e/student (HESA, 2014b; HESA, 2015b). The University has been able to achieve these reductions through a combination of energy efficiency interventions, installation of renewable and low-carbon energy generation systems (e.g. PVs and CHP), and behavioural change initiatives (C03; C04; C07). Where possible, projects have been combined with planned development of the estate (C04).

Despite these achievements, the University is finding progress against the current target a difficult task. There are two main reasons for this, firstly, when setting the reduction target, TU included plans for the installation of large-scale renewable energy generation, however these failed to achieve planning permission. Secondly, the reduction target was set prior to a period of expansion, in terms of the opening of new facilities on campus. Thus, the University is currently reviewing the reduction target and considering intensity targets based on full-time equivalent (FTE) staff and students as opposed to an absolute target (RC1).

Scope 3 emissions

TU scored highly in the Scope 3 emissions category of the carbon assessment (16/20). Indeed, the University is sector leading in terms of reporting having voluntarily submitted data to the 2013/14 EMR return for all Scope 3 components (HESA, 2014b). Furthermore, the University reported emissions from staff and student commuting, business travel, procurement, and waste, as an addendum to the CMP in 2013 (C05). TU does not measure and report emissions from inbound or outbound student air travel. Table 6.19 presents a breakdown of TU's GHG emissions for 2013/14 based on the EMR data and incorporating inbound student air travel emissions, estimated using the methodology from Appendix 12 and data from HESA (2015a). Scope 3 emissions accounted for 78.1% of total emissions in 2013/14. Procurement (other) was the largest source (40.9%) followed by inbound student air travel (17.9%), and Scope 2 emissions (16.8%). Given the year on year variability in construction related emissions, if they are excluded, inbound student air travel accounted for 18.6% of the footprint in 2013/14.

Table 6.19 Breakdown of TU's emissions in 2013/14

HESA EMR/Additional Reporting Category	Emissions Scope		t/CO_2e	% Footprint
HESA EMR [a]	Scope 1		3,928	5.1
	Scope 2		13,022	16.8
	Scope 3	Total	60,406	78.1
		Business travel	*1,945*	*2.5*
		Staff commuting	*3,702*	*4.8*
		Student commuting [c]	*5,880*	*7.6*
		Waste	*18*	*0.0*
		Water supply	*44*	*0.1*
		Wastewater treatment	*87*	*0.1*
		Procurement (construction)	*3,296*	*4.3*
		Procurement (other)	*31,625*	*40.9*
Additional		*Inbound student air travel* [b]	*13,809*	*17.9*
	Total		**77,356**	-

Note. (a) Data retrieved from HESA (2014b); (b) Inbound student air travel emissions were estimated using the methodology presented in Appendix 12; (c) Daily commute from term-time address to the University.

TU has adopted a sector-leading position and set a target to reduce Scope 3 emissions by 5% by 2020/21, from a 2012/13 baseline (C05). Inclusion of Scope 3 sources in the EMR was a significant factor for TU in engaging with Scope 3 (RC1). However, as financial savings have been a significant driver for carbon management at TU, justifying time spent on Scope 3 has been difficult (RC1). Furthermore, RC1 felt that there was no desire to push reporting of Scope 3 emissions by the funding councils, highlighting a perceived lack of support and drivers at a sector level. Nevertheless, the University plans to continue calculating Scope 3 emissions annually and to refine and make the methodologies as robust as possible going forward (RC1).

6.5.5 Institutional response to the Conflict: awareness but lack of action

The scale of the Conflict at TU is illustrated in Table 6.20, which presents a comparison of inbound student air travel emissions to Scope 1 and 2 emissions for 2013/14 and forecasts the potential changes in the magnitude of these emissions by 2020/21. This information was presented to RC1 during the interview. The 2020/21 scenario is based on the University achieving its Scope 1 and 2 reduction target and in the absence of an institutional target, assumes annual growth in international student numbers of 3.7% (DBIS, 2013). In 2013/14, inbound student air travel emissions were equivalent to 81% of Scope 1 and 2 emissions, rising to 166% in the 2020/21 scenario. Table 6.20 shows that overall emissions decrease by 2020/21 but this is contingent on TU achieving its Scope 1 and 2 reduction target, which is highly unlikely.

Table 6.20. TU's Scope 1 and 2 and inbound student air travel emission in 2013/14 and projected emissions to 2020/21

Emissions source		**Emissions (tCO_2e)**		
		2013/14		**2020/21**
Scope 1 and 2		**16,950**	**48% reduction below 2005/06 baseline by 2020/21**	**10,754**
Inbound student air travel	*EU and EEA*	*1,212*	3.7% increase in international student numbers per annum	*1,563*
	Other Europe	*143*		*184*
	RoW	*12,454*		*16,061*
	Total inbound student air travel	**13,809**		**17,808**
Total Scope 1, 2 and inbound student air travel emissions		**30,759**		**28,562**

Accounting for student air travel emissions

There is an acknowledgement and have been discussions about the Conflict at TU, however RC1 stated that, "…people quite quickly didn't want to discuss it because it's so awkward". Consequently, the University has not estimated the carbon impact of inbound and outbound student air travel and has no plans to in the near future. Nevertheless, RC1 stated that the University should "…at least account for it and at least monitor it" going forward. With regard to the calculation methodology, RC1 felt that data would not be too difficult to acquire and would not act as a barrier to accounting for these emissions.

RC1 indicated that coherent sector guidance and some control from HEFCE and Government in this area would provide clarity for HEIs, but felt that it was unlikely to happen. Furthermore, RC1 stated that this was probably not the view of the University, who would prefer to have complete freedom to make an internal decision on what course of action, if any, to pursue.

Responsibility for student air travel emissions

RC1 was unsure as to the extent of the University's responsibility for student flight emissions, stating that there are different approaches to arguing where these emissions lie, and even questioned whether the University should take any responsibility for the emissions:

> *…there are other trains of thought that would say that these aren't University emissions, these are perhaps private emissions, individuals' emissions (RC1).*

The uncertainty surrounding responsibility is a significant factor in the University not having an official stance on student air travel emissions at this moment in time (RC1).

Focusing specifically on outbound (study abroad) student air travel RC1 stated:

> *I think if people pay for it themselves then it's their footprint […] If the student is doing that journey and arranging it themselves and paying for it themselves then I think they should be responsible for that footprint (RC1).*

With regard to the concept of shared responsibility and allocating emissions amongst the various beneficiaries, RC1 thought that in theory it was a good solution, but questioned how viable such a complex approach would be in practice. Notwithstanding the debate as to where responsibility for student air travel emissions ultimately lies, and there is clearly significant uncertainty at TU, RC1 stated that, in their personal view, it is important to at least account for and monitor these emissions.

Mitigating student air travel emissions

There has been no direct action to mitigate the emissions from student air travel at TU, and current evidence suggests this is some way off. RC1 felt that the HE sector was at a tipping point and that going forward there would be more options to deliver education to international students without them having to travel to the UK. So much so that RC1 though that the overall international intake might increase but emissions might not increase, as much of this growth will be in students enrolled on TU's courses overseas. However, TU's internationalisation strategy specifically states that growth in international students coming to study in the UK is a priority as well as growing TNE (C02).

With regard to reducing the amount of air travel undertaken by students, restricting travel to long-distance destinations such as New Zealand and Australia was dismissed by RC1, given that at this moment in time, the University is unsure as to whether these emissions even belong to the University's carbon footprint.

In terms of prioritising engagement with international students for whom train travel would be viable alternative to air travel (i.e. students from Western Europe), RC1 felt this would be a sensible approach and an area which the sector as a whole could pursue. Much in the way that HEIs provide incentives for public travel schemes in their locality, the sector could provide a similar scheme for students on high speed rail around Europe, "…it's not beyond the realms of possibility that the HE sector could do that" (RC1).

With regard to carbon offsetting, while one department within the university has committed to offset business air travel emissions, RC1 doubted whether the University would ever consider offsetting student air travel emissions. Moreover, while RC1 recognised that offsetting has a place within a mitigation approach, they were sceptical about offsetting in general, arguing that it is all too easy for people to pay to offset and then continue business as usual (RC1).

Alternative compensatory activities

In terms of alternative carbon compensation schemes, RC1 considered this option to be greenwash, in that the University could just excuse its actions by doing something noble somewhere else no matter what the scheme entailed. RC1 stated that at least with offsetting, projects are accredited and there is some science around the actual accounting for a tonne of carbon. That said, RC1 was open to the idea of establishing a compensation fund and investing in certain schemes as long as they are quantifiable, e.g. carbon reduction projects on campus, but restated the University was a long way off making any commitments around carbon offsetting or compensation. Furthermore, the University would likely look at business travel or supply chain emissions rather than student air travel emissions, if it were to prioritise components of the Scope 3 footprint to put time in to (RC1).

6.5.6 Summary

TU is identifiable as a leader in carbon management, with a low degree of internationalisation in terms of inbound students but high in terms of TNE provision. While TU has had success in reducing its Scope 1 and 2 emissions, it is unlikely to achieve its reduction target. Consequently, the University is reviewing the absolute reduction target and considering intensity targets instead. However, as RC1 acknowledged, intensity targets do not necessarily result in absolute reductions and do not solve the problem of climate change. The University is therefore changing its reduction target and ambitions as opposed to increasing commitment to achieving its original target.

The University has accounted, reported and set targets for certain components of the Scope 3 footprint. However, this does not include emissions from inbound and outbound student air travel. The University is aware of the Conflict between the internationalisation and carbon management agendas, but is wary of engagement.

RC1 was uncertain as to whether the University had any responsibility for student air travel emissions, given that the student is paying and making the decision to come to study in the UK or participate in a study abroad programme. Notwithstanding issues surrounding responsibility, RC1 stated that the University should at least be accounting and monitoring these emissions, however current evidence suggests this is some way off.

6.6 Highfield University case study

6.6.1 Data sources and interviewees

The document search strategy identified 13 documents (Table 6.21). In addition, a face-to-face interview with the Director of Sustainability provided insight into the current and future response to the Conflict between the internationalisation and carbon management agendas.

Table 6.21. Data sources for HU case study

Code	Document/interviewee	Date
D01	Carbon Management Plan	2010
D02	Environmental Strategy	2010
D03	Strategic Plan	2010-2015
D04	Internationalisation Strategy	2012
D05	Strategic Plan	2015-2020
D06	Financial Statements	2014
D07	Facts and Figures	2014
D08	Carbon Management Plan Annual Report	2013/14
D09	Carbon Management Plan Annual Report	2012/13
D10	Carbon Management Plan Annual Report	2011/12
D11	University Environment Committee Meeting Notes	Apr-14
D12	University Environment Committee Meeting Notes	Oct-14
D13	Annual Sustainability Report	2012/13
RD1	Interview with Director of Sustainability	Jun-15

6.6.2 Highfield University context

HU is a large institution situated in the same geographical region as TU. With origins dating back to the late 18th century, HU was granted university status in the middle of the 20th century and is a member of the Russell Group of British research-intensive universities (Russell Group, 2016). HU has multiple campuses and is one of the largest HEIs in the UK by GIA (HESA, 2014b). The University has over nearly 3,500 academic staff and 30,000 students, with student numbers increasing by 1% between 2008/09 and 2013/14 (HESA, 2015b; HESA, 2015d). The University maintains a strong financial position based on strong student demand and research awards (D06). Tuition fees accounted for 44.3% of total income in 2013/14, with funding council grants accounting for 19.2% and research grants and contracts accounting for 18.4% (D06).

HU is in the top 30 universities in the Guardian league table (Guardian, 2016), and is in the top 100 universities in the 2016 QS World University Rankings (Top Universities, 2015a). In terms of research, the University has 0.9 research students per member of staff and ranked highly in the 2014 REF (top 30 for research quality and top 10 for research power), with 80% of research ranked either 'world-leading' or 'internationally excellent' (THE, 2014).

6.6.3 Internationalisation (Medium/High)

HU has established itself as an international institution, with international students accounting for 22.6% (Medium) of the student population in 2013/14 (which is below the sector average of 20.3%) (HESA, 2015a; HESA, 2015b). The University has a strong global presence with 11,000 students registered on courses overseas, equivalent to 33% (High) of students studying at HU in the UK, and a global community of more than 230,000 alumni (D07; HESA, 2014b; HESA, 2015a). Fundamental to the University's strong international standing has been the development of a number of overseas branch campuses (C-BERT, 2015), which are now well-established scholarly communities (D03).

The University is committed to maintaining and improving its global standing and reputation through international student and staff recruitment, increasing TNE activities, increasing and international teaching and research partnerships, internationalising the curriculum, and increasing the number of students participating in study abroad programmes (D03; D04).

Recruitment of international students and study abroad schemes

Table 6.22 presents the themes that emerged from the analysis of the documents and interview, regarding the drivers and motivations for international student recruitment and study abroad schemes.

Table 6.22. Drivers and motivations for recruitment of international students and study abroad schemes at HU (D03; D04; D05; D06; RD1)

Drivers and motivations identified	Documentation	Interviews
Financial	Income diversification	
Student experience and employability	Promote global citizenship	Promote global citizenship
	Contribute to a diverse and global society	
	Produce graduates prepared to face global problems	
	Development of intercultural competence	
	Build global networks	
	Maintain and enhance international character of the campus	
Reputational	QS World University Rankings	
	Enhance international reputation	

As stated previously, the University has a significant international student population (from 150 countries) and approximately 20% of students have some form of international experience each year (D04). The University recognises the importance of preparing its students for an increasingly globalised world and increasing international student and study abroad numbers is a strategic priority (D03; D05). While it can be inferred that international students are an important source of income for the University (accounting for 15% of total income in 2013/14 (D06), the financial benefits of international students in terms of income generation were not stated in the documentation. A further motivation for the recruitment of international students is to improve the University's reputation overseas, as measured by global league tables (D03). Indeed, one of the indicators within the QS World University Rankings methodology is based on the proportion of international students at the University (Top Universities, 2015b). The University has a portfolio of recruitment activities in place as it recognises the challenge of maintaining and increasing international student demand in the context of increasing competition for students from other universities in the UK and around the world (D05).

6.6.4 Carbon management (2:2/Weak)

Carbon assessment

Table 6.23 presents the result of the carbon assessment for HU, where overall engagement with carbon management achieves a 2:2 rating, with reduction progress rated as 'weak'.

Table 6.23. Carbon assessment results for HU

Category	Description	Score (%)
Environmental policy		
	Publicly available environmental policy	10/10
Leadership commitments		
	Carbon management a part of the corporate strategy	2.5/2.5
	Endorsement from executive leadership	2.5/2.5
Governance		
	The establishment of an environment (sustainability) team	10/10
Planning		
	Carbon reduction target (Scope 1 and 2)	4/10
	Interim target	5/5
	Access to funding	5/5
	Carbon management projects outlined to meet target	5/10
Reduction progress		
	Percentage reduction	0/20
Scope 3 emissions		
	Submitted Scope 3 data to EMR reporting system	5/6
	Scope 3 emissions included in the carbon management plan	0/9
	Initiatives to reduce the Scope 3 footprint	4/5
Monitoring and reporting		
	Annual monitoring of emissions	2.5/2.5
	Publicly available annual progress report	2.5/2.5
TOTAL		**58% (2:2)**

Drivers and motivations for carbon management

The drivers and motivations for carbon management at HU (Table 6.24) include sector targets, financial, legislative compliance, reputational and moral responsibility (D01; D03; RD1). Furthermore, senior leadership at the University have committed to carbon management in terms of both human (establishment of a sustainability directorate) and financial resources (investment of over £8 million in carbon reduction projects) (RD1). The

University recognises it has a responsibility to the environment and that the HE sector is key in helping to make the transition to a low-carbon economy (D03). Moreover, the University recognises that potential students are starting to factor in environmental performance when choosing where to study and so set about positioning itself as a leading 'green university' within the sector (D03).

Table 6.24. Drivers and motivations for carbon management at HU (D01; D03; RD1)

Drivers and motivations identified	Documentation	Interviews
Sector and national targets	Sector targets	Sector targets
	UK Government targets	
Leadership		Leadership commitment
Financial	HEFCE linking capital funding to carbon reduction performance	
Legislative	CRCEES	
Reputational	Environmental performance to become important element of student choice	
	Leading 'green University'	
	PPUL	
Moral responsibility	To help make the transition to a low-carbon society	
	Responsibility to the environment	

Scope 1 and 2 carbon reduction target and progress

The University set a target to reduce Scope 1 and 2 emissions by 40% by 2020 from a 2005/06 baseline (D01). Thus, HU's Scope 1 and 2 reduction target does not meet the HEFCE reduction target (43%), but exceeds the average reduction target for UK HEIs (35.2%) (HEFCE, 2010a; HESA, 2014b).

HU received 0/20 for carbon reduction progress. Indeed, Scope 1 and 2 emissions increased by 1% (Weak) between 2005/06 and 2013/14 (HESA, 2014b). Carbon intensity on a per student basis remained level at 1.9 tCO_2e in both 2005/06 and 2013/14, this is significantly higher than the 2013/14 sector average of 1.2 tCO_2e/student (HESA, 2014b; HESA, 2015b). Nevertheless, RD1 argued that the CMP had resulted in a 9,000 t/CO_2e annual saving compared to a business as usual scenario, stating that:

…whilst we've made some significant reductions, we have only made a modest absolute reduction because of the growth of the University and increased investments in new build projects in particular, and ever increasingly energy intensive buildings so, that's kind of been offset I suppose by the CMP (RD1).

Furthermore, RD1 stated that that the University's research activity and outputs contribute to the sustainability agenda, where that contribution outweighs its Scope 1 and 2 emissions:

We've done a piece of work as part of our sustainability strategy to try and capture all of the activity that we undertake and in reality it dwarfs what our Scope 1 and 2 emissions as they probably are, in terms of the research outputs that we have…

The University's approach to carbon management broadly covers three areas; energy efficiency interventions, behavioural change initiatives, and renewable/low-carbon energy (D01; D08). Renewable energy in particular was one of the cornerstones of the CMP and the University has successfully installed photovoltaic (PV) panels, solar water heating, air-, lake- and ground-source heat pumps and wood pellet-fired boilers. HU had plans for additional large-scale renewable projects, however these failed to receive planning permission and coupled with increased investment in energy intensive buildings and higher than anticipated growth in energy intensive activities, suggests that the current reduction target is now highly unrealistic (D08). Thus, the CMP is in the process of being reviewed to re-establish reduction targets and an associated delivery plan (D08). The University is therefore changing its reduction target and ambitions as opposed to increasing efforts to achieving its original target.

Scope 3 emissions

HU scored 9/20 in the Scope 3 emissions category of the carbon assessment. The University voluntarily submitted data to the 2013/14 EMR return for all Scope 3 components with the exception of waste. Currently, the University does not include Scope 3 emission in its CMP. However, the CMP is currently being revised to account for the growth the University has experienced over the last five years and this revised plan will include certain elements of the Scope 3 footprint, but not all. RD1 stated that:

> *…rightly or wrongly, we've taken a sort of financial control approach to our CMP and what I mean by that is, the scope of our CMP is largely limited to the things that we directly purchase (RD1).*

Thus, GHG emissions from procurement and business travel are included, while emissions from staff/student commuting and inbound/outbound student air travel will not be included. Nevertheless, the University has implemented a number of GHG reduction initiatives in relation to Scope 3 emissions not included under a financial control approach (D13).

Table 6.25 presents a breakdown of HU's GHG emissions for 2013/14 based on the EMR data (HESA, 2014b) and incorporating inbound student air travel emissions, estimated using the methodology from Appendix 12 and data from HESA (2015a). Scope 3 emissions accounted for 67% of total emissions in 2013/14. Procurement was the largest source of emissions (30.9%) followed by Scope 2 emissions (24.2%), and inbound student air travel (16.0%).

Table 6.25. Breakdown of HU's emissions in 2013/14

HESA EMR/Additional Reporting Category	Emissions Scope		t/CO_2e	% Footprint
HESA EMR [a]	Scope 1		16,841	8.9
	Scope 2		45,881	24.2
	Scope 3	Total	127,207	67.0
		Business travel	*4,296*	*2.3*
		Staff commuting	*4,697*	*2.5*
		Student commuting [c]	*3,452*	*1.8*
		Waste	*Not reported*	-
		Water supply	*293*	*0.2*
		Wastewater treatment	*559*	*0.3*
		Procurement (construction)	*24,884*	*13.1*
		Procurement (other)	*58,601*	*30.9*
Additional		*Inbound student air travel* [b]	*30,425*	*16.0*
	Total		**189,929**	**-**

Note. (a) Data retrieved from HESA (2014b); (b) Inbound student air travel emissions were estimated using the methodology presented in Appendix 12; (c) Daily commute from term-time address to the University.

6.6.5 Institutional response to the Conflict: awareness but lack of action

The scale of the Conflict at HU is illustrated in Table 6.26, which presents a comparison of inbound student air travel emissions to Scope 1 and 2 emissions for 2013/14 and forecasts the potential changes in the magnitude of these emissions by 2020/21. This information was presented to RD1 during the interview. The 2020/21 scenario is based on the University achieving its Scope 1 and 2 reduction target and in the absence of an institutional target, assumes annual growth in international student numbers of 3.7% (DBIS, 2013). In 2013/14, inbound student air travel emissions were equivalent to 49% of Scope 1 and 2 emissions, rising to 96% in the 2020/21 scenario. Table 6.26 shows that overall emissions decrease by 2020/21 but this is contingent on HU achieving its Scope 1 and 2 reduction target, which is highly unlikely.

Table 6.26. HU's Scope 1 and 2 and inbound student air travel emission in 2013/14 and projected emissions to 2020/21

Emissions source		Emissions (tCO_2e)		
		2013/14		**2020/21**
Scope 1 and 2		**62,721**	**40% reduction below 2005/06 baseline by 2020/21**	**40,944**
	EU and EEA	*2,689*	3.7% increase in international student numbers per annum	*3,468*
	Other Europe	*482*		*622*
	RoW	*27,255*		*35,148*
	Total inbound student air travel	**30,426**		**39,238**
Total Scope 1, 2 and inbound student air travel emissions		**93,147**		**80,182**

Accounting for student air travel emissions

There is an awareness and acknowledgement of the Conflict at HU, however, it has not estimated the carbon impact of inbound/outbound student air travel and it is not something the University is actively considering at this stage (RD1). One of the greatest concerns for RD1 in terms of accounting for inbound/outbound student air travel emissions was the reliability of the data, specifically the number of flights made by students during the academic year. RD1 stated, "…our ability to accurately account for it [student air travel] is extremely limited". Moreover, RD1 questioned whether the University could ever collect accurate data given that there are thousands of students enrolled at the University making individual decisions every day of the year, further adding:

> *We would be making some fairly sizeable assumptions if we simply assume that a student that was from I don't know, Shanghai, but was going to study in [UK city] for a year would make one journey from Shanghai to [UK city] and another one back. You know they might make ten journeys, they might make two, they might make one, they might never go back (RD1).*

Indeed, the inability to accurately account for student air travel emissions was cited as a reason for the University focusing on other areas of the Scope 3 footprint:

There's things that we know we can measure better and tackle quicker in other areas of our carbon management plan (RD1).

Furthermore, RD1 was of the opinion that the ability for the University to influence student air travel was limited:

...there is an important differentiation between emissions that the university, or any university, can directly influence and those which you can't and then it becomes a much more sort of influencing role (RD1)

Nevertheless, RD1 stated a willingness to obtain a better understanding of actual travel behaviour and if the challenges of accurately estimating the impact of student air travel could be overcome, "…we'd be very interested in understanding how significant that was".

Responsibility for student air travel emissions

In terms of determining attributable student air travel emissions, RD1 was unsure as to the extent of the University's responsibility, arguing:

It's a tricky one because I think this is an important area but those decisions about how many flights are taken, where those flights are taken, what routes they're taking and what planes they're on, all those sorts of decisions, are not taken by the University, they're taken by the individual (RD1).

Furthermore, RD1 questioned whether the additional trips taken during the academic year are really a function of the University:

…a student making six trips, three trips there, six journeys there and back, between Shanghai and the UK […] is that part of our responsibility as oppose to the student, who may have been making the same number of trips but for leisure purposes to other parts of the world.

Nevertheless, RD1 believed that the University might choose to take some degree of responsibility for the flights taken for the sole purpose of study (i.e. the flight taken at the beginning and end of the study period), but not for flights that are optional (i.e. flights taken during the academic year).

RD1 stated that the emissions are important and that the University would like to understand the true carbon impact of student air travel. However, while there is still a significant policy decision to be made at HU regarding responsibility for student air travel emissions, RD1 felt that they would fall outside the scope of the revised CMP.

RD1 acknowledged that the scale of the Conflict would most likely increase in the future and stated that, "I don't think it's going to influence our international policy at all". The ambition of the University is that it will continue to provide education to international students, "…if anything, probably in greater numbers not less" (RD1). RD1 stated that fundamentally, there is a policy issue within the UK HE sector, which from a financial perspective, is increasing the attractiveness of overseas students versus UK students.

Mitigating student air travel emissions

RD1 noted that the University has sought to educate and influence student behaviour through online sustainability learning programmes, however there has been no direct action to mitigate/compensate the emissions from student air travel at HU and current evidence suggests this may be a long way off. With regard to carbon offsetting, the University has made carbon offsetting available for staff business travel but has not considered extending it as a formal university initiative to its students. RD1 stated that the University had not actively considered offering offsetting initiatives for students and at this moment in time was not ruling it in or out.

In terms of alternative carbon compensation activities, RD1 believed it was an interesting idea but thought it unlikely that the University would directly compensate for student air travel emissions stating that what would likely happen is they would end up ring fencing part of a budget that already existed.

Nonetheless, RD1 stated that before a discussion on offsetting/compensation can happen, the University has to be able to capture the data in order to have a meaningful estimation of the scale of the carbon impact of inbound/outbound student air travel.

6.6.6 Summary

HU is identifiable as a highly international institution and a University that has been proactive towards carbon management but struggled to make absolute emission reductions. The University is aware of the Conflict between the carbon management and internationalisation agendas but has taken no action to curb the environmental impacts of student air travel, thus adopted a business as usual approach with emissions likely to increase in the future in line with its strong internationalisation agenda. Moreover, there is uncertainty as to how much responsibility the University should take and RD1 stated that student air travel emissions were unlikely to be included in the CMP. That said, the Director of Sustainability stated a willingness to understand the significance of this source of emissions going forward.

6.7 Cross-case comparison and conclusions

In this section, a cross-case analysis of all four HEIs allowed the findings to be evaluated and discussed. Table 6.27 presents a synthesis of the main findings relating to the Objectives and Research Questions.

Table 6.27. Summary of the main findings from each case study

Domain	Findings			
	Saints University	**Bank University**	**Talbot University**	**Highfield University**
Drivers and motivations for international student recruitment/study abroad	Financial; student experience and employability; and increasing brand awareness	Financial resilience; student experience and employability	Financial; student experience and employability	Student experience and employability; QS World University Rankings; maintain international character of campuses
Drivers and motivations for carbon management	Financial; legislative; sector and national targets; reputational; environmental; moral responsibility; leadership; and the Estates Masterplan	Financial; legislative; sector and national targets; reputational; environmental; moral responsibility; Campus Masterplan; and risk management	Financial; legislative; sector and national targets; reputational; environmental; leadership; and energy security	Financial; legislative; sector and national targets; reputational; moral responsibility; and leadership

Carbon reduction progress	Achieved a 21% reduction in Scope 1 and 2 emissions but looks unlikely to meet its 50% reduction target by 2020/21 due to an increase in the size of the operational floor area of the estate and student accommodation	Achieved a 4% reduction in Scope 1 and 2 emissions but looks highly unlikely to achieve its 40% reduction target by 2020/21 due to increased research activity and growth in the estate. In the process of reviewing reduction target	Achieved an 18% reduction in Scope 1 and 2 emissions but looks unlikely to achieve its 48% reduction target by 2020/21. This is due to failure to achieve planning permissions for large-scale renewable energy installations, and growth in the estate. In the process of reviewing reduction target	Scope 1 and 2 emissions increased by 1% meaning the University will not achieve its 40% reduction target by 2020/21. This is due to failure to achieve planning permissions for large-scale renewable energy installations, and increased investments in new energy intensive buildings. In the process of reviewing reduction target
Engagement with Scope 3 emissions (excludes student air travel)	Submitted data to the 2013/14 HESA EMR for all Scope 3 components. All components are included in the CMP in addition to inbound student air travel and UK students home to term-time address travel. Set reduction targets for all Scope 3 components with the exception of inbound student air travel	Submitted data to the 2013/14 EMR for all Scope 3 components. However, Scope 3 emissions will not be included in a revised CMP	Submitted data to the 2013/14 EMR for all Scope 3 components. Scope 3 sources are included in the CMP along with reduction targets	Submitted data to the EMR for all Scope 3 components except waste. The Scope of the revised CMP will be largely limited to emissions from procurement and staff business travel
Extending the boundary to account for inbound/outbound student air travel emissions	Has estimated and reported on inbound student air travel emissions; used HEFCE assumptions regarding flight frequency but in future to increase the robustness of the estimate, will use results of an annual student survey	The University has not estimated emissions from student air travel. Lack of institutional support for inclusion of student air travel emissions within the operational boundary. It is something the Head of Environmental Sustainability will be raising in the future	The University has not estimated emissions from student air travel. The Environmental Manager felt the University should at least be accounting for, and monitoring these emissions	The University has not estimated emissions from student air travel. The Director of Sustainability stated a willingness to understand the significance of these emissions
Responsibility for student air travel emissions	The University considers itself to hold some responsibility for student air travel emissions	The University has not considered the issue of responsibility for student air travel emissions	Uncertainty over the extent of the University's responsibility, questioning whether they are actually the responsibility of the student. Thought that in theory, shared responsibility was a good solution but questioned how such an approach would work in practice	Unsure as to the extent of the University's responsibility as all decisions are made by the student. Thought that the University may choose to take some responsibility for flights made at the start and end of the academic year but questioned whether the University was responsible for additional flights made during the academic year

Mitigating and compensating for student air travel emissions	Committed to sector-leadership in the provision of online education; promoting airlines with modern, more fuel efficient fleets; did not think purchasing carbon offsets was the right approach; investing in compensatory actions	No actions to mitigate emissions. Did not think carbon offsetting was the right approach; have had discussions about an internal carbon compensation fund but unlikely to directly link to student air travel emissions	No actions to mitigate emissions. Unlikely to consider offsetting student air travel emissions. Thought some of the carbon compensation schemes were greenwash but was open to schemes with quantifiable reduction. Stated that the University was a long way off making any commitments	No actions to mitigate emissions. Not considered carbon offsetting, but have not ruled it in or out. Thought carbon compensation schemes were a good idea, but it is unlikely that the University would directly compensate for student air travel emissions

6.7.1 Drivers and motivations for international student recruitment and study abroad

This section contributes to addressing Objective 2 (RQ3), which was to evaluate the dominant motivations for UK HEIs to recruit international students and promote study abroad for UK students.

With respect to international students, while only one HEI (with currently very low international student numbers) had set a specific recruitment target, all HEIs identified the importance of international students and intended to increase numbers. While a variety of drivers and motivations for international student recruitment emerged from the case studies including enhancing the student experience, increasing brand awareness, and enhancing international status, the financial benefits are the primary drivers. International students are identified by the HEIs as an important source of income, and a way of increasing financial resilience through income diversification going forward. Indeed, financial forecasts produced by HEFCE (2015) to 2017/18 show that UK HEIs are becoming increasingly reliant on income from non-EU international students to remain financially sustainable. The results correspond to the findings of Bolsmann and Miller (2008), in their study of the motivations for international student recruitment at four English HEIs. Knight (2011) notes that while HEIs may state the primary motivation of recruitment is to internationalise the campus, the reality is that it is masking other motivations such as revenue generation or desire for improved rankings in global league tables.

All of the HEIs were looking to increase study abroad numbers going forward in order to enhance the student experience and employability of graduates. All of the HEIs felt it was important for graduates to have global experiences and perspectives, to develop intercultural competence, and be able to compete and operate in a diverse, global labour market. Indeed, previous research has revealed that students who study abroad gain increased levels of cross-cultural interest, greater intercultural proficiency and become more globally minded than students who remain in the traditional campus setting throughout their degree (Carlson and Widaman, 1988; Clark et al., 2009). In addition, SU felt that students with global experiences could stimulate positive changes for the local economy. This is especially important for SU given that a high percentage of its students come from and return to the same region in which the University is located.

6.7.2 Institutional engagement with the carbon management agenda

This section contributes to answering Objective 2 (RQ4), in exploring institutional engagement with the carbon management agenda.

Drivers and motivations for carbon management

A range of drivers and motivations for carbon management emerged from the case studies. Financial drivers were prominent at each of the HEIs, in particular the CRCEES, rising energy costs and HEFCE linking capital funding to reduction progress. At SU and BU, the focus on carbon management coincided with estate redevelopment thus presenting an opportunity to incorporate significant reductions within Estate Master Plans. In addition, all of the HEIs highlighted the reputational benefits of proactive engagement with carbon management, thus 'enlightened self-interest' was a significant motivation. Moreover, all HEIs were aware of the potential negative impacts on their reputation particularly given the increasing public scrutiny of the HE sector and the increasing prominence of environmental league table such as the PPUL.

Sector leadership emerged as a significant driver at SU, TU and HU, with all performing well in the 2015 PPUL. Indeed, SU and TU are positioned in the top 20, while HU achieves a top 50 position, placing it as one of the top Russell Group HEIs.

Each of the HEIs alluded to moral responsibility in some form stating that it is the right thing for the sector to do and that the sector should be at the forefront of efforts to make the transition to a low carbon economy.

Scope 1 and 2 carbon reduction progress

Every UK HEI has set a Scope 1 and 2 emission reduction target and while these are a key step towards delivering environmental improvement, it is important that they are realistic (Robinson et al., 2015). The targets set by the HEIs in this study look to have been extremely ambitious and it is unlikely that any will achieve the target they originally set, despite both SU and TU (the post-1992 HEIs) delivering significant reductions in comparison to the sector average.

The Russel Group HEIs (BU and HU) have struggled to achieve absolute reductions in emissions, and attributed this to a number of factors: failure to attain planning permission for large-scale renewable energy installations, estate growth and an increase in energy-intensive research activity. The model presented in Figure 6.2 demonstrates the concerns present at each of the HEIs regarding reputational risks associated with organisational functions like research activity and accompanying carbon consequences. Moreover, the model demonstrates the reputational enhancement associated with a low-carbon HEI or making a strong indirect contribution to a low-carbon society. A number of strategies for reputational risk management emerged from the case studies and these are also presented in the model and discussed further in the rest of this section.

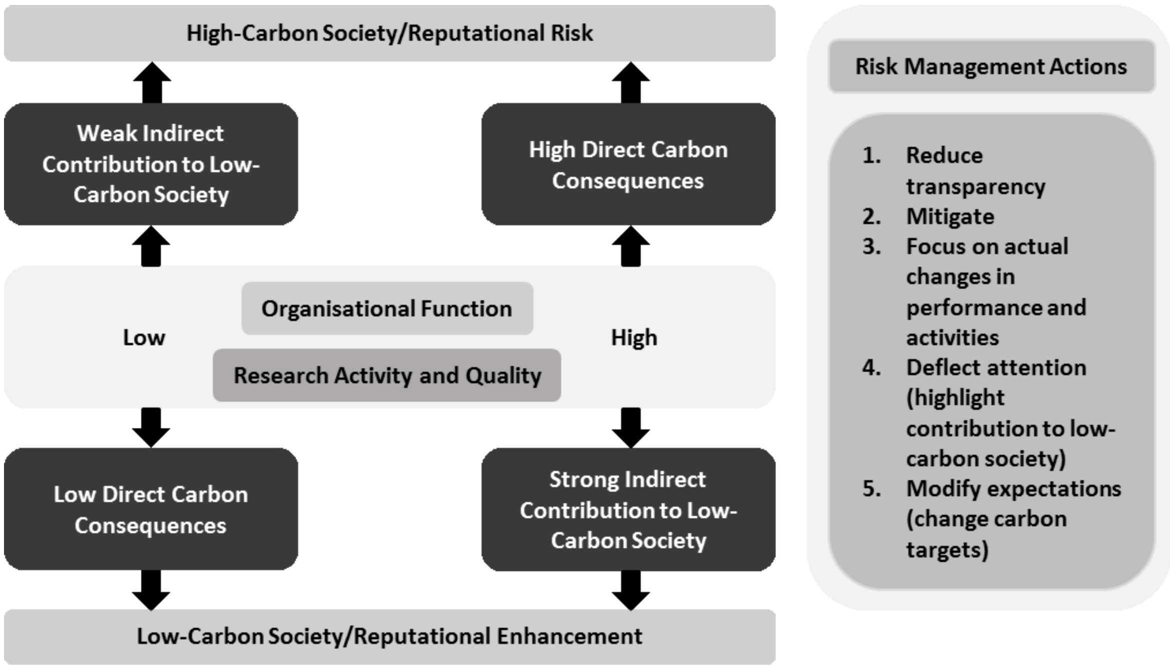

Figure 6.2. Model demonstrating the link between research activity and carbon/reputational consequences and risk management actions

It could be suggested that it was because of concerns of reputational risk that BU decided to boycott the PPUL in 2015 in an attempt to reduce its credibility as a driver of sustainability and carbon management, and to reduce transparency. Indeed, many research-intensive and older HEIs have voiced concerns in the past that the PPUL does not distinguish between them and the more modern HEIs in the sector (Guardian, 2015). HEIs will act if the risk to their reputation becomes too great to ignore and increasing exposure with transparency afforded by the PPUL is seen to be a contributory factor. In this case, a logical move is to remove oneself from PPUL assessment while simultaneously questioning the validity and legitimacy of that assessment.

Lindblom (1994) states that when seeking legitimation organisations may seek to inform stakeholders about (actual) changes in the organisation's performance and activities in response to recognition that a "legitimacy gap" arose from an actual failure of performance of the organisation. Indeed, in justifying poor performance and in a sense, to repair legitimacy (Suchman, 1995), HU alluded to a relative saving of 9,000 tCO_2e compared to a business as usual scenario. Furthermore, Lindblom (1994) argues that organisations may seek to manipulate perception by deflecting attention from the issue of concern to other matters. This aligns with what Benoit (1995) refers to as 'bolstering' in his typology of image restoration strategies. Both BU and HU argued that research activity is often ignored when assessing sustainability and carbon management performance. Indeed, RD1 (HU) stated that the impact of its research probably dwarfs the Scope 1 and 2 carbon footprint, suggesting that HEIs are 'special cases' in comparison to other sectors of the economy and that more emphasis should be placed on sustainability research when benchmarking HEIs. Thus, these HEIs argue that in order for the sector to help make the transition to a more sustainable, low-carbon society, research quality and activity will need to increase, which in turn will make it more challenging to reduce absolute emissions (Figure 6.2). This is not dissimilar to the case being made by the Information Technology (IT) sector; the difference between Green IT and IT for Green. Green IT refers to the IT sector reducing the use of toxic substances, consumption of natural resources and carbon emissions, while IT for Green is the potential contribution of IT to reducing the carbon impact of other sectors of the economy (Faucheux and Nicolaï, 2011). The argument made by the IT sector is that the potential of IT for Green significantly exceeds the carbon impact of the sector itself, where as to achieve this absolute emissions associated with IT will increase.

BU, TU and HU are in the process of reviewing their CMPs with a view to setting less ambitious targets, for example, TU is considering the use of relative or intensity targets (e.g. tCO_2e/FTE staff) over absolute targets. However, relative targets allow for growth in emissions and do not solve the problem of climate change.

Engagement with Scope 3 emissions

In terms of reporting Scope 3, SU, BU and TU scored highly in the carbon assessment, given that they have included some Scope 3 elements in their CMPs and reported against all Scope 3 elements in the 2013/14 EMR (HESA, 2014b). HU reported against all the Scope 3 elements in the EMR with the exception of waste and although the University does not currently include Scope 3 emissions within its CMP, it plans to incorporate certain emissions in a revised CMP. BU on the other hand has decided to not include and set targets for Scope 3 in their revised CMP. The Environment Manager stated they would like to see Scope 3 included but there is lack of senior leadership support at this moment in time. The University may be wary of doing so given its experience with Scope 1 and 2 emissions and concerns regarding reputational damage arising from missing targets. Conversely, while senior leadership support is identifiable as a barrier to engagement with Scope 3 emissions at BU, at SU and TU, senior leadership support has been a significant factor in proactive engagement. Moreover, in keeping with SU and TU's position of wanting to be at the forefront of the sustainability and carbon management agendas, both have set targets for the Scope 3 elements within their CMPs. That said, the Environment Manager at TU stated that it was difficult to justify increasing time and resources on mitigating Scope 3 emissions and identified the lack of direct financial benefits as a barrier.

All of the HEIs are engaging in activities to mitigate elements of the Scope 3 footprint, particularly student and staff commuting, procurement and waste. Respondents from BU and HU noted that mitigation efforts have primarily focused on sources of emissions they feel they can influence most significantly, e.g. procurement.

A critical theme to emerge from the cases was the need for coherent sector and Government guidance on Scope 3 emissions. Both BU and TU felt there was no desire to push reporting of Scope 3 from HEFCE, which was making justifying time spent on Scope 3 more challenging.

6.7.3 Awareness and willingness to engage with the Conflict

This section contributes to addressing Objective 2 (RQ5), which was to critically appraise institutional awareness of and level of engagement with the Conflict.

Figure 6.3 shows the motivations, success factors and barriers to engagement with Scope 3 emissions in general and the Conflict in particular.

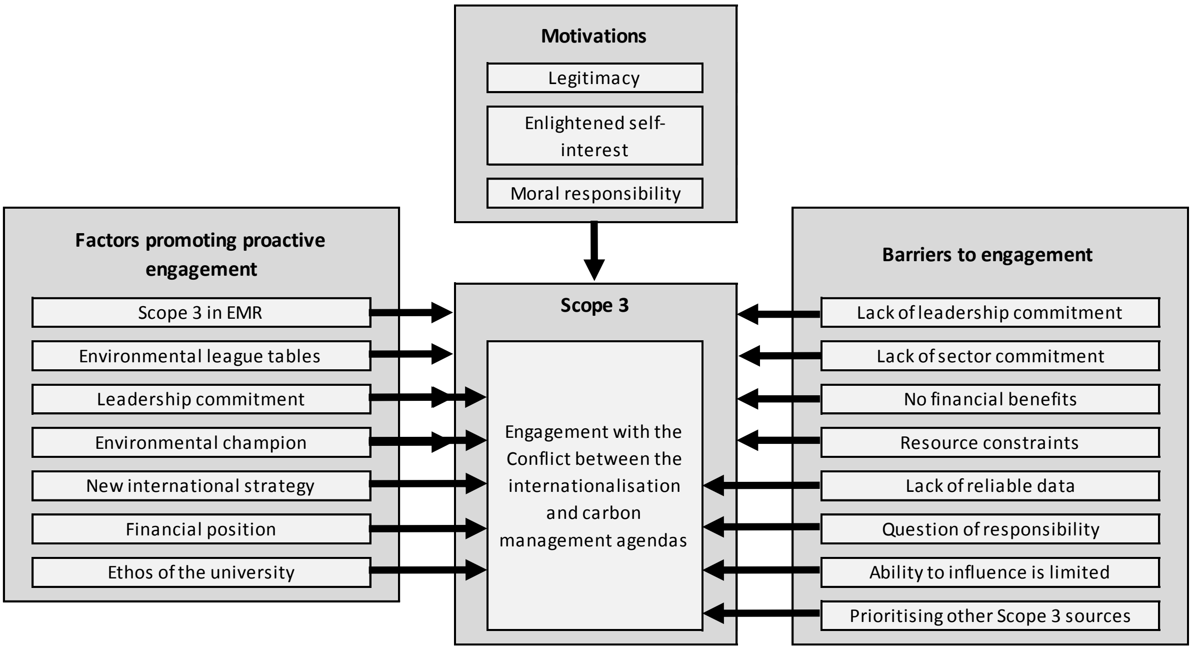

Figure 6.3. Motivations, success factors and barriers to engagement with Scope 3 emissions and the Conflict identified from the analysis of case studies

The findings indicate that every HEI was aware of the Conflict between the carbon management and internationalisation agendas, however only SU had demonstrated proactive engagement in terms of accounting, reporting and compensating for student air travel emissions, and thus is identifiable as an outlier case. Nevertheless, SU, in addition to the other case studies, is still pursuing the internationalisation strategy and GHG emissions from inbound and outbound student air travel will increase if targeted growth is achieved. For all the HEIs, the income from international students is vitally important and for BU and HU, having a large international student population is critical to their standing and credibility as 'global' institutions. Thus, in each of the cases, the benefits of the internationalisation agenda are perceived to outweigh the additional induced GHG emissions.

The difference between SU and the three other cases is that it has acknowledged this induced carbon, and demonstrated proactive engagement. This commitment is in keeping with its position of wanting to be at the forefront of the sustainability/carbon management agenda and carve out its own niche marketing opportunities and unique selling point

(Barth, 2013). In an increasingly competitive student market, HEIs are having to differentiate themselves from other institutions in order to create a competitive advantage and attract students (Chapleo, 2005; Wæraas and Solbakk, 2009). BU and HU, while stating reputation as a motivation for sustainability and carbon management, already have unique selling points and a niche market built upon the foundations of their research activities, international status and Russell Group membership.

The findings from SU indicate that the presence of an environmental champion and commitment from senior leadership were pivotal in proactively engaging with the Conflict, aligning with the literature (Clugston and Calder, 1999; Ferrer-Balas et al., 2008; Ralph and Stubbs, 2014). Moreover, SU has recently reviewed its internationalisation strategy and recognises that emissions from student air travel will increase in line with new international student recruitment and study abroad targets posing a reputational risk to the University. SU has foreseen the potential risk and emerging challenge associated with student air travel emissions and, as a strategy to maintain legitimacy (Suchman, 1995), and arguably to mitigate larger financial risks, has proactively engaged by compensating for inbound student air travel emissions through an educational fund. Thus, the financial position of the University was an additional factor in engaging with the Conflict.

For TU and HU, lack of engagement with student air travel emissions links to issues surrounding whether or not they are actually the responsibility of the individual as opposed to the University. Furthermore, at HU, lack of reliable data concerning flight frequency was perceived to be a barrier to accounting. However, this view was not shared by TU, who felt reliable data could be acquired relatively easily, or SU, who have incorporated questions on intended travel behaviours in the annual online enrolment process. At BU, while discussions regarding accounting for student air travel emissions had taken place, the University has not accounted and does not plan to account in the short term. The focus at BU has been on areas of the carbon footprint where it feels it can have a visible impact and influence. Likewise, the Director of Sustainability at HU felt that the University had a limited ability to influence student air travel emissions and as with BU, HU is focusing on areas of the CMP it can measure more accurately, see visible reductions in and tackle quicker.

Regardless of each of the HEIs' position towards inbound and outbound student air travel emissions, each interviewee stated a willingness to account for these emissions, however, current evidence suggests this may be some way off. At the institutional level, only SU has committed to engaging with student air travel emissions through accounting and funding compensatory activities. Therefore, there is an attitude-behaviour gap with regard to institutional responses to the Conflict, given that all are aware of the impact of air travel, but as of yet, the majority have not engaged with it.

6.7.4 Mitigating and compensating for student air travel emissions

This section contributes to addressing Objective 3 (RQ6 and RQ7), which was to assess perceptions of responsibility for student air travel emissions and evaluate preferences for potential mitigation and compensation options.

There were varied positions adopted by the HEIs with regard to responsibility for student air travel emissions. SU considers itself at least in part responsible for the induced carbon resulting from its internationalisation strategy, and has engaged in compensatory actions. Conversely, BU has not engaged with student air travel emissions and has not considered issues of responsibility, electing instead to focus on areas of carbon emissions where it can exert a greater degree of influence.

There is a degree of uncertainty at both TU and HU and the common theme to emerge from these cases was whether the emissions are actually the responsibility of the individual given that they are making the decision to come to the UK to study and deciding how many times they will fly home during the academic year. That said, RD1 believed that HU might choose to take some degree of responsibility for the flights taken for the sole purpose of study, but not for any additional flights taken during the year.

In terms of mitigating student air travel emissions, TNE was identified by SU and TU as a less carbon intensive way of pursuing the internationalisation agenda. Indeed, RC1 (TU) went as far to say that while the number of registered international students at TU may increase in the future, emissions might not, because of this transition to TNE provision. However, as found in Chapter 5, TNE is not fully substitutable for studying for a full degree in the UK and even if this mode of delivery were pursued, substantial emissions from air travel would likely remain.

In terms of options to reduce emissions from student air travel, SU has committed to promoting airlines with modern, more fuel-efficient aircraft (e.g. easyJet's (2016) carbon emissions per passenger kilometre in 2014 were 81.1g, while British Airways' (2015) were 101.1g). The Environmental Manager from TU discussed the option of restricting air travel to long-distance destinations but indicated that the University was unlikely to take this step, given that it is currently unsure as to whether the emissions are their responsibility. RC1 (TU) believed that the sector could incentivise train travel between the UK and Western Europe, much in the same way that HEIs provide incentives for public transport in their locality.

While HU had not considered offsetting, neither ruling it in or out, interviewees from SU, BU and TU expressed their view that offsetting was not the correct approach to reconciling the Conflict. The prominent themes to emerge regarding issues associated with offsetting included:

- **Offsetting does not tackle the root of the problem:** offsetting allows HEIs to continue business as usual. Students will continue to fly and offsetting can delay actions to avoid/reduce this travel.
- **No intrinsic link to the HEI:** most offsetting schemes occur in developing countries and as RA1 (SU) stated, "…it's almost like paying a tax and you don't see the benefit of that tax".

However, with respect to offsetting not tackling the root of the problem, one could argue that HEIs are planning to increase international and study abroad student numbers and are not engaging with initiatives to reduce or avoid air travel, leaving offsetting or compensation as the only options. There was evidence of departmental offsetting at each of the case study HEIs, highlighting its general acceptability within these institutions as a mitigation option, particularly in cases (as identified by RC1) where no other options are available. Thus, it could be suggested that the reason for BU and TU not considering offsetting student air travel emissions as a mitigation option is that they do not believe the emissions are their responsibility.

While all respondents thought carbon compensation schemes were of value, BU and HU did not think they would directly link certain compensatory actions to student air travel emissions. SU, already identified as an outlier case, was the only HEI to have invested in compensatory actions in keeping with its position at the leading edge of the sustainability and carbon management agenda. RC1 (TU) thought some of the schemes, including investing in an educational fund as SU is doing, could be dismissed as 'greenwash' and would only be interested in schemes that provided quantifiable reductions. To overcome scepticism it is important that carbon compensation schemes are credible. Indeed, at SU, the money used to compensate for student air travel emissions is ring fenced from the energy budget and so energy savings resulting in Scope 1 and 2 reductions, will need to be made.

6.8 Chapter summary

This chapter sought to critically appraise institutional awareness of and willingness to engage with the Conflict between the internationalisation and carbon management agendas (Objective 2 - RQ3, RQ4 and RQ5), assess perceptions of responsibility for student flight emissions, and evaluate preferences for potential mitigation and compensation options (Objective 3 - RQ6 and RQ7). The findings of this chapter show how important the recruitment of international students and study abroad schemes are to HEIs, motivated by the financial benefits and enhancement of the student experience and employability. All of the interviewees were aware of the Conflict between the internationalisation and carbon management agendas and felt it was important to understand the size of the carbon footprint from student air travel. However, only SU demonstrated proactive engagement at the institutional level in accounting and compensating for inbound student air travel emissions, in keeping with its position at the leading edge of the sustainability and carbon management agenda. For the remaining HEIs the focus was on other areas of the carbon footprint and they appear to be a long way from making any commitments with regard to mitigating and/or compensating for student air travel emissions.

This chapter has revealed a number of interesting themes, however it has a limited sample of case study HEIs and during the coding process it became clear that theoretical saturation had not been reached (Urquhart, 2013), with new codes emerging and no dramatic tail-off across the cases (Figure 6.4).

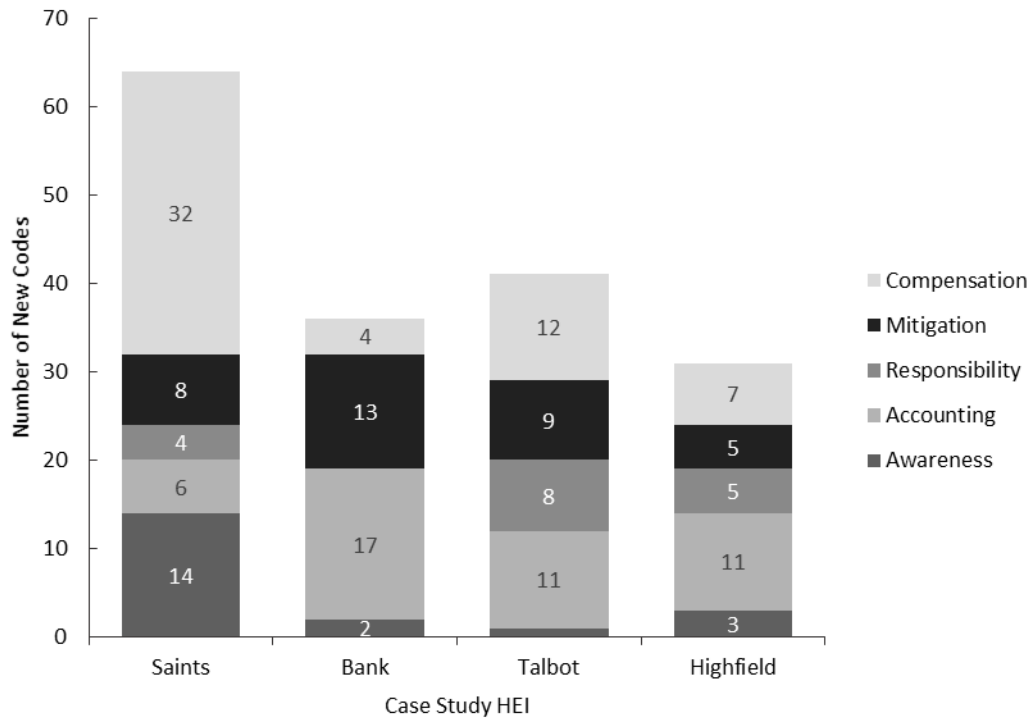

Figure 6.4. Number of new codes emerging from each case study

This suggested that further investigation was needed. Thus, replication logic (Eisenhardt, 1989; Yin, 2014) was used to corroborate, validate and refine the emerging themes with new evidence from four additional verification cases. Analysis of additional cases enhanced the generalisability of findings to other contexts.

While data collection for the four verification cases covered all the Objectives and Research Questions, specific attention was given to the following emergent themes from the in-depth cases:

- Financial resilience as the main driver for internationalisation in the UK HE sector.

- The risk management actions employed by HEIs in response to the reputational risks associated with various organisational functions and resulting carbon consequences, these included (see Section 6.7.2):
    - Reducing transparency
    - Reporting on actual changes in performance and activities
    - Deflecting attention
    - Modifying expectations
- At each HEI, the benefits of the internationalisation agenda are perceived to outweigh the induced GHG emissions.
- The question of who has responsibility for student air travel emissions acting as a barrier to proactive engagement.
- In terms of mitigating student air travel emissions, due to offsetting not targeting the root of the problem, it is not the right mitigation approach for student air travel emissions.

These emergent themes informed both the selection of cases and the data collection. Indeed, in order to confirm and extend the themes it was important to replicate the in-depth case selection process and maximise the diversity of the sample across a range of variables specific to the research. This selection logic is relevant across all themes, for example it was important to have both good and poor performing HEIs in terms of carbon management to confirm important factors and barriers to engagement but also to confirm and further explore the risk management actions employed by HEIs.

One of the significant barriers to engagement with student air travel emissions was the question of responsibility and it was clear from the number of new codes relating to this topic emerging from TU and HU that this required further exploration. Thus, the researcher ensured that the interviews covered the emergent perspectives on allocating responsibility for emissions, for example, by discussing the view that it is the student's choice to study abroad thus the associated emissions are their responsibility.

With regard to interviewees stating that offsetting is not the right mitigation approach, the researcher used the verification cases to further probe the point that if HEIs are not engaged in actions to reduce or avoid emissions from air travel then offsetting and/or compensation are the only remaining options. Indeed, a preliminary conclusion of this research is that a robust carbon management strategy for the HE sector will likely have to involve offsetting and/or compensation due to the limited opportunities to avoid and reduce student air travel emissions.

Chapter 7. Verification Case Studies

7.1 Chapter outline

The four in-depth case studies were complemented with an additional four integrated case studies, providing data triangulation and corroboration for the emerging themes. Thus, this chapter presents the results of the verification case studies, critically appraising institutional awareness of and willingness to engage with the Conflict (Objective 2 - RQ3, RQ4 and RQ5); assessing perceptions of responsibility for student flight emissions (Objective 3, RQ6); and evaluating preferences for potential mitigation and compensation options (Objective 3, RQ7). Section 7.2 outlines the case selection process, while Section 7.3 provides information on the data sources and interviewees. Sections 7.4 - 7.7 report the results of the four case studies, and finally, Section 7.8 presents the cross-case analysis and discusses the findings with comparison to the in-depth case studies.

7.2 Selection of verification case studies

The selection of HEIs sought to maximise the diversity of the sample across a range of variables (see Chapter 3, Section 3.5.2). The verification case studies were selected from the list of 30 potential HEIs (Appendix 11). Following the original sampling strategy, three pairs were selected and invited to participate. Only four institutions accepted the invitation, comprising one geographical pair and two institutions located in different regions but still a contrasting pair in terms of degree of internationalisation and engagement with carbon management. Figure 7.1 shows the positioning of the cases on the component matrix, while Table 7.1 presents summary information for the HEIs including degree of internationalisation and engagement with carbon management (see Chapter 3, Section 3.5.6). Each of the case study HEIs has been given a pseudonym to preserve anonymity.

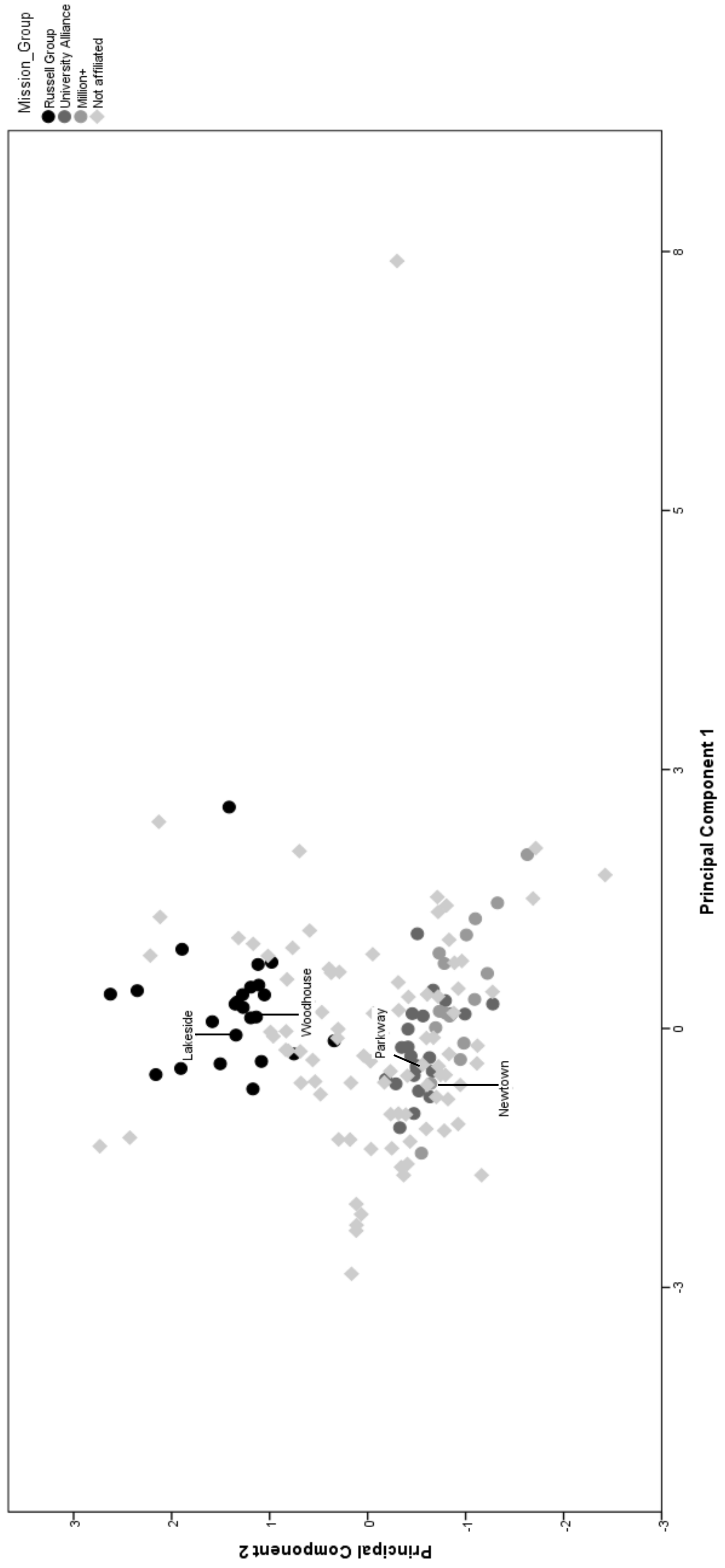

Figure 7.1. Component matrix with verification case study HEIs identified

Table 7.1. Summary information for the selected case study HEIs

University	Data source reference	Mission Group	Degree of internationalisation		Carbon management		
			International student numbers	TNE student numbers	Emissions per student (tCO_2e)	Carbon assessment classification	Scope 1 and 2 emissions reduction progress (2005/06-2013/14)
Newtown University (NU)	**E**	Million+	Medium	Low	0.6	2:2	Moderate
Lakeside University (LU)	**F**	Russell Group	High	Medium	1.4	3rd	Weak
Parkway University (PU)	**G**	University Alliance	Low	High	0.6	2:2	Very Weak
Woodhouse University (WU)	**H**	Russell Group	Medium	Low	1.8	2:1	Moderate

7.3 Data sources and interviewees

The document search strategy identified 52 documents across the four case studies, while four interviews were also completed (Table 7.2; see Appendix 13 for more information on the documentation along with reference codes used throughout the chapter).

Table 7.2. Interviewee information

HEI	Code	Interviewee	Date
Newtown	RE1	Telephone interview with Environmental and Sustainability Manager	Jul-15
Lakeside	RF1	Telephone interview with member of Carbon Management Group (Leading accounting side of CMP)	Aug-15
Parkway	RG1	Face-to-face interview with the Assistant Vice Chancellor for Environment and Sustainability	Jun-15
Woodhouse	RH1	Telephone interview with Environment Manager	Jul-15

7.4 Case study context

7.4.1 Newtown University

NU is located in the same geographical region as LU. It is a new HEI having being granted university status after 2001, and is a member of the Million+ association of UK universities (Million+, 2016). NU is a relatively small, multiple campus institution with a GIA of approximately 120,000 m^2, compared to a sector average of 170,925 m^2 (HESA, 2014b). The University has approximately 750 academic staff and 12,000 students (HESA 2015a; HESA 2015d). Total student numbers remained stable between 2008/09 and 2013/14, with undergraduates accounting for the majority of the population (96%) (HESA, 2015a; HESA 2015d). The University is financially robust with tuition fees accounting for two-thirds (66.9%) of total income in 2013/14, and research grants and contracts accounting for just 0.3% (E12).

The University ranks poorly in the Guardian university league table (bottom quarter) (Guardian, 2016) and was one of the lowest ranking institutions (bottom 10%) in terms of both research quality and research power in the 2014 REF (THE, 2014).

7.4.2 Lakeside University

LU is located in the same geographical region as NU. LU was granted university status in the middle of the 20th century, and is a member of the Russell Group of British research-intensive universities (Russell Group, 2016). The University has a main campus located on the edge of the city and is supplemented by a number of smaller campuses within the same city. Furthermore, LU operates a branch campus in a nearby city and an international branch in Asia (C-BERT, 2015). Total GIA in 2013/14 was approximately 400,000 m^2 (HESA, 2014b) making it one of the largest HEIs in the UK. The University has approximately 3,000 academic staff members and 24,000 students (HESA 2015a; HESA 2015d). Between 2008/09 and 2013/14, the University experienced significant growth (a 6% increase) in its student population, with undergraduates accounting for two-thirds of total student numbers in 2013/14 (HESA, 2015b).

The University's financial position improved significantly in 2013/14 in comparison to 2012/13, achieving a £10 million increase in its operating surplus (F08). In 2013/14, tuition fees accounted for approximately 40% of income, and research grants and contracts accounted for approximately 23% of income (F08).

LU ranked highly (top 25) in the 2016 Guardian league table, and is a top 100 HEI in the QS World University Rankings (Top Universities, 2015a; Guardian, 2016). LU ranked highly (top 20) for both research power and quality in the 2014 REF (F06; THE, 2014).

7.4.3 Parkway University

PU is a large post-1992 institution set over multiple campuses and a member of the University Alliance mission group (University Alliance, 2016). The University's largest and primary campus is located a few miles outside of the nearest city with additional campuses in the city and surrounding suburbs. The University's estate has a GIA of approximately 250,000 m^2 making it slightly larger than the sector average (HESA, 2014b). The University is in the early stages of a new Campus Masterplan, which will see it consolidate all its activity on one site over the next twenty years (G11).

The University has approximately 1,600 academic staff and 27,000 students (HESA 2015a; HESA 2015d). Between 2008/09 and 2013/14, the University struggled to maintain student numbers, experiencing a 15% decrease in the total student population (HESA, 2015b). Nevertheless, the University currently maintains a healthy financial position and in 2013/14, tuition fees accounted for approximately 65% of income, and research grants and contracts for approximately 5% of income (G14).

PU is a mid-ranking HEI in the Guardian league table (Guardian, 2016), and performed well compared to other post-1992 HEIs in the 2014 REF, achieving a top 60 position for research power and top 75 position for research quality (THE, 2014).

7.4.4 Woodhouse University

WU is a single campus institution located on the edge of the city in which it is located and is a member of the Russell Group of British research-intensive universities (Russell Group, 2016). With a GIA of approximately 500,000 m^2, it has one of the largest estates in the UK HE sector (HESA, 2014b). The University has roughly 3,200 academic staff and one of the largest student populations in the UK HE sector (approximately 30,000) (HESA, 2015a; HESA, 2015b). The University is financially robust, achieving one of the largest operating surpluses in the sector in 2013/14, with tuition fees accounting for approximately 40% of income, and research grants and contracts for approximately 23% of income (H14).

WU is a top 25 HEI in both the Guardian and Complete University Guide league tables as well as a top 100 HEI in the QS World University Rankings (Top Universities, 2015a; Complete University Guide, 2016; Guardian, 2016). The University also ranked highly (top 25) for both research quality and research power in the 2014 REF (H14; THE, 2014).

7.5 Degree of internationalisation

Table 7.3 presents the results for the degree of internationalisation at each HEI (see Chapter 3, Section 3.5.6). NU is the least international (Medium/Low) of these institutions, while the three other HEIs either perform well in terms of international student numbers (LU and WU) or TNE numbers (PU), but not both.

Strengthening international reputation is a strategic priority for NU (E07), while increasing international student numbers is a significant component of the internationalisation strategy, particularly students from China and Malaysia (E09). Furthermore, NU is looking to develop sustainable international partnerships, an international aspect to its research strategy, and internationalise the curriculum through study and work abroad opportunities (E09). TNE does not appear to be a significant priority for NU, however it is looking to increase students studying by distance or blended learning (E07).

LU considers itself a global HEI and is committed to remaining globally competitive and increasing its global presence (F06). The University is looking to develop further international partnerships to increase its overseas reputation, to attract staff and students and increase international research collaborations (F06). With respect to TNE, while TNE student numbers at LU may be low relative to the sector, it does have an overseas branch campus highlighting its future commitment to TNE provision, in keeping with aspirations to increase its global presence (F06).

PU wishes to expand its international profile going forward (G12). The University has prioritised a number of key areas including the development of partnerships for teaching and research, recruiting international students, TNE and study abroad (G11; G12). PU has a high number of TNE students reflecting its commitment in this area, with the majority of partner HEIs located in South East Asia. Significant increases in TNE student numbers have more than compensated for the decline in student numbers at PU over the last three years (G14).

WU's strategic aim is to be along the world's leading research-intensive HEIs (H11; H12). The University has been successful in recruiting international students and has one of the largest study abroad programmes by volume and subject breadth (H12). Moreover, WU has a large and diverse academic staff community and a diverse number of international research collaborations (H12). All of these have served to raise the profile of WU overseas. In terms of TNE, while student numbers are low, it is an area of the internationalisation strategy that the University is prioritising (H12).

Table 7.3. Degree of internationalisation at each case study

HEI	Degree of internationalisation			
	International students (% of student population)	**Rating**	**TNE students (% equivalent to students studying in the UK)**	**Rating**
NU	12.5%	Medium	0.1%	Low
LU	28.7%	High	2.6%	Medium
PU	11.3%	Low	17.7%	High
WU	18.9%	Medium	1.1%	Low

7.5.1 Recruitment of international students and study abroad schemes

Table 7.4 presents the drivers and motivations for international student recruitment and study abroad schemes at the HEIs. The recruitment of international students to increase and diversify income is a significant driver for each HEI. Indeed, non-EU students accounted for 6% (NU), 14% (LU), 7% (PU) and 12% (WU) of total income in 2013/14 (E12; F08; G14; H14). NU has a financial target within its Corporate Strategy to achieve an annual increase in the income from tuition fees paid by international students (E07).

Moreover, all HEIs identified both international student recruitment and study abroad as essential to improving the home student experience and improving employability in an increasingly competitive and global labour market (E09; F06; G11; G12; H12). Accordingly, each HEI has stated that increasing in international and study abroad student numbers is a priority going forward (E09; F06; G12; H12).

Table 7.4. Drivers and motivations for international student recruitment and study abroad (E09; F06; G11; G12; H12)

Drivers and motivations		**NU**	**LU**	**PU**	**WU**
Financial	Income generation	**X**	**X**	**X**	**X**
	Income diversification	**X**	**X**	**X**	**X**
Brand awareness	International alumni can increase brand awareness	**X**			**X**
Student experience and employability	Compete in global labour market	**X**	**X**	**X**	**X**
	Employers value international experience	**X**			
	Expose home students to new cultures and ways of thinking	**X**	**X**	**X**	**X**
	Prepare students for an increasingly global and diverse society	**X**	**X**	**X**	**X**

7.6 Carbon management

7.6.1 Carbon assessment

Table 7.5 presents the results of the carbon assessment for the four HEIs, where overall ratings range from a 3rd (LU) to a 2:1 (WU).

Table 7.5. Carbon assessment results for the verification cases

Category	**Description and maximum score**	**Score (%)**			
		NU	LU	PU	WU
Environmental policy					
	Publicly available environmental policy (10)	10	10	10	10
Leadership commitments					
	Carbon management a part of the corporate strategy (2.5)	0	0	2.5	0
	Endorsement from executive leadership (2.5)	2.5	2.5	2.5	2.5
Governance					
	The establishment of an environment (sustainability) team (10)	5	10	5	10
Planning					
	Carbon reduction target (Scope 1 and 2) (10)	4	4	4	4
	Interim target (5)	0	0	5	5
	Access to funding (5)	5	5	5	5
	Carbon management projects outlined to meet target (10)	5	5	5	5
Reduction progress					
	Percentage reduction (20)	8	0	0	12
Scope 3 emissions					
	Submitted Scope 3 data to EMS reporting system (6)	2	1	1	6
	Scope 3 emissions included in the carbon management plan (9)	2	2	6	0
	Initiatives to reduce the Scope 3 footprint (5)	4	4	4	4
Monitoring and reporting					
	Annual monitoring of emissions (2.5)	2.5	2.5	2.5	2.5
	Publicly available annual progress report (2.5)	0	0	2.5	0
TOTAL		**50% (2:2)**	**46% (3rd)**	**55% (2:2)**	**66% (2:1)**

7.6.2 Drivers and motivations for carbon management

The exploration of the drivers and motivations for carbon management at the four HEIs reveals a number of key themes (Table 7.6). It is clear that the financial driver is significant at each of the HEIs. Indeed, financial savings, CRCEES costs, rising energy prices and HEFCE funding linked to carbon reduction, appeared as drivers for carbon management in the documentation of each HEI. For NU in particular, where senior leadership buy-in for carbon management has been a difficult and slow process, the financial savings are the primary driver, along with legislative compliance (RE1). WU was the only case to be required to participate in the EUETS, which acts as a further significant financial and legislative driver for the University (H01).

All HEIs alluded to HEFCE as a significant driver given its proactive engagement with the carbon management agenda including setting a sector reduction target, requiring the development of a CMP and as mentioned above, linking capital funding to reduction progress (E01; F01; G02; H01).

All HEIs considered that there were reputational benefits to engagement with sustainability and carbon management. NU, LU and PU specifically highlight that potential student concerns regarding climate change will lead to increased scrutiny of institutional environmental performance and may be a determining factor when choosing where to study (E01; F01; G02). Consequently, NU, LU and PU identify environmental leagues such as the PPUL as drivers for carbon management. However, LU and PU (rated 'Weak' and 'Very Weak' respectively for carbon reduction progress) were two of the 69 UK HEIs to boycott the PPUL in 2015 (PPUL, 2015). While not citing environmental league tables as a driver, WU was the only HEI to aspire publicly to sector leadership in sustainability and carbon management (H01; H05). Indeed, it achieved the highest score out of the four HEIs in the carbon assessment (66%). In addition, WU was the only HEI to identify credibility as a driver, stating:

> *…the University runs various sustainability related courses across a number of faculties and therefore needs to be able to demonstrate to both students and the*

wider community that it supports the need for carbon reduction at [an] institutional level (H01).

Senior leadership commitment was an important factor in determining engagement with carbon management at each HEI. At NU, senior leadership was a negative factor, acting as a barrier to proactive engagement (RE1), while for LU, PU and WU, senior leadership commitment helped to drive forward the carbon management and sustainability agendas (RF1; RG1; RH1). Finally, moral responsibility was identified as driver for all HEIs, particularly at PU, with RG1 stating it is important for the University to do the right thing and act as a role model for students:

…we have a very clear sense that the people that are going through an educational programme with us they have 50-60 years of life expectancy post-graduation and they will live in the climate that we have created.

Table 7.6. Drivers and motivations for carbon management identified by data source in the verification cases

Drivers and motivations		NU	LU	PU	WU
Financial	Financial savings	D/I	D	D/I	D/I
	CRCEES	D	D	D	D
	Rising energy prices	D	D	D	D
	HEFCE linking capital funding to carbon reduction performance	D	D	D	D
	Financial resilience			D	I
	EUETS				D
Legislative	CRCEES	D	D	D/I	D
	Display Energy Certificates	D		D	D
	Part L Building Regulations	D		D	D
	EUETS				D
Sector, regional and national targets	HEFCE sector target	D/I	D/I	D	D
	Climate Change Act (2008)	D/I	D	D	D
	Local council target			D	
Reputational	PPUL	D	D	D	
	Sector leadership				D
	Student recruitment	D	D	D	
	Staff recruitment	D	D	D	
	Media and press	D	D		
Environmental	Climate change	D	D	D	D
Moral responsibility	Responsibility to the environment	D	D	I	D
	To help make the transition to a low-carbon society		D	I	D
	Right thing to do		I	I	
	Role model			D/I	D
Leadership	Senior leadership commitment		I	D/I	I
Risk management	Volatile energy markets	D	D	D	I
Credibility	Practicing what we preach				D/I

Note. 'D' refers to the driver or motivation identified in the documentation, 'I' refers to interview, and 'D/I' indicates both the documentation and interview.

7.6.3 Scope 1 and 2 carbon reduction targets and progress

Each HEI has set out a carbon reduction roadmap in their respective CMPs to meet Scope 1 and 2 reduction targets of 33% (NU), 20% (LU), 22.5% (PU) and 35% (WU) (HESA, 2014b). Thus, none of the case study HEIs' Scope 1 and 2 reduction targets meet either the HEFCE target (43%) (HEFCE, 2010a) or the average reduction target for the sector (35.2%) (HESA, 2014b).

Only NU and WU achieved a reduction in Scope 1 and 2 emissions between 2005/06 (baseline year) and 2013/14, 10% and 15% respectively (Table 7.7) (HESA, 2014b). Thus, both exceeded the average institutional reduction for the sector (7%) (HESA, 2014b).

Moreover, both NU and WU reduced their carbon intensity on a per student basis by 15% and 8% respectively (HESA, 2014b; HESA, 2015b). Both LU and PU increased emissions by 4% and 17% respectively (HESA, 2014b) and RF1 and RG1 acknowledged that it would be extremely difficult to achieve their respective reduction targets. With regard to PU, which was the 14th worst performing HEI in the sector for carbon reduction progress (HESA, 2014b), significant estate growth was the primary reason for the increase in emissions (RG1). Indeed, in 2013/14, the University reported an extra 33 buildings in the EMR in comparison to 2008/09, while GIA increased by 12% over the same period (HESA, 2014b). Increases in research activity and estate growth were cited by RF1 as the reasons for LU failing to achieve any reductions in Scope 1 and 2 emissions, further stating that it is perhaps not appropriate to compare HEIs given the diversity within the sector.

At all of the HEIs, engagement with Scope 1 and 2 emissions reduction covered a number of key areas including measuring and monitoring, behavioural change initiatives, energy efficiency interventions, renewable energy generation, and at LU and WU, installation of CHP plants (E01; E02; F01; G01; G02; H01; H02; H03).

Table 7.7. Carbon reduction progress and rating for the verification cases

HEI	% Change in Scope 1 and 2 emissions between 2005/06 - 2013/14	Scope 1 and 2 emissions per student (tCO_2e)		
		2005/06 (Baseline)	2013/14	% Change
NU	-10% (Moderate)	0.7	0.6	-15%
LU	4% (Weak)	1.4	1.4	1%
PU	17% (Very Weak)	0.5	0.6	19%
WU	-15% (Moderate)	1.9	1.8	-8%

7.6.4 Scope 3 emissions

The results indicate some engagement with Scope 3 emissions at all of the HEIs, albeit at varying levels. In terms of reporting Scope 3 emissions in the 2013/14 EMR, only WU reported against all six categories, however it does not include any Scope 3 emission sources in its CMP (HESA, 2014b; H01). NU reported against two categories in the EMR and included the same two sources in its CMP (waste and water supply/wastewater treatment) (HESA, 2014b; E01). LU and PU only reported against water supply/wastewater treatment in the 2013/14 EMR (the only mandatorily reported Scope 3 category) (HESA, 2014b). LU included waste and water supply/wastewater treatment emissions in its CMP (F01), while PU included emissions from waste, water supply/wastewater treatment, business travel, staff and student commuting and procurement in its CMP (G02).

All of the HEIs have made further commitments surrounding Scope 3. However, at NU, RE1 stated that while they would be trying to monitor emissions from business travel and staff and student commuting in the near future, there were no commitments to include Scope 3 emissions in a future CMP, and that the focus would remain on Scope 1 and 2 emissions going forward:

> *…what I noticed with the University was that when I started to look into energy management is that there's such a huge amount of waste and unnecessary carbon emissions, which are more important to focus on than the more esoteric areas like Scope 3 (RE1).*

LU are funding a PhD student to calculate a full Scope 3 footprint and improve calculation methodologies (RF1). PU has committed to defining how a 10% absolute reduction in Scope 3 emissions by 2020 can be achieved (G02) and the presence of an environmental champion at a senior leadership level is a significant factor in driving engagement with Scope 3 emissions. Moreover, RG1 indicated that HEIs should be engaging with Scope 3 to maintain legitimacy and stated that, "Universities are held to a higher level of accountability than most organisations in societies". WU has committed to including Scope 3 emissions in an updated CMP (H06) with RH1 stating, "…we see these as part of the whole package of our emissions".

Only PU had calculated emissions from inbound student air travel, however it does not publicly report them (RG1). All of the HEIs were engaged in initiatives to avoid and reduce emissions from staff business travel (E06; F04; G08; H07), staff and student commuting (E06; F04; G08; H07), waste (E01; F01; G05; G09; H06; H09), water (E01; F01; G10; H06) and the supply chain (E05; F01; G05; H10).

In terms of barriers to engagement with Scope 3, two interviewees (RE1 and RG1) identified ambivalence from HEFCE, with RE1 stating they felt commitment from HEFCE to push the Scope 3 agenda was dissipating:

> *The other thing which is also worth thinking about is, we, I think in 2011/12, we said ok HEFCE are pushing us to provide this information on Scope 3 and we'll probably need to do that in the next year or two and if we don't there might be penalties. But HEFCEs completely changed now as far as I can see and there isn't that push.*

However, RH1, while acknowledging that commitment from HEFCE to Scope 3 was reducing, did not feel this was affecting engagement with Scope 3 at WU:

> *I think the university has identified HEFCE as one of, but not the key driver to reducing carbon emissions […] Certainly here there's a feeling like 'do you know what, HEFCE didn't do what they could have done but we've got to crack on anyway'.*

Thus, for WU, while HEFCE was a driver for engagement with the sustainability and carbon management agendas initially, this is no longer the case and it is now backing away. However, the strong leadership commitment to sustainability and carbon management at WU has ensured this has not affected engagement with Scope 3 emissions. Conversely, at NU, given the lack of senior management commitment to carbon management, RE1 has had difficulty in justifying time and effort on Scope 3 stating that HEFCE "…has been a negative factor in us chasing Scope 3 emissions and trying to produce accurate figures". The difficulty for RE1 is that the benefits of investing heavily in trying to establish the Scope 3 footprint are not obvious. RE1 further stated that, "…in the absence of any real driver then I don't think it's going to happen", adding:

> *…if there was a driver for us to produce Scope 3 information, in detail for HEFCE, and that would be quite a strong driver.*

Additional barriers to engagement with Scope 3 included difficulties in setting the operational boundary and deciding which sources to include (due to lack of clear sector guidance) (RE1; RG1), lack of reliable data (RE1; RF1), and lack of resources (RE1) (which links to a lack of senior leadership support at NU).

7.7 Institutional responses to conflict

The scale of the Conflict at each of the verification cases is illustrated in Table 7.8, which presents a comparison of inbound student air travel emissions to Scope 1 and 2 emissions for 2013/14 and forecasts the potential changes in the magnitude of these emissions by 2020/21. Inbound student air travel emissions in 2013/14 were estimated using the methodology located in Appendix 12 and institutional data on inbound student numbers from HESA (2015a). This information was presented to each of the interviewees. The 2020/21 scenario is based on the HEIs achieving their Scope 1 and 2 reduction targets and in the absence of an institutional target, assumes annual growth in international student numbers of 3.7% (DBIS, 2013).

In 2013/14, inbound student air travel emissions were equivalent to 51% (NU), 85% (LU), 73% (PU) and 43% (WU) of Scope 1 and 2 emissions, rising to 77% (NU), 142% (LU and PU) and 72% (WU) in the 2020/21 scenario. Table 7.8 shows that overall emissions decrease at WU and PU, but this is contingent upon the HEIs achieving their Scope 1 and 2 reduction targets, which is highly unlikely. For NU and LU, the increase in emissions from inbound student air travel results in an overall increase in emissions in the 2020/21 scenario.

Table 7.8. Case study HEIs' Scope 1 and 2 and inbound student air travel emission in 2013/14 and projected emissions to 2020/21

HEI	Emissions in 2013/14 (tCO_2e)			Emissions in 2020/21 (tCO_2e)		
	Scope 1 and 2	Inbound student air travel	Total	Scope 1 and 2	Inbound student air travel	Total
NU	7,007	3,556	10,563	5,986	4,586	10,571
LU	33,198	28,114	61,312	25,600	36,256	61,856
PU	17,428	12,668	30,096	11,513	16,337	27,850
WU	54,398	23,319	77,717	41,692	30,072	71,764

All the HEIs were aware of the Conflict between the internationalisation and carbon management agendas and all interviewees were of the opinion that emissions from international and study abroad student air travel would increase going forward (RE1; RF1; RG1; RH1). RG1 referred to the Conflict as a balancing act, arguing that while HEIs need to increase their international student community, they also need to recognise that this carries carbon implications and look to mitigate where possible, for example by reducing the need for air travel or offsetting. Similarly, while recognising that LU is looking to expand and increase its international student population, RF1 stated that this should not be at the cost of the environment. RH1 felt that the Conflict could be overcome and that it is an area that is increasingly coming up in internal discussions at WU. In contrast, RE1 stated that at NU student air travel emissions were not being addressed and were unlikely to be addressed in the future. RE1 noted that:

> *Carbon management […] will probably be seen as a relatively poor relation to the University's main ambitions, which are to increase the number of student studying here and make sure it's financially secure.*

7.7.1 Accounting for student air travel emissions

Only PU had measured inbound student air travel emissions, however it is not publicly reported (RG1), while no HEI had measured emissions from outbound students. LU is in the process of calculating a full Scope 3 footprint including international student air travel emissions (RF1). Both RF1 (LU) and RG1 (PU) recognised that students were likely to be flying home more frequently than the HEFCE assumptions suggest and LU are trying to improve the robustness of the assumptions going forward (RF1). A number of barriers were identified in relation to accounting and reporting for student air travel emissions, including a lack of reliable data, its omission as a category in the EMR, the limited ability to influence these emissions, and prioritising other Scope 3 sources (RE1; RF1; RG1; RH1). With regard to LU, RF1 felt that the impact on the University's image was a barrier to reporting, asserting that the more sources you include, the worse the footprint looks. Furthermore, RF1 highlighted the incomparability of HEIs in terms of student air travel emissions:

…if you've got a university like [Lakeside] and you're comparing them to other universities that may not necessarily have such a great international influence, then they're pretty incomparable […] [Lakeside] always likes to look innovative but it also doesn't necessarily want to be the worst performing institution.

RF1 further stated that, "there needs to be kind of tier to tier comparison" to remove this as a barrier to accounting and reporting.

7.7.2 Mitigating and compensating for student air travel emissions

In terms of determining whether HEIs bear responsibility for mitigating or compensating for student air travel emissions, only RG1 offered a firm position, arguing:

If a student is studying a [Parkway] degree in one of our [UK sites] or some of the other places…then they're ours and we should be responsible and accountable for the carbon associated with their activities.

RG1 also stated that any additional flights made during the academic year are also the responsibility of PU. The other interviewees (RE1, RF1 and RH1) had not engaged or considered responsibility for inbound and outbound student air travel emissions.

With respect to mitigation, in terms of reducing or avoiding the need for students to fly, respondents felt that they have little influence:

Frankly, if you recruit, there's a limited amount of abatement you can do because for most students beyond the EU, air travel is the only route in (RG1).

…there's typical ways of doing things, (1) carbon reduction, not taking the flights in the first place or not making the business travel in the first place. Clearly for an international student getting here, they can't necessarily do that, they can't not fly here to get here (RH1).

None of the HEIs had engaged in any activities to reduce or avoid the need for student air travel. That said, RH1 argued that internationalisation:

...needn't necessarily be something that is just about bringing international students here […] There are other ways of internationalising our offering for students.

RH1 stated that there had been conversations with the international team about options for reducing the carbon consequences of the internationalisation strategy, but these had been informal. RH1 was optimistic in stating, "I don't think it's necessarily a conflict that we can't overcome".

In terms of carbon offsetting, NU, LU and PU did not think offsetting was the correct option and respondents did not think their institutions would offset, or encourage offsetting of air travel emissions citing concerns regarding the traceability and verification of schemes and stating that HEIs should aim to reduce emissions rather than offset (RE1; RF1; RG1). Nonetheless, RE1 proposed a sector wide scheme, to which they might contribute:

…if we were asked to be part of a HE drive to mitigate and offset and to contribute to some fund which would plant forests or whatever, I certainly think, if it was an accredited scheme, then we'd be considering it.

Conversely, WU are very much looking to carbon offsetting as a mitigation option for air travel emissions:

…we're currently in the process of developing a carbon offsetting programme that would be across the University […] for international students or students who are going on research trips for part of their dissertations, for staff and also for people in the Scope 3 area who are coming here for instance for conferences and having to have international travel for conferences (RH1).

With regard to alternative carbon compensation activities, PU was the only HEI to be considering this as an option. Indeed, RG1 felt that linking compensatory activities to student air travel emissions is the direction the University is heading. However, RG1 stated:

We're not there yet […] it will be quite a delicate political positioning that will need to be put in place to ensure that we do actually get the right awareness at the right time for the right decision to emerge. It would be easy to blow it

RG1 believed the University could compensate through an already established internal scheme that supports initiatives such as student community volunteering or investing in tree planting and providing agricultural training in developing countries. With regard to WU, RH1 stated that the sustainability team were keen to avoid any carbon compensation scheme where it may appear that the University is profiting or the money be used for schemes that should be happening already, e.g. carbon reduction projects on campus. Thus, RH1 stated their preference for using the money to provide grants for students to undertake sustainability related courses.

7.8 Discussion and cross-comparison to the in-depth case studies

In this section, a cross-case analysis of the verification HEIs allowed the findings to be evaluated and discussed. Table 7.9 presents a cross-case comparison of the emergent themes relating to the Objectives and Research Questions for both the in-depth and verification cases.

Table 7.9. Cross-case comparison of the emergent themes

Domain (RQ)	Key and Sub Themes	Case Study HEI							
		SU	BU	TU	HU	NU	LU	PU	WU
Drivers and motivations for student mobility (RQ3)	**Financial resilience**								
	Income generation								
	Income diversification								
	Reduce dependency on 'home' undergraduates								
	Benefit local economy								
	Subsidise 'home' students								
	Student experience and employability								
	Promote global citizenship								

	Compete in global labour market	■	■	■	■	■	■	■	■
	Global experiences and perspectives	■	■			■	■	■	■
	Stimulate regional change	■							
	Global network of contacts	■			■				
	Internationally mobile professionals		■						
	Development of language skills		■	■					
	Provide an insight into international business and academic environments		■						
	Contribute to a diverse and global society				■				
	Produce graduates prepared to face global problems				■				
	Development of intercultural competence	■	■	■	■	■	■	■	■
	Maintain and enhance international character of the campus				■				
	Brand awareness/ global reputation	■	■	■	■	■	■	■	■
	Raise the profile of the university abroad	■		■					
	Ambassadors for the university	■				■			■
	Strengthen international standing/brand		■		■				
Engagement with carbon management – Scope 1 and 2 reduction progress (RQ4)	**Difficulty achieving Scope 1 and 2 emission reductions**	■	■	■	■	■	■	■	■
	Increase in energy-intensive research activity		■		■		■		
	Estate growth		■	■	■		■	■	
	Failure to obtain planning permission for large-scale renewable energy installations			■	■				
	Reputational risk management actions		■				■	■	
	Boycott PPUL to reduce transparency		■				■	■	
	Focusing on actual changes in performance and activities				■				
	Deflect attention (highlighting contribution to the low-carbon economy)		■		■				■
	Modifying expectations (change carbon targets)		■	■	■				
	Benefits of the internationalisation agenda perceived to outweigh GHG emissions	■	■	■	■	■	■	■	■
	Increasing international student and study abroad numbers	■	■	■	■	■	■	■	■

Conflict between the internationalisation and carbon management agendas (RQ5)	**Willingness to understand magnitude of emissions**								
	Important to quantify and understand the significance of student air travel emissions								
	Fairness								
	HEI should be allowed to increase its international student population to levels seen in peer institutions								
	Cannot compare different groups of HEIs								
Drivers and motivations for engaging with the Conflict (RQ5)	**Moral responsibility**								
	Corporate social responsibility								
	Right thing to do								
	HEIs as role models								
	Altruism								
	Legitimacy								
	Ensure activities are legitimate								
	Operate within bounds and norms of society								
	Enlightened self-interest								
	Reputation management								
	Gain competitive advantage								
Factors promoting proactive engagement with the Conflict (RQ5)	**Key internal factors**								
	Environmental champion								
	Senior leadership commitment								
	Ethos of the university								
	New international strategy								
	Financial position								
Barriers to engaging with the conflict (RQ5)	**Internal barriers**								
	Lack of reliable date								
	Question of responsibility								

	Limited influence		■		■	■			
	Prioritising other Scope 3 sources		■		■	■			
	Potential negative image						■		
	External barriers						■		
	Omission as an EMR category						■		
Responsibility for student air travel emissions (RQ6)	**Student solely responsible**			■	■				
	Students are making the decision to study abroad			■	■				
	University solely responsible	■						■	
	Emissions increasing in line with the internationalisation agenda	■						■	
	Students are coming to the UK because of the university							■	
	Shared responsibility			■	■				
	Flight at the beginning and end of academic year the responsibility of the university				■				
	Additional flights throughout the academic year the responsibility of the student				■				
	Share responsibility between the university and student			■	■				
	Feasibility of implementing such an approach			■					
	Uncertain		■			■	■		■
	Unsure or not considered who bears responsibility for student air travel emissions		■			■	■		■
Mitigating student air travel emissions (RQ7)	**TNE**	■		■					
	TNE as a low-carbon method of pursuing the internationalisation agenda	■		■					
	Reducing emissions	■							
	Promoting more fuel-efficient airlines	■							
	Changing the mode of transport for a less carbon-intensive alternative			■					
	Incentivise train travel to Western Europe			■					
	Offsetting not correct approach	■	■	■		■	■	■	
	Offsetting does not tackle the root of the problem	■	■	■					
	No intrinsic link to the HEI	■							

	Concerns regarding the traceability and verification of schemes								
Compensating for student air travel emissions (RQ7)	**Compensating through carbon literacy training**								
	Behaviour change								
	Benefits for wider society								
	Enhance employability								
	Unquantifiable schemes not the correct approach								
	Greenwash								
	Need schemes with quantifiable reductions, e.g. investment in schemes on campus								
	Investing in carbon reduction schemes on campus								
	Need to prove additionality								

7.8.1 Drivers and motivations for international student recruitment and study abroad

This section contributes to addressing Objective 2 (RQ3), which was to evaluate the dominant motivations for UK HEIs to recruit international students and promote study abroad for UK students.

All of the HEIs identified the importance of international students and all intended to increase numbers. While a number of themes emerged regarding the motivations for the recruitment of international students, including increasing brand awareness and enhancing the home student experience, the direct financial benefits are the primary motivations. For both the in-depth and verification case study HEIs, international students were found to be a key source of income, although the size of the contribution to income was uneven between Russell Group HEIs (average - 14.5%) and the post-1992 HEIs (average - 7.5%).

The verification case study HEIs identify study abroad schemes as a way of internationalising the home student experience and increasing employability of graduates, consistent with the findings from the in-depth cases. All of the HEIs felt it was important for students to be exposed to new cultures and new ways of thinking to compete in a global labour market and operate in an increasingly diverse society.

7.8.2 Institutional engagement with the carbon management agenda

This section contributes to answering Objective 2 (RQ4), in exploring institutional engagement with the carbon management agenda.

Drivers and motivations for carbon management

Table 7.10 presents the drivers and motivations for carbon management at the four verification case study HEIs. The cells shaded grey indicate a new theme not found in the in-depth cases.

Table 7.10. Drivers and motivations for carbon management at the verification cases

Drivers and motivations	
Financial	Financial savings
	CRCEES
	Rising energy prices
	HEFCE linking capital funding to carbon reduction performance
	Financial resilience
	EUETS
Legislative	CRCEES
	Display Energy Certificates
	Part L Building Regulations
	EUETS
Sector, regional and national targets	HEFCE sector target
	Climate Change Act (2008)
	Local council target
Reputational	PPUL
	Sector leadership
	Student recruitment
	Staff recruitment
	Media and press
Environmental	Climate change
Moral responsibility	Responsibility to the environment
	To help make the transition to a low-carbon society
	Right thing to do
	Role model
Leadership	Senior leadership commitment
Risk management	Volatile energy markets
Credibility	Practicing what we preach

Financial savings were found to be one of the most significant drivers for carbon management, with all HEIs recognising the opportunity to reduce energy costs and increase financial resilience. All HEIs recognise the reputational benefits of proactive engagement, thus “enlightened self-interest” was a significant motivation, particularly for WU as they have stated sector leadership in sustainability and carbon management as a goal.

One stakeholder group not identified in the in-depth cases, media and press, was cited as a factor for engagement with sustainability and carbon management. LU was the only HEI to cite credibility as a driver for sustainability and carbon management. Given that many HEIs are conducting research around sustainability and incorporating education for sustainable development into degree programmes, it is important that HEIs practice what they preach. Moreover, moral responsibility was identified as a driver at all HEIs and as RG1 (PU) stated, HEIs have a significant opportunity to influence the lives of their students and should act as role models for a sustainable society. As with the in-depth cases, it is difficult to determine the extent to which moral responsibility alone acts as a driver for carbon management at the HEIs but there is no reason to believe that it does not have some influence. Senior leadership commitment was identified as critical to successful engagement with the carbon management agenda, as it was for the in-depth case studies.

Scope 1 and 2 carbon reduction progress

As with each of the in-depth case studies, none of the HEIs are likely to achieve their stated Scope 1 and 2 reduction targets. Indeed, both LU and PU increased emissions between 2005/06 and 2013/14. It appears that targets were set without taking into account expansion of estates, increased energy consumption, research activity and student and staff numbers. Even LU, who RF1 stated, “were quite pragmatic in not over-promising anything”, will fall significantly short of their reduction target. Thus, the setting of targets in the UK HE sector has not guaranteed reductions in emissions. Furthermore, as with BU and HU, PU demonstrates that high levels of disclosure do not necessarily translate to strong reduction performance. Indeed, the implications are that the sector as a whole may have been overly optimistic in target setting, with potential implications for credibility and reputation, acknowledged by the University representatives interviewed.

It could be suggested that it was because of these concerns that PU and LU decided to boycott the PPUL in 2015 in an attempt to reduce its credibility as a driver of sustainability and carbon management, and to reduce transparency and reputational risk. RH1 (WU) alluded to the University's significant research and teaching agenda around sustainability and carbon management when discussing engagement with carbon management. This aligns with the arguments of BU and HU, in that the older, more research-intensive HEIs have voiced concern that the PPUL does not distinguish between them and more modern HEIs and that sustainability research is ignored when benchmarking. Nonetheless, WU has demonstrated that research-intensive HEIs, with a significant number of older and listed buildings, can deliver significant emission reductions, this is all the more impressive as WU has achieved this against a backdrop of estate expansion and increased research activity. Senior leadership commitment was a critical success factor for WU.

Engagement with Scope 3 emissions

While all HEIs had engaged with Scope 3 emissions, the extent of engagement varied. The motivations for proactive engagement with Scope 3 emissions at the HEIs correspond to those found in the in-depth cases; legitimacy, enlightened self-interest and moral responsibility. Interviewees felt that society and potential students had expectations of the HE sector to be at the leading edge of the sustainability and carbon management agendas and that HEIs have a societal responsibility to be doing the right thing. WU, in keeping with its position of wanting to achieve sector leadership in sustainability and carbon management, was the only HEI to report against all six Scope 3 categories in the 2013/14 EMR. PU was the only HEI to include significant Scope 3 sources in its CMP, while LU is funding a PhD student to calculate a full Scope 3 footprint.

Senior leadership support was a significant factor for proactive engagement at LU, PU and WU, while at NU, senior leadership appears to be a barrier. For NU, the main driver for carbon management is financial and so it has been difficult for the Environment Manager to justify spending time measuring and developing initiatives to reduce Scope 3 emissions.

The evidence indicating senior leadership support as a critical factor in engaging with Scope 3 emissions corresponds to the findings from the in-depth case studies. Furthermore, a number of interviewees felt that the push to report and engage with Scope 3 emissions from HEFCE was dissipating, highlighting a perceived lack of commitment from the funding council, a theme identified from the in-depth cases. That said, for WU, strong leadership commitment to sustainability and carbon management has ensured this has not affected engagement with Scope 3 emissions.

7.8.3 Awareness and willingness to engage with the Conflict

This section contributes to addressing Objective 2 (RQ5), which was to critically appraise institutional awareness of the Conflict and willingness to engage.

Figure 7.2 presents the motivations, barriers and positive factors influencing engagement with the Conflict between the internationalisation and carbon management agendas as well as Scope 3 emissions in general. The dark grey boxes indicate a theme found only in the in-depth cases, while white shading designates themes found in both the in-depth and verification cases and light grey indicates new themes found solely in the verification cases.

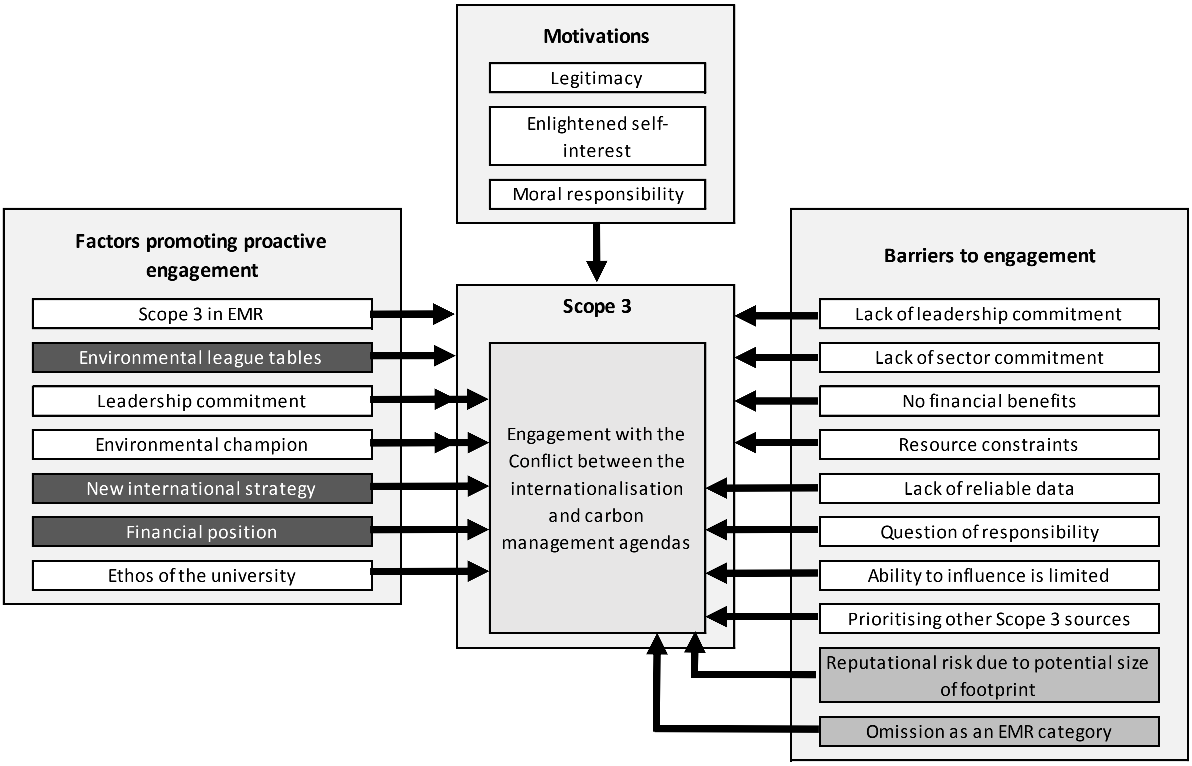

Figure 7.2. Motivations, success factors and barriers to engagement with Scope 3 emissions and the Conflict, identified from the analysis of the verification case studies

As with the in-depth case studies, the findings indicate that every HEI is aware of the Conflict between the carbon management and internationalisation agendas. All of the HEIs are actively trying to increase international and study abroad student numbers, thus the benefits of the internationalisation agenda outweigh the additional induced carbon emissions. Only PU has estimated emissions from inbound student air travel. Respondents from LU, PU and WU stated a willingness to engage (mainly in terms of accounting for student air travel emissions), while for NU this is simply not a priority at this moment in time. RE1 highlighted the small international student population at NU stating that the University should be allowed to increase its population to similar levels seen in other HEIs before engaging.

At PU, which is the only verification HEI to have accounted for inbound student air travel emissions, leadership commitment and an environmental champion were factors influencing this proactive engagement.

As with the in-depth case studies, respondents highlighted lack of reliable data, a limited ability to influence, and prioritisation of other Scope 3 sources, as barriers to engagement with student air travel emissions. Furthermore, its omission as a category within the HESA EMR was identified as a barrier to engagement. Indeed, the inclusion of Scope 3 emissions in the 2012/13 EMR was one of the factors that influenced TU to account and report on Scope 3. Thus, it would be reasonable to suggest inclusion of inbound and outbound student air travel emissions would result in more HEIs accounting and reporting on this source. Finally, given the potential size of inbound and outbound student air travel emissions, there is a worry at LU of how this might affect the University's image, particularly when it has a significant international student population in comparison to many HEIs in the sector. RF1 (LU) further suggested that benchmarking HEIs only against their peers would help to overcome some of the barriers to accounting and reporting on student air travel emissions. Again, this links to the general concerns of research-intensive and Russell Group institutions being compared to more teaching-intensive HEIs.

7.8.4 Mitigating and compensating for student air travel emissions

This section contributes to addressing Objective 3 (RQ6 and RQ7), which was to assess perceptions of responsibility for student air travel emissions and evaluate preferences for mitigation and compensation options.

As with SU from the in-depth case studies, PU adopted a firm position and considered itself to have at least some responsibility for the induced carbon resulting from its internationalisation strategy. Moreover, RG1 (PU) stated that the University should take responsibility for additional flights made during the academic year. PU adopts the view that students are coming to the UK because of the University and so for that reason, the University has responsibility for emissions. On the other hand, the interviewees from NU, LU and WU had not considered who should bear responsibility for inbound and outbound student air travel emissions.

None of the verification HEIs had engaged in activities to mitigate or compensate for student air travel emissions and current evidence suggests this is someway off (although PU was exploring compensatory options), which again highlights SU as an outlier case in this study. Respondents highlighted their limited ability to avoid or reduce student air travel emissions. While this may be the case for the flight at the beginning and end of the students' period of study, HEIs have the potential to influence additional flights made during the academic year by offering incentives to stay such as reduced rate or free accommodation during the summer or incentivising train travel.

With regard to offsetting the emissions, NU, LU and PU were sceptical of offsetting schemes citing concerns regarding the traceability and verification of schemes and stating that HEIs should aim to reduce rather than offset, an argument made by respondents from the in-depth cases. Nevertheless, the point here is that the HEIs are not engaged in activities to reduce or avoid emissions from air travel, and they are highly likely to increase in the future. Thus, offsetting or compensation are the only options. However, RE1 (NU) proposed the idea of a sector-level offsetting scheme, which is something that could be investigated in the future.

With respect to alternative carbon compensation schemes, PU was the only HEI actively considering this as an option with RG1 stating that linking compensatory activities to student air travel emissions is the direction the University is heading. This was being driven by RG1, identifiable as an environmental champion at PU. There is an awareness of the potential reputational risk associated with student air travel emissions at PU and behind the scenes it is ensuring that it will be ready to respond by accounting for student air travel emissions and exploring compensatory activities.

Respondents stated their preference for compensation schemes such as volunteering in the community and providing grants for students from developing countries to come to the UK to study. In contrast to RC1 (TU), RH1 (WU) felt that using the money to achieve carbon reductions on campus should be avoided, as it may appear the university is profiting and using the money to do what it should be doing anyway. If HEIs were to fund carbon reduction projects on campus, it would be important to ensure that the project demonstrated additionality and would not have occurred in the absence of the compensation fund, perhaps because it may not have met the required payback period without the intervention.

7.9 Chapter summary

The four in-depth case studies were complemented with an additional four integrated case studies, providing data triangulation and corroboration for the emerging themes. The findings of this chapter show how important the recruitment of international students and study abroad schemes are to HEIs, motivated by the financial benefits and enhancement of the student experience and employability. While all the respondents were aware of the Conflict, only one of the verification case studies had accounted for these emissions and one was in the process of calculating a full Scope 3 footprint, including student air travel emissions. In terms of mitigation and/or compensation, only one HEI was considering compensatory actions, the other three HEIs, as with the majority of the in-depth cases, are not yet considering actions to mitigate and/or compensate for student air travel emissions.

Chapter 8. Conclusions

8.1 Chapter outline

The aim of this final chapter is to draw-out the primary conclusions of this research by synthesising the discussions presented in Chapters 4-7. Following this, this chapter considers the contribution to knowledge and the theoretical and practical implications of this thesis. Finally, the limitations of the study are acknowledged along with recommendations for further research opportunities.

8.2 Introduction

The UK higher education (HE) sector has a key role to play in facilitating the transition to a more sustainable, low-carbon society. Education for sustainable development (ESD) is an interdisciplinary approach to teaching and learning that encourages students to consider concepts such as environmental stewardship, social justice, and global citizenship and how they relate to their private and professional lives (HEA/QAA, 2014). Promoting global citizenship is a key aspect of ESD, given that we live in an increasingly interconnected world comprising of related environmental, social and economic systems. It is important that students are aware of the wider world and recognise their own role in the global community (Rieckmann, 2012). This new global context is forcing higher education institutions (HEIs) to reconsider their mission, tasks and responsibilities and engage with internationalisation, providing students with a global learning experience (Gacel-Avila, 2005).

The recruitment of international students and study abroad schemes have been a fundamental aspect of the internationalisation agenda in the UK HE sector and this research has shown that HEIs will continue to place considerable importance on student mobility going forward. However, student mobility has significant carbon consequences in terms of greenhouse gas (GHG) emissions from air travel (as well as the effects of emissions at altitude), where there are limited opportunities to reduce aviation related emissions due to the ongoing reliance of the sector on fossil fuels and the limitations of technological development. Thus, there are conflicting priorities with regard to the UK HE sector's internationalisation and carbon management agendas. While previous research articles have identified the potential conflict between elements of the internationalisation and carbon management agendas (Fawcett, 2005; Roy et al., 2008; Dvorak et al., 2011; Long et al., 2014; Mazhar et al., 2014), the various dimensions of this conflict (accounting for student flight emissions, exploring institutional and student responses, and potential mitigation/compensation options) have not been explored.

The conflict between the internationalisation and carbon management agendas in the UK HE sector (hereafter 'the Conflict') is a prime example of the difficulties that organisations across all sectors of the economy can face in responding to the sustainability agenda and the need to account for the environmental impacts of their operations alongside the economic and social benefits. As such, the conclusions of this research may serve as a framework for different sectors of the economy when engaging with challenging emission sources.

8.3 The scale of the challenge

Currently, the HESA Estates Management Record (EMR) excludes inbound and outbound student air travel from the greenhouse gas emissions (carbon footprint) reporting boundary of a HEI (HESA, 2014b). However:

> ***To have credibility, and to be in a position to strategically respond to the Conflict, HEIs need to include inbound and outbound student air travel emissions in a comprehensive Scope 3 carbon footprint.***

According to the Greenhouse Gas Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard (commonly referred to as the 'Scope 3 Standard'; WBCSD/WRI, 2011a), organisations should report downstream emissions from the use of sold products. HEIs are explicitly providing education for overseas students and study abroad opportunities as service offerings, where students are required to travel in order to access these services. Thus, student air travel emissions could be considered part of a HEIs Scope 3 emissions. When determining relevant Scope 3 emissions (Table 8.1), the Scope 3

Standard states that if key stakeholders deem the emission source as important, or if the emission source contributes to the organisation's risk exposure, it should be included within the reporting boundary (WBCSD/WRI, 2011a). Furthermore, if the source is expected to contribute significantly to the Scope 3 footprint or if an organisation has the capacity to influence the emission source, then these too provide arguments for such emissions to be included within the reporting boundary (WBCSD/WRI, 2011a).

Table 8.1. Criteria for identifying relevant Scope 3 emissions (adapted from: WBCSD/WRI, 2011a)

Criteria	**Description**	**Implications for HE sector**
Stakeholders	They are deemed critical by key stakeholders.	The People and Planet University League (PPUL) is a key stakeholder and they look for inclusion of student air travel emissions in carbon management plans (PPUL, 2015).
Size	They contribute significantly to the total anticipated Scope 3 emissions.	For the 25 HEIs who reported against all Scope 3 categories in the 2013/14 HESA EMR (Appendix 3), estimated inbound student flight emissions were equivalent to 65% of mandatorily, 27% of voluntarily, and 19% of total reported emissions. If VFR flights were included, this increased to 113%, 47%, and 33% respectively.
Influence	There are potential emissions reductions that could be undertaken or influenced by the organisation.	As discussed in Chapter 5, HEIs have an influence over student air travel emissions, including the emissions from additional flights taken during the year.
Risk	They contribute to the organisation's risk exposure	As discussed in the case studies (Chapters 6 and 7), there is a reputational risk for HEIs through negative media coverage relating to emissions in the supply chain.

Accounting for student air travel emissions may be challenging for HEIs given that it relies on a robust methodology and robust data. While the Higher Education Funding Council for England (HEFCE) has produced accounting guidance for estimating emissions associated with inbound and outbound student air travel (HEFCE, 2010b), this research has shown that the recommended assumptions regarding flight frequency are not appropriate. Indeed, this research found that emissions calculated from the actual number of flights were 84% higher than those estimated using the HEFCE methodology. It is therefore recommended that HEIs should base emissions estimates on actual flight frequency as determined by a student travel survey, or employ the revised estimates of average flight frequency reported in this study (see Chapter 4).

This research has demonstrated the urgency with which HEIs need to engage with the Conflict given that:

> ***Student air travel emissions are significant and will likely account for an increased proportion of the total carbon footprint of the UK HE sector in 2020/21. Furthermore, increases in student air travel emissions are likely to exceed reductions achieved in Scope 1 and 2 emissions.***

Chapter 4 evaluated the potential significance of student flight emissions to the carbon footprint of the UK HE sector (Objective 1). For the 25 UK HEIs who reported against all available emission categories in the 2013/14 EMR return (HESA, 2014b), it was found that inbound student flights and the associated visiting friends and relatives (VFR) flights were significant, being equivalent to 33% of total reported emissions. Indeed, they were the third and fourth most significant source of emissions respectively, after procurement emissions and Scope 2 emissions.

Looking to how these emissions might evolve in the future, Scope 1, 2 and 3 emissions reported in the HESA EMR are likely to decrease due to technological, infrastructural and operational improvements. Meanwhile, inbound and outbound student numbers (and therefore the associated air travel emissions) are expected to increase (DBIS, 2013) in line with the sector's internationalisation agenda and the need to increase and diversify income, promote global citizenship and increase employability (see Chapters 6 and 7). Opportunities to minimise or mitigate these emissions, e.g. through inter-modal transfer to other forms of low-carbon transport, are limited (Townsend and Barrett, 2015). Moreover, there is no step-change in technology on the horizon for the aviation industry and this is exacerbated by the fact that aircraft have a long life span, effectively locking society to current technology for the next 30-50 years (Bows and Anderson, 2007).

Using mandatorily reported 2013/14 emissions data (HESA, 2014b) and inbound and outbound student numbers (HESA, 2015a, 2015c) for all 159 UK HEIs, this research estimated changes in sector level emissions to 2020/21 based on forecasts for Scope 1 and 2 reductions and growth in student air travel (see Chapter 4, Section 4.5). The results suggest that by 2020/21, increases in student and VFR travel emissions are likely to exceed the reductions achieved in Scope 1 and 2 emissions unless HEIs manage to achieve their original reduction targets, and/or there is close to zero growth in international and study abroad student numbers.

8.4 Institutional awareness of and willingness to engage with the Conflict

The capacity of the sector to respond to the Conflict is dependent on current levels of competence in relation to carbon management, engagement with Scope 3 emissions and willingness to engage with the Conflict. Awareness of the Conflict, specifically the carbon consequences of student air travel, is a pre-requisite to engaging with and responding to it. The consensus within the literature was that HEIs have yet to acknowledge the emissions associated with inbound and outbound student air travel and have made few (if any) changes to account for or reduce them (Fawcett, 2005; Dvorak et al., 2011; Hale et al., 2013). That said, there was no empirical evidence on institutional responses to student air travel emissions and this research sought to address this gap in knowledge, where Objective 2 was to critically appraise institutional awareness of and willingness to engage with the Conflict. An assessment of sector-wide reporting practices (see Chapter 2, Section 2.7.4) and the eight case studies (see Chapters 6 and 7) revealed that:

> ***While the majority of HEIs have undertaken some element of Scope 3 emissions quantification, very few have included emissions from student air travel.***

Of the 159 HEIs in the UK, 119 reported against at least one of Scope 3 categories in the 2013/14 HESA EMR return (HESA, 2014b), while only 25 were found to have reported against all available categories. According to the PPUL, only nine HEIs included student air travel emissions in their carbon management plans (PPUL, 2015).

Of the eight case study HEIs, four had reported against all Scope 3 categories, two had calculated inbound student air travel emissions and none had calculated emissions from study abroad air travel. However, the findings from the interviews and document reviews revealed that case study HEIs were aware and recognised the significance of the Conflict.

These low levels of accounting and reporting, in combination with the findings from the case studies (see Chapters 6 and 7) led to the conclusion that:

The sector is poorly equipped to respond to the challenge presented by student air travel emissions. This relates to an ongoing focus on, and difficulties achieving, Scope 1 and 2 emission reductions, varied engagement with Scope 3 emissions, the economic and social importance placed on student mobility and an unwillingness at the institutional level from the majority of HEIs to engage with the Conflict.

While two of the case study HEIs had measured inbound student air travel emissions, only one demonstrated proactive engagement and committed to compensate for inbound student air travel emissions (see Chapter 6, Section 6.3). While all respondents acknowledged the likely significance of student air travel emissions, and the majority stated a willingness to engage in the future, current evidence suggests this is some way off. Indeed, none of the case study HEIs were engaging in actions to avoid or reduce student air travel and many felt they had a limited ability to influence these emissions.

It could be suggested that if the HE sector cannot even achieve its Scope 1 and 2 reduction targets, what hope is there for reductions in Scope 3 emissions. Moreover, current failures in meeting Scope 1 and 2 reduction targets due to failure to attain planning permission for large-scale renewable energy installations, estate growth and an increase in energy-intensive research activity, has meant HEIs are prioritising and focusing more on this area rather than indirect emissions.

The most actively engaged HEI is looking to compensate for student air travel emissions (see Chapter 6, Section 6.3.5), motivated by the need to maintain legitimacy, a moral responsibility and enlightened self-interest (Figure 8.1). Moreover, the presence of an environmental champion and senior leadership commitment (among other factors) were crucial in engaging with the Conflict and compensating for student air travel emissions. The barriers to engagement presented in Figure 8.1 may explain the disparity between some respondents' stated willingness to account for, and engage in actions to mitigate and/or compensate for student air travel emissions, and actual evidence. A lack of reliable data with regard to student travel behaviour was identified as a barrier to accounting for student air travel emissions at a number of HEIs, particularly when data collection is likely to be a time-consuming task. Respondents felt there were alternative emission sources they could better measure and exert greater influence on, thus HEIs were prioritising other (less significant) Scope 3 sources (e.g. staff business travel, staff and student commuting). Given the potential size of inbound and outbound student air travel emissions, there was a worry for some HEIs of how this might affect the university's image, particularly when they may have a significant international student population in comparison to many HEIs in the sector.

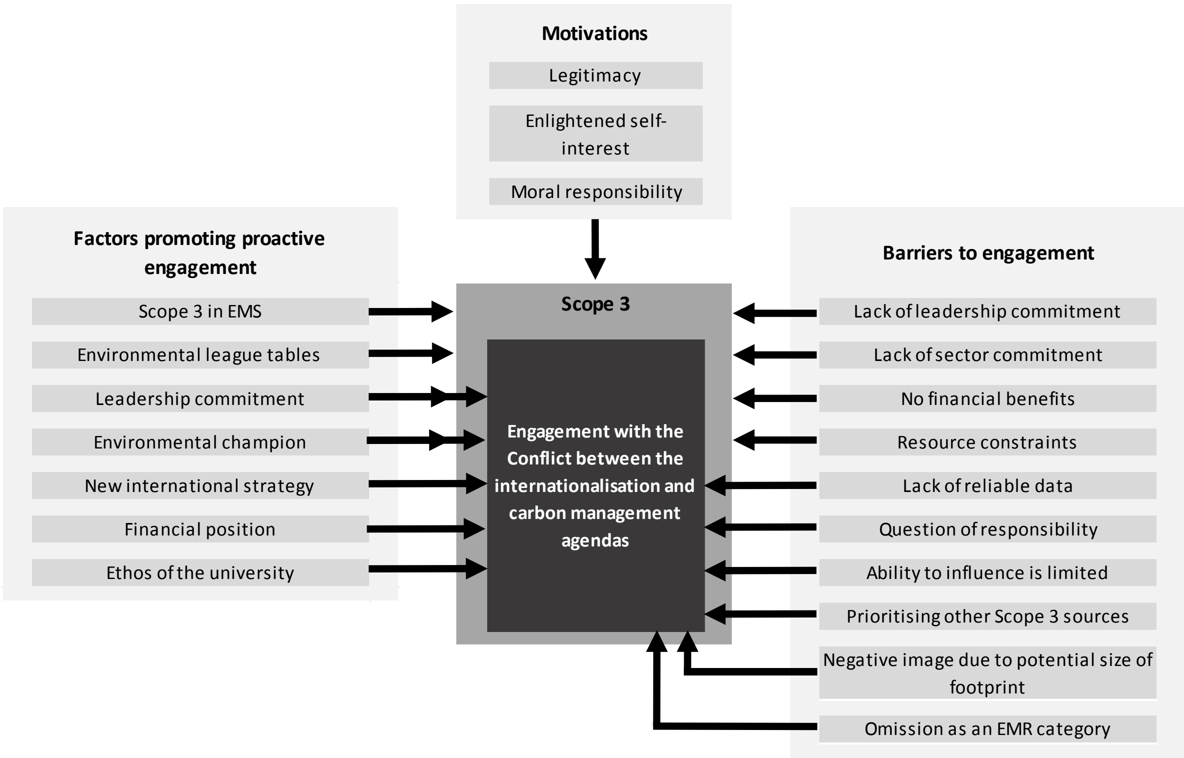

Figure 8.1. Motivations, success factors and barriers to engagement with Scope 3 emissions and the Conflict, identified from the analysis of the case studies

All the case study HEIs, including those at the leading edge of the sustainability/carbon management agenda, were pursuing the internationalisation agenda and therefore emissions from student air travel will increase in the future. Thus, for all HEIs the benefits of the internationalisation agenda in terms of income generation and enhancing the student experience were perceived to outweigh the additional induced emissions. There is an attitude-behaviour gap in terms of institutional responses to the Conflict, with the majority of HEIs not accounting for student air travel emissions and not engaging in actions to mitigate and/or compensate for them. However, organisations need to significantly increase the rate of emission reduction and that requires radical changes and breaking away from current models and behaviours (Bouvrie et al., 2014).

8.5 Options to reconcile the Conflict

The UK HE sector will continue to place considerable importance on student mobility going forward as part of its internationalisation strategy. Given the limited technological ability to reduce emissions from air travel, this research sought to identify and qualitatively evaluate a range of options that HEIs could implement to mitigate and/or compensate for student air travel emissions (Objective 3). The carbon management hierarchy (Chapter 2, Section 2.4.6) aids organisations in planning and determining a starting point for engagement with carbon mitigation efforts. Avoiding emissions, as the preferred option, is followed by actions to reduce emissions and offsetting/compensation. In the context of emissions arising from international and study abroad student air travel, this would correspond to, removing the need for travel, reducing the frequency of travel or travel distance, changing the mode of transport for a less carbon intensive alternative and offsetting/compensation. However, the findings from Chapters 5-7 suggests that:

> ***A robust carbon management strategy for the HE sector must involve offsetting and/or compensation due to the limited opportunities to avoid and reduce student air travel emissions.***

As identified in the literature review, in theory transnational education (TNE) could provide the UK HE sector with a way of avoid or reducing student air travel, while maintaining a cohort of international students. However, while some forms of TNE have the potential to avoid and reduce student air travel, it is likely that substantial emissions will remain due to the importance international students place on experiencing British culture and the perceived quality of education in the UK (as discussed in Chapter 5, Section 5.3). Moreover, Tsiligiris (2014) states that TNE tends to attract different types of students, those who under normal circumstances could not afford to come to the UK to study. Notwithstanding the above, given the importance placed on international students for income generation, the home student experience, and international standing, it is unlikely any HEI would want to reduce students coming to study in the UK.

With regard to reducing air travel consumption, the student survey results (Chapter 5) suggest that while there is an awareness of the impact of air travel on global climate change from the majority of students, this is coupled with an apparent reluctance to reduce personal levels of air travel consumption. Thus, the reality is that there is a limited potential to reduce emissions through voluntary reduction in air travel consumption.

Nevertheless, HEIs could provide incentives to reduce flight frequency. This could involve providing free or reduced-price accommodation over the summer. However, as noted in Chapter 4, if HEIs took action to encourage fewer student flights, a behavioural rebound-type effect might occur, where the number of VFR flights increases to maintain a similar degree of student-VFR contact. Train travel represents a viable substitute for students from Western Europe and is an area of focus that the sector as a whole could pursue. Moreover, providing information to students about the climate change implications of different modes of transport will help them to make an informed decision. Furthermore, HEIs could raise awareness of options for reducing emissions associated with the flight, for example choosing direct flights, flying economy class and choosing airlines with lower carbon emissions. With respect to study abroad, there are alternative ways of internationalising the student experience, for example utilising local immigrant populations and creating local 'study away' experiences (Dvorak et al., 2011).

As noted above, it is likely carbon offsetting will prove necessary in order to deliver a reduction in total emissions. The survey found that approximately three quarters of respondents were willing to pay to offset their flight emissions (Chapter 5, Section 5.4). Conversely, the majority of case study HEIs did not believe carbon offsetting was the right approach, citing similar reasons to the survey respondents (scepticism about where money is going, the belief that offsetting does not target the root of the problem and may delay actions to avoid/reduce air travel). However, some recognised it does have a place in certain situations (but only as a last resort) while one HEI was very much looking to carbon offsetting and was in the process of developing an institutional offset scheme for staff and students (see Chapter 7, Section 7.7.2). With regard to offsetting not tackling the root of the problem and delaying actions to reduce/avoid air travel, the facts remain that all case study HEIs were looking to increase international and study abroad student numbers and that they are not engaging in activities to reduce/avoid air travel. As the students are also unwilling to reduce air travel, offsetting/compensation is the only remaining option. Moreover, it is an option that the majority of students are willing to pay for.

With respect to compensatory activities (see Chapter 5, Section 5.5), the case study HEIs generally considered them to be of value (see Chapter 6, Section 6.7.4 and Chapter 7, Section 7.8.4). The student survey results revealed a preference for schemes with quantifiable reductions (see Chapter 5, Section 5.5). However, only a small proportion of respondents opposed or strongly opposed any of the schemes presented, suggesting that all of them could be deemed acceptable/unlikely to be opposed. That said, for the amount of money involved, any investment in carbon reduction projects on campus or in the local community (the most popular approaches) would be unlikely to deliver significant reductions. The relative impact of money spent in developing countries would be greater compared to the same amount invested in the UK.

8.6 Contribution to knowledge

There is a recognition that current patterns of human activity and consumption cannot continue going forward, and that if we were to pursue a 'business as usual' path, this would lead to intolerable consequences for the planet. Society needs to achieve significant reductions in GHG emissions but must do so against a backdrop of continuous economic growth. This is a global challenge that will require a concerted effort from every nation. From a UK perspective, the Climate Change Act (2008) sets out a framework for the UK to achieving emission reductions and includes a legally binding commitment to reduce GHG emissions by 80% by 2050, from a 1990 baseline (HMSO, 2008).

Clearly, as this research has demonstrated, there are significant challenges for organisations who face conflicting business priorities in responding to the sustainability/carbon management agenda. Indeed, while there is the need for growth and risk management, there is also the requirement to account for and reduce the environmental impact of operations. This is not just in relation to direct GHG emissions. This research has clearly demonstrated that narrowly set boundaries that exclude indirect (Scope 3) emissions significantly underestimate emissions and thus provide a misleading picture of an organisation's carbon footprint. Moreover, not accounting for indirect emissions inhibits what can be done to proactively engage with carbon reductions. As such, this research has confirmed the need for organisations to account for and engage with Scope 3 emission sources such as employee commuting and business travel, and the emissions associated with products (goods and services).

One of the main contributions of this thesis is concerned with exploring the willingness and capacity of economic actors to modify their behaviour when the options available do not conventionally fall into the environmental-economic win-win category. This research, using the Conflict between the internationalisation and carbon management agendas in the UK HE sector, has provided a clear demonstration of the significance of the challenge facing society. The reluctance and inability to engage with challenges that require a trade-off, or compromise between the economic and social benefits and environmental costs has implications for the achievability of a global reduction in emissions. If organisations continue to focus on easy options (i.e. direct emissions), there is a risk that the impacts associated with harder to reach parts of the supply chain may soon negate any reductions in Scope 1 and 2 emissions. As such, this research has demonstrated the urgency with which organisations need to act. The position of leaving the harder aspects of the carbon footprint for another day is no longer an acceptable course of action.

This research has revealed a sector struggling with the trade-off between economic and social incentives and carbon. While this research found that a small minority of HEIs are beginning to engage with the challenges more proactively, the majority are struggling and in response to reputational risks associated with various organisational functions and resulting carbon consequences, have employed a number of strategies that are termed here, 'negative' risk management actions (Figure 8.2). These risk management actions are not limited to the HE sector, having been utilised by companies in various sectors of the economy in response to sustainability performance and reputational risks (see Bebbington et al. 2008).

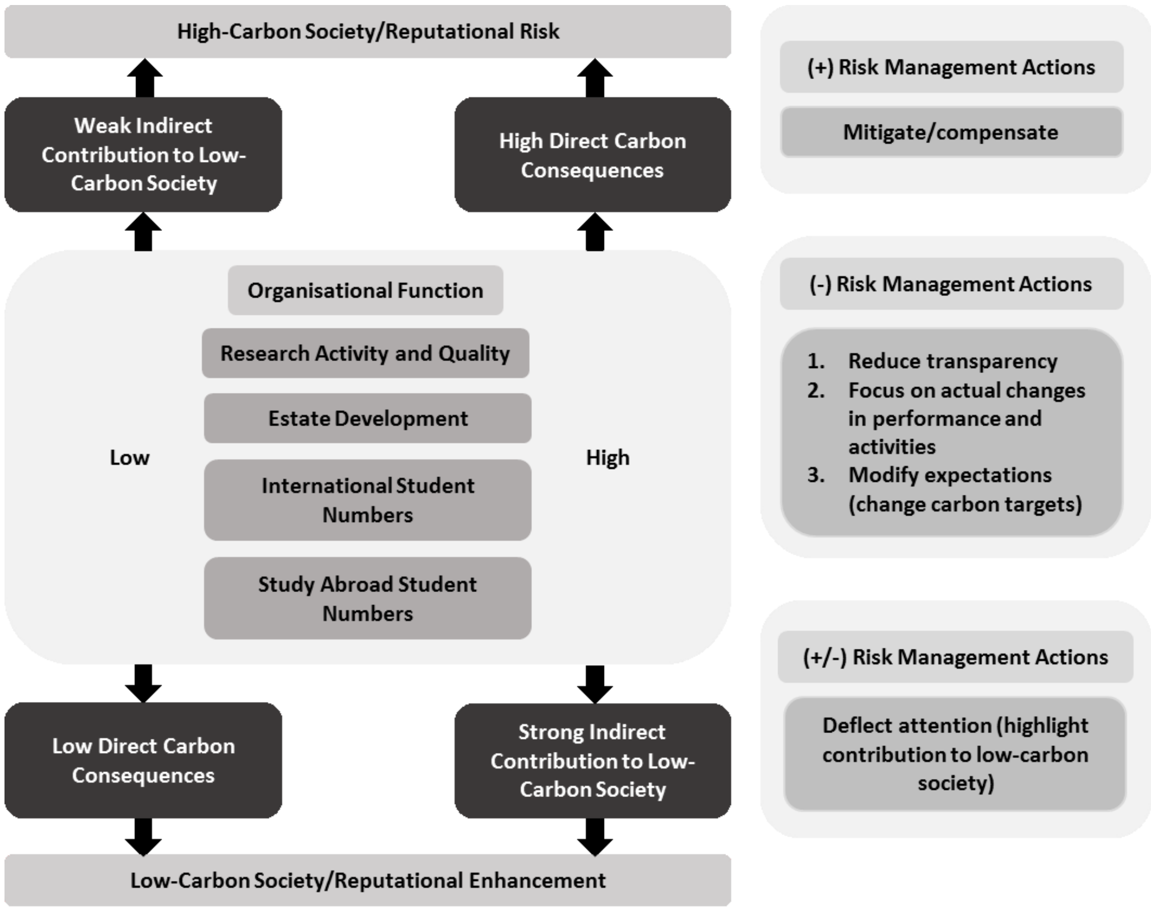

Figure 8.2. Model demonstrating the link between organisational functions and carbon/reputational consequences and risk management actions

This research identified three main negative risk management strategies (as shown in Figure 8.2). HEIs were reducing transparency through a boycott of the PPUL as well as by obfuscation, whereby instead of reporting achievements against institutional and sector targets, they focused on and highlighted specific information that was not placed in the context of the overall footprint or target. In addition, some HEIs were considering setting intensity, rather than absolute carbon reduction targets, which would further obscure actual performance. A number of HEIs were modifying expectations by establishing less challenging Scope 1 and 2 emission reduction targets, rather than taking additional action or making the required investment to achieve original targets.

One of the main arguments from some research-intensive HEIs was that their contribution to the low-carbon society is often ignored and that the HE sector may be seen as a 'special case'. This is not dissimilar to the case being made by the Information Technology (IT) sector; the difference between Green IT and IT for Green (see Chapter 6, Section 6.7.2). This risk management action is classed in Figure 8.2 as potentially positive or negative. Indeed, while the indirect impact of the contribution to the low-carbon society may be far greater than the direct carbon consequences, there is a need to make the low-carbon society argument more credible by substantiating this claim. If an institution is simply stating this point, then it falls into obfuscation and is classed as a negative risk management action.

Most HEIs sit on either the left hand side of the model presented in Figure 8.2 (weak indirect contribution to low-carbon society/low direct carbon consequences) or the right hand side (strong indirect contribution to low-carbon society/high direct carbon consequences). However, there is a need to shift the positioning of HEIs to the lower half of the model (low direct carbon consequences/strong indirect contribution to low-carbon society). HEIs must move away from actions to reduce transparency, deflect attention, etc., towards positive actions to mitigate and/or compensate and find solutions to overcome barriers to engaging with more challenging emission sources. Only a few HEIs in this study had overcome barriers (presented in the revised conceptual framework; Figure 8.3) to engaging with challenging emission sources, motivated by the need to maintain legitimacy, moral responsibility and enlightened self-interest. Moreover, the presence of an environmental champion and senior leadership commitment (among other factors) were crucial in engaging with the Conflict and accounting and compensating for student air travel emissions.

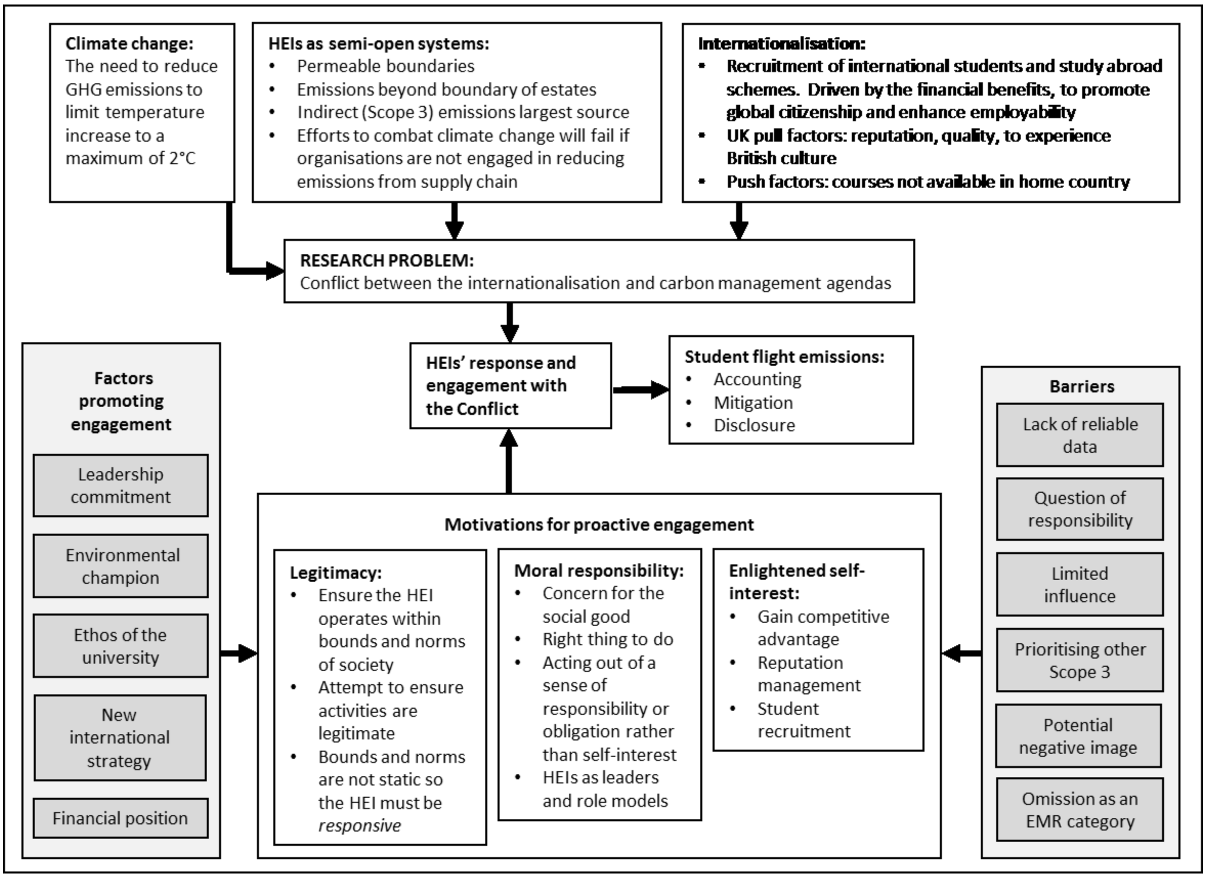

Figure 8.3. Revised conceptual framework presenting the motivations for proactive engagement with the Conflict along with factors promoting engagement and barriers

8.7 Theoretical implications

This section positions the findings and conclusions discussed above (Section 8.6) in relation to prior research. Previous articles have identified the potential conflict between elements of the internationalisation and carbon management agendas (Fawcett, 2005; Roy et al., 2008; Dvorak et al., 2011; Hale et al., 2014; Long et al., 2014; Mazhar et al., 2014). However, as Dvorak et al. (2011) state, there has yet to be a strategic examination of the relative costs and benefits of study abroad, given the climate impact of air travel.

Only two peer-reviewed journal articles (Dvorak et al., 2011; Long et al., 2014) and one conference paper (Hale et al., 2014) specifically focus on the conflict between the HE sector's sustainability and internationalisation agendas. However, these studies are somewhat limited in scope, focusing on short term study abroad and the environmental and social impacts at the destination, with no consideration of inbound international students or the carbon implications of internationalisation. This research sought to extend the work of Dvorak et al. (2011), Hale et al. (2014) and Long et al. (2014) through examination of the carbon implications of air travel (the largest environmental impact of studying abroad) including; accounting for student (and VFR) flight emissions, attributing responsibility for the emissions, and potential mitigation and compensation measures. Moreover, institutional and student awareness of the carbon implications of student air travel and the extent of engagement with this issue by HEIs was examined.

As discussed in the previous section (8.6), this research has clearly demonstrated the importance of including Scope 3 emissions within a HEI's carbon footprint. A number of research articles have sought to produce a full carbon footprint for HEIs however these studies have focused on emissions from a single HEI, which given the diversity of institution types, are unlikely to be representative of the sector as a whole (Ozawa-Meida et al., 2013; Townsend and Barrett, 2015). Townsend and Barrett (2015) state that downstream emissions associated with goods and services are negligible for HEIs. Thus, they did not include emissions from student and staff commuting or student travel from their home to term-time address when they estimated the carbon footprint of Leeds University. However, this study contradicts Townsend and Barrett's (2015) statement and has clearly demonstrated the significance of student air travel emissions (see Chapter 4). Ozawa-Meida et al. (2013) included international student air travel emissions when calculating the carbon footprint of De Montfort University, while acknowledging that it could be an underestimate due to the low number of trips assumed for EU (two trips) and non-EU (one trip) nationals and the use of capital cities as the departure and arrival point. This research has confirmed that the HEFCE (2010b) assumptions used by Ozawa-Meida et al. (2013) significantly underestimate student travel frequency. However, the use of the capital city was found to have a minimal impact on the emissions estimate.

With regard to institutional responses to the Conflict, Dvorak et al. (2011) offer three positions likely to be adopted by a HEI. The first is that the internationalisation agenda, and associated international student recruitment and study abroad schemes, are so valuable that the socio-economic benefits outweigh any environmental costs. The second perspective is to reflect on and compare the socio-economic benefits of study abroad against the environmental costs and make an informed decision as to whether the travel can be justified. Finally, the third perspective is that international student recruitment and study abroad schemes are too consumptive and not aligned with the sector's sustainability agenda. Dvorak et al. (2011) believe that the HE sector has made few (if any) changes to curb or account for the environmental impacts associated with student air travel. Fawcett (2005: 13) agrees with this assessment, stating "…there is little evidence that the sector has begun to acknowledge the damage to the climate involved in recruitment of international students". While Hale et al. (2013: 361) assert that the trend toward sustainability in educational travel may lag behind other areas of the general push for sustainability in HE. This research confirms these hypotheses, concluding that the UK HE sector is poorly equipped to respond to the challenge presented by student air travel emissions. This relates to an ongoing focus on, and difficulties achieving, Scope 1 and 2 reductions (as found by Robinson et al. (2015) in their analysis of carbon reduction progress at Russell Group HEIs), varied engagement with Scope 3 emissions and the economic importance HEIs place on student mobility. Indeed, the results of this research correspond to the findings of Bolsmann and Miller (2008) and Knight (2011) in concluding that the primary motivation of international student recruitment is income generation and diversification.

While many of Environment and Sustainability Managers in this study demonstrated a willingness to engage with the Conflict, there is little open acknowledgement or action from HEIs. Indeed, only two were proactively engaging with the Conflict, driven by an environmental champion and strong leadership commitment to the sustainability and carbon management agendas. These driving factors are in line with the factors identified in previous research on organisational change for sustainability in HE (Clugston and Calder, 1999; Ferrer-Balas et al., 2008; McNamara, 2010; Brinkhurst et al., 2011; Ralph and Stubbs, 2014; Zhao and Zou, 2015). The barriers to engagement presented in Figure 8.1 (see Section 8.4) may explain the disparity between some respondents' stated willingness to account for, and engage in actions to mitigate and/or compensate for student air travel emissions, and actual evidence. A number of barriers to engagement with student air travel emissions align with previous research on barriers to engage with sustainability in

HE, for example, resource constraints, lack of leadership commitment and a profits orientation (Filho, 2000; Velazquez et al., 2005; Dyball, 2010), while others are more specific and extend knowledge on barriers to engaging with challenging Scope 3 sources. These include a lack of reliable data, a limited ability to influence Scope 3 sources, and reputational risks associated with extending the carbon footprint. One significant barrier relates to the question of who has responsibility for mitigating and/or compensating for student air travel emissions (see Chapter 2, Section 2.7.7). Dvorak et al. (2011: 145) state that, “If the aim is for students to gain cultural awareness and understand global social inequities, then institutions must accept some responsibility for contributing to climate change”. This research extends thinking on responsibility for student air travel emissions, highlighting that there is no single view on who should hold responsibility for these emissions, rather, multiple positions reflecting the concept of producer vs consumer responsibility, as well as the notion of sharing responsibility among all stakeholders who benefit from student air travel. Further work examining alternative approaches to determining attributable emissions would make a valuable contribution to the responsibility debate, and would help define the extent to which the HE sector should (or could) mitigate or compensate for these emissions. In particular, evaluating incremental emissions (based on a comparison of flight frequency, including leisure trips, between those who do and do not study overseas) may prove helpful.

With regard to reconciling the conflict, there are limited options to avoid or reduce student air travel. Indeed, while the results indicate increasing awareness of the impact of air travel on global climate change (the flyers’ dilemma), this is coupled with an apparent reluctance to reduce personal levels of air travel consumption (as found by, Becken, 2007; Hares et al., 2010; McKercher et al., 2010; Higham and Cohen, 2011; Higham et al., 2014). This highlights the point that far fewer people appear willing to make profound changes to their lifestyle. Thus, confirming previous literature, there is an attitude-behaviour gap in relation to air travel consumption (Becken, 2007; Higham and Cohen, 2011). This research builds on the work of Becken (2007), who suggests that people look to alleviate inconsistencies between attitude and behaviour through denial, as one of a number of possible defence mechanisms. Students in this study demonstrated denial by highlighting aviation as a small source of emissions, by noting sources of emissions perceived to be of greater concern, by highlighting that the benefits of air travel outweigh the costs, and by alluding to 'compensatory actions' in other areas of their lives.

Notwithstanding the above, given the importance placed on international students for income generation, the home student experience, and international standing, it is unlikely any HEI would want to reduce students coming to study in the UK. Thus, a robust carbon management strategy for the HE sector must involve offsetting and/or compensation, given the limited opportunities to avoid or reduce air travel. Indeed, Dvorak et al. (2011), Hale et al. (2014) and Long et al. (2014) all see the value of carbon offsetting as a method of mitigating student air travel emissions. Moreover, this research has confirmed it is an option that the majority of students are willing to pay for.

8.8 Practical contributions and policy implications

One of the intended outcomes of this research was to provide best practice guidance for HEIs and to inform the sustainability and carbon management policies of the various funding councils, thereby contributing to improved environmental sustainability across the UK HE sector.

HEIs have been given a mandate to help facilitate the transition to a more sustainable, low-carbon society and their carbon management strategy should include actions to create a carbon literate population given that to achieve significant emission reductions will likely require consumer behavioural changes. When accounting for GHG emissions, HEIs should consider all Scopes, identify drivers for action and determine what policies and practices can be implemented.

Given the magnitude and urgency of the climate change challenge, far greater engagement with Scope 3 emissions is required. Furthermore, there is a risk that significant Scope 3 emissions are not being accounted for and are therefore not being managed. In order to shift the majority of HEIs to more proactive engagement, both the risks of non-engagement (reputational risks) and benefits of engagement (reputational enhancement) need to increase through increased exposure. Thus, this research recommends the sector adopt a leading position by introducing mandatory reporting of Scope 3 emissions for UK HEIs, with penalties for non-compliance.

Inbound and outbound student air travel emissions should be included as a reporting category in the HESA EMR and while the ideal would be that HEIs evaluate and report on VFR emissions as well, this is unlikely to be feasible. Nevertheless, HEIs should be aware of the significance of VFR emissions and consider evaluating any potential changes to VFR travel behaviour before implementing any initiatives to mitigate student air travel emissions. Indeed, if action were taken to encourage fewer student flights, it is conceivable that the number of VFR flights might increase, thereby decreasing or negating any expected reduction in economy-wide emissions. An option for encouraging HEIs to engage with student air travel emissions may be for the HESA to estimate and report the emissions based on the inbound and outbound student population at each HEI, using the estimates for flight frequency presented in this study. Moreover, for informative purposes, HESA could estimate and report VFR air travel emissions.

This research has shown that senior leadership support was a critical factor for HEIs proactively engaging with student air travel emissions and Scope 3 emissions in general. Sustainability/Environmental Managers could develop a business case for engagement with Scope 3 and student air travel emissions that emphasises the reputational benefits, the moral responsibility of the HEI to be at the leading edge of the sustainability agenda and the need to maintain legitimacy. Moreover, managers could use the reasoning presented in Section 8.3 when justifying inclusion of student air travel emissions within the operational boundary of the HEI.

Figure 8.4 presents the accounting methodology for calculating student flight emissions and revised estimates for flight frequency (see Chapter 4, Section 4.2). As an alternative to a travel survey, HEIs may want to incorporate a mandatory question on travel frequency (i.e. how many times do you plan to return home during the academic year?) within the online enrolment process.

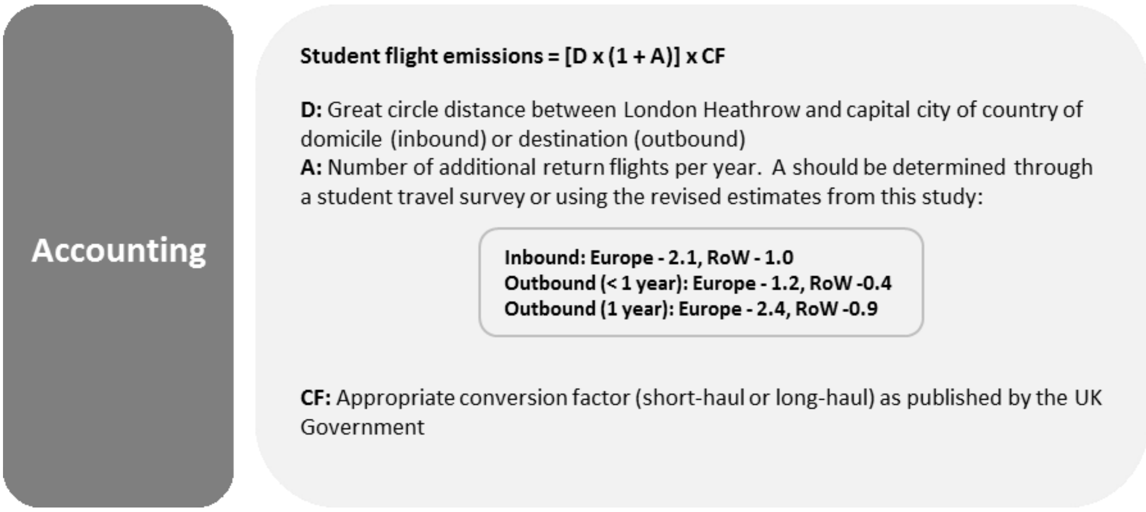

Figure 8.4. Accounting methodology for inbound and outbound student air travel emissions

Figure 8.5 presents a range of options to mitigate or compensate for student air travel emissions.

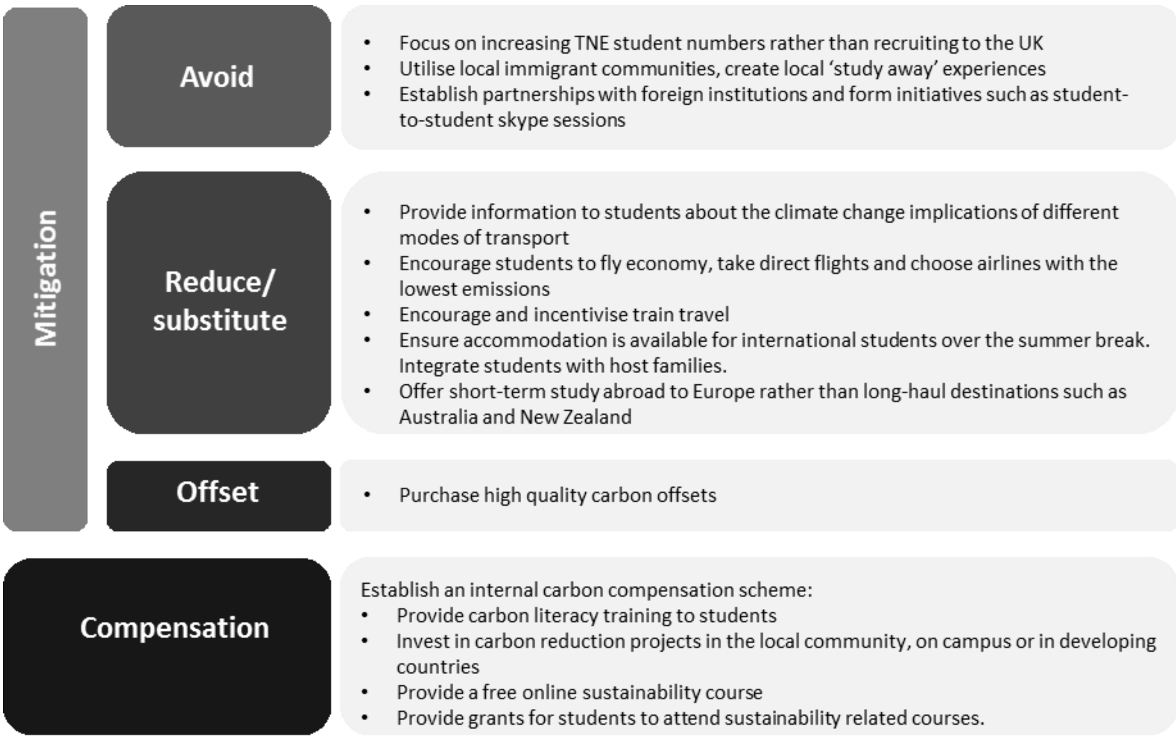

Figure 8.5. Mitigation and compensation options for inbound and outbound student air travel emissions

The results of the student survey (Chapter 5) suggests that, (a) there is not enough information available for students regarding aviation's impact on climate change and (b) some students thought they were well informed but actually do not understand the relative impact of aviation. HEIs should raise awareness about the carbon consequences of individual consumer decisions (not just in relation to transport) given that the less information that people have, the more likely that they are to act in their own self-interest (McKercher et al., 2010).

This research has highlighted the importance of carbon offsetting/compensation when there is a limited ability to implement initiatives to avoid or reduce emissions. While some argue that offsetting does not tackle the root of the problem, the fact is that, as shown in this study, when an organisation is not engaging in activities to avoid and reduce emissions, offsetting/compensation is the only remaining option. With respect to the establishment of a university led offset or compensation scheme, Mair (2011) suggests that offsetting must become mandatory or it will not be a viable mitigation method. Moreover, in line with some of the respondents' comments, Mair (2011) suggests building in the price of the offset in the ticket price, or in the case of HEIs, the tuition fee. The results of the survey suggest the majority of students would accept an additional cost with a small minority potentially resistant. To overcome potential resistance, HEIs need to be transparent about where the money is going if they are to administer such a scheme themselves. The UK HE sector as whole should also explore the possibility of a sector-wide offset/compensation scheme.

8.9 Research critique and further lines of enquiry

This section acknowledges the limitations of the research and suggests further lines of enquiry.

Given the diversity of HEIs across the UK and indeed internationally both in respect of their internationalisation agenda, their teaching and research activities, their infrastructure, age and size, there would have been benefit in significantly expanding the case study sample size. However, Ritchie et al. (2003) note that a small-scale sample can work if a robust purposive sampling strategy, such as the strategy adopted in this study, has taken place.

Accessibility to potential interviewees was a significant factor in determining the number of interviews held at each of the case study HEIs. While this study included interviews with individuals involved at all levels (e.g. senior executive level, management level and operational staff level), it would be valuable to broaden the data collection further to include interviews with individuals involved in the sustainability or internationalisation agenda from different departments and levels at each institution. Indeed, individuals at an executive level with knowledge of the sustainability and/or the internationalisation agenda would be in a position to comment on current and future policy relating to the Conflict, while those at the operational level would provide insights into operational matters and current response. Moreover, including individuals from different departments and contexts would increase richness and depth on the phenomenon of interest.

One of the main arguments from some research-intensive HEIs in this study was that their contribution to the low-carbon society is often ignored when benchmarking HEIs. However, while the indirect impact of the contribution to the low-carbon society may be far greater than the direct carbon consequences, there is a need, through further research, to make the low-carbon society argument more credible by substantiating this claim.

When conducting qualitative and quantitative research, there is always a possibility of response bias that influences the participants in the study. These biases are especially important to acknowledge when using self-reported data such as interviews. This response bias could be in the form of selective memory, whereby the interviewee acknowledges the positive aspects of the HEI but ignores or attributes the negatives to external forces, and exaggeration, whereby the interviewee presents outcomes as more significant than actually suggested from other data (USC, 2016). However, the researcher sought to limit response bias by anonymising institutions and respondents and by ensuring the questions did not imply there was a correct answer.

This research was based on a cross-sectional survey and interview and so was limited in that it did not provide longitudinal evidence of changes in student's travel behaviour and perceptions of the Conflict or the institutional response to the Conflict. Further research will be able to monitor perceptions towards, and engagement with, Scope 3 emissions and the Conflict between the internationalisation and carbon management agendas going forward.

This research was geographically focused to UK HEIs. However, internationalisation in higher education is a global phenomenon and it would be valuable to compare and contrast responses and perceptions of the Conflict from the perspective of countries such as the United States, France, Germany, Canada and Australia, who all have significant international student populations. In addition, this research was limited to international students who had elected to study at UK HEIs. Thus, it would be useful to ask the question on the attractiveness of alternative models of delivering UK HE to potential international students who have not experienced studying in the UK, contrary to the respondents in this study. Indeed, there is another potential risk in that increased provision of split study modes of delivery might attract students who would not consider studying in the UK for a full degree.

With respect to accounting for all student air travel emissions, emissions from study abroad air travel could not be calculated at an institutional level due to limited data availability. While this source is much smaller than inbound student air travel emissions, it may increase proportionally in the future. Thus, to evaluate the full impact of the internationalisation agenda on institutional carbon footprints, further research should endeavour to include and evaluate outbound student air travel emissions within the operational boundary of HEIs.

The researcher acknowledges that by arguing that all student flights are induced by HEI service offerings (Section 8.3), a particular perspective on accounting for student travel emissions has been adopted. Thus, further work examining alternative approaches to determining attributable emissions would make a valuable contribution to the responsibility debate, and would help define the extent to which the HE sector should (or could) mitigate or compensate for these emissions. In particular, evaluating incremental emissions (based on a comparison of flight frequency, including leisure trips, between those who do and do not study overseas) may prove helpful.

Finally, the lack of prior research on this topic could be considered a limitation as prior literature helps to lay the foundations for understanding the research problem under investigation, thus it left the researcher without any established framework to work with. Without this prior knowledge, the researcher had to define the area of investigation, which ultimately led to the exploratory research design, which can serve as a basis for further work in the field.

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Appendices

Appendix 1. Key International Events in Response to Climate Change

Year	Event	Description
1988	Intergovernmental Panel on Climate Change (IPCC) established	IPCC established by the World Meteorological Organization (WMO) and UN Environment Programme (UNEP) to assess scientific, technical and socio-economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation (IPCC, 2016a). The IPCC comprises of three working groups (IPCC, 2016b): • Working Group I: Assesses physical scientific aspects of climate change. • Working Group II: Assesses the environmental and socio-economic impacts of climate change. • Working Group III: Assesses options for mitigating climate change.
Nov. 1990	IPCC and Second World Climate Conference Call for Global Treaty	IPCC releases its **first assessment report** (FAR) and presented a flexible and progressive approach comprising of shorter-term mitigation and adaptation measures and proposals for more intensive action over the longer-term (IPCC, 1990). Developed possible elements for inclusion in a framework convention on climate change.
Dec. 1990	UN General Assembly (UNGA) Negotiations on a Framework Convention Begin	The 45th UNGA noted the findings of the IPCC FAR and initiated negotiations (via WMO & UNEP) of an effective framework convention on climate change to be completed prior to the UN Conference on Environment and Development in June 1992 (UNGA, 1990).
May 1992	Convention adopted	The text of the United Nations Framework Convention on Climate Change (UNFCCC) is adopted
June 1992	UN Conference on Environment and Development (Rio Earth Summit)	**The Earth Summit Agreements** (UN, 1997): (1) Agenda 21, a programme for global action in all areas of sustainable development (2) Rio Declaration on Environment and Development, a series of principles defining the rights and responsibilities of States (3) Statement of Forest Principles, a set of principles to underlie the sustainable management of forests worldwide. **Legally binding conventions opened for signature:** (1) The UNFCCC, (2) The Convention on Biological Diversity, (3) The Convention to Combat Desertification.
Mar. 1994	UNFCCC enters into force	The UNFCCC enters into force and is ratified by 196 countries (known as "Parties") thus has near-universal membership. The UNFCCC specified the aim of Annex I Parties[a] reducing their GHG emissions to 1990 levels by the year 2000 (UN, 1992a). Parties commit to meet annually at the Conference of the Parties (COP) to negotiate unilateral responses to climate change (UN, 1992a).

April 1995	COP 1 - Berlin	Parties agree that commitments in Convention are inadequate for meeting the Convention's objectives (UNFCCC, 2014b). The **Berlin Mandate** proposes strengthened commitments for developed countries, thus laying the groundwork for the **Kyoto Protocol** (UNFCCC, 2014b).
Dec. 1997	COP 3 - Kyoto	Adoption of the **Kyoto Protocol,** which commits 37 industrialised countries to legally binding targets to limit or reduce GHG emissions (UN, 1998). Under the Kyoto Protocol the 37 nations were required to reduce emissions from the six GHGs[b] by an average of 5% from 2008-2012 against a baseline of 1990 levels (UN, 1998).
Nov. 2001	COP 7 - Marrakesh	The **Marrakesh Accords** set the stage for ratification of the **Kyoto Protoco**l. Three Flexibility Mechanisms are established, designed to lower the cost of meeting targets: International Emissions Trading, Joint Implementation and Clean Development Mechanism. These 'flexible mechanisms' help stimulate green investment and help Parties meet their reduction targets in a cost-effective way (UNFCCC, 2015).
Feb. 2005	Kyoto Protocol enters into force	The **Kyoto Protocol** enters into force a little over 7 years after it was adopted. As of 2015, 191 countries and one regional economic integration organisation (the European Union) had ratified the Kyoto Protocol (UNFCCC, 2014c). However, the world's largest emitter of GHGs at the time, the USA, never ratified the protocol (UNFCCC, 2014c).
Dec. 2005	COP 11/Meeting of the Parties (CMP) 1 - Montreal	COP 11 is held in conjunction with the first CMP. The CMP reviews the implementation of the **Kyoto Protocol**. The **Montreal Action Plan** agrees to extend the life of the **Kyoto Protocol** beyond the 2012 expiration and begin negotiations for greater cuts in GHG emissions (UNFCCC, 2006).
Dec. 2007	COP 13/CMP 3 - Bali	Adoption of the **Bali Road Map**, which aims to achieve a new international agreement with legally binding emission reduction targets by 2009 (UNFCCC, 2014b).
Dec. 2009	COP 15/CMP 5 - Copenhagen	Resulted in the **Copenhagen Accord** but did not achieve international agreement on legally binding reduction targets. Commits to achieving agreement in 2010 (UNFCCC, 2009).
Dec. 2010	COP 16/CMP 6 - Cancun	Resulted in the **Cancun Agreements**, a package by governments to assist developing nations adapt to climate change (UNFCCC, 2010). Fails to achieve a legally binding agreement to reduce emissions but results in a shared vision to keep global temperature rise to below 2°C (including possibility of 1.5°C limit).
Dec. 2011	COP 17/CMP 7 - Durban	Fails to achieve a legally binding agreement. Starts the process again and an agreement to establish a legally binding deal by 2015, COP 21/CMP 11 (UNFCCC, 2011).
Dec. 2012	COP 18/CMP 8 - Doha	Governments agree to work toward a universal climate change agreement by 2015. New commitment period for Kyoto Protocol launched under the **Doha Amendment**. The Doha Amendment to the protocol commits 37 nations to binding targets to reduce GHG emissions[c]. The European Union committed to a 20% reduction by 2020, from a 1990 baseline, but stated a conditional offer to move to a 30% reduction provided other developed countries commit to similar targets (UNFCCC, 2012). Japan, Russia and New Zealand have not

		adopted new targets for the second commitment period (UNFCCC, 2012).
Nov. 2013	COP 19/CMP 9 - Warsaw	Continues negotiations for 2015. Produces the **Warsaw Outcomes**, including a rulebook for reducing emissions from deforestation and forest degradation and a mechanism to address loss and damage caused by long-term climate change impacts (UNFCCC, 2014b).
Nov. 2014	Climate Summit – New York	Summit focuses on initiatives and actions to reduce emissions rather than on negotiations between nations (UNFCCC, 2014b).
Dec. 2014	COP 20/CMP 10 - Lima	The **Lima call for Climate Action** strengthens the negotiation process to reach an agreement in 2015 (UNFCCC, 2014b).
Dec. 2015	COP 21/CMP 11 - Paris	Resulted in the **Paris Agreement** and a commitment to limit global average temperature rise to well below 2°C and to pursue efforts to limit the temperature increase to 1.5°C

Note. (a) Annex I Parties to the Convention include: Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, European Union, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland, and the United States of America (UNFCCC, 2014a); (b) Carbon dioxide ($C0_2$), Methane (CH_4), Nitrous oxide (N_20), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulphur hexafluoride (SF_6) (UN, 1998); (c) Nitrogen trifluoride (NF3) was added to the six Kyoto GHGs for the second commitment period (UNFCCC, 2012).

Appendix 2. Classification of UK Higher Education Institutions

Classification group	2013/14		
	tCO_2e	Total Students	tCO_2e/ student
Ancient	**347,085**	**115,935**	**3.0**
The University of Aberdeen	37,409	12270	3.0
The University of Cambridge	84,992	18855	4.5
The University of Edinburgh	81,889	26595	3.1
The University of Glasgow	45,059	26380	1.7
The University of Oxford	74,518	23320	3.2
The University of St Andrews	23,217	8515	2.7
Red Brick	**316,389**	**155,930**	**2.0**
The University of Birmingham	47,525	26865	1.8
The University of Bristol	49,876	19320	2.6
The University of Leeds	54,398	29615	1.8
The University of Liverpool	43,770	19850	2.2
The University of Manchester	76,978	35160	2.2
The University of Sheffield	43,841	25120	1.7
2nd Wave Civic	**293,901**	**200,940**	**1.5**
Aberystwyth University	13,330	10025	1.3
Bangor University	11,669	10350	1.1
Cardiff University	36,048	25385	1.4
St Mary's University College	769	1185	0.6
Stranmillis University College	1,978	1495	1.3
Swansea University	17,215	13550	1.3
The Queen's University of Belfast	26,451	21485	1.2
The University of Exeter	25,415	18275	1.4
The University of Hull	17,389	16370	1.1
The University of Leicester	31,456	14185	2.2
The University of Reading	16,260	12480	1.3
The University of Southampton	33,198	23655	1.4
University of Nottingham	62,721	32500	1.9
Plate Glass	**424,547**	**284,105**	**1.5**
Aston University	10,145	8515	1.2
Brunel University London	18,691	11995	1.6
Heriot-Watt University	16,987	8360	2.0
Loughborough University	23,793	13985	1.7
Royal College of Art	2,213	1340	1.7
The City University	7,959	14620	0.5
The University of Bath	19,231	12135	1.6
The University of Bradford	7,863	11225	0.7
The University of Dundee	23,412	10480	2.2
The University of East Anglia	22,797	14730	1.5
The University of Essex	16,068	10590	1.5
The University of Keele	10,921	9580	1.1
The University of Kent	15,821	17745	0.9
The University of Lancaster	13,978	12510	1.1
The University of Salford	12,650	16930	0.7
The University of Stirling	13,671	9080	1.5

The University of Strathclyde	29,313	18470	1.6
The University of Surrey	23,695	12080	2.0
The University of Sussex	20,946	12985	1.6
The University of Warwick	45,688	20170	2.3
The University of York	24,739	15735	1.6
University of Newcastle-upon-Tyne	43,965	20845	2.1
University of London (current and past members)	**295,147**	**149,950**	**2.0**
Birkbeck College	3,916	15295	0.3
Central School of Speech and Drama	587	985	0.6
Courtauld Institute of Art	734	400	1.8
Goldsmiths College	5,333	8130	0.7
Heythrop College	804	670	1.2
Imperial College of Science, Technology and Medicine	76,428	15570	4.9
Institute of Education	2,851	5135	0.6
King's College London	42,607	25480	1.7
London Business School	3,357	1670	2.0
London School of Economics and Political Science	13,860	10420	1.3
London School of Hygiene and Tropical Medicine	5,926	1090	5.4
Queen Mary University of London	25,389	14740	1.7
Royal Academy of Music	924	725	1.3
Royal Holloway and Bedford New College	11,928	9165	1.3
St George's Hospital Medical School	10,426	5125	2.0
The Institute of Cancer Research	7,977	270	29.5
The Royal Veterinary College	5,137	1755	2.9
The School of Oriental and African Studies	1,837	5260	0.3
University College London	63,342	27840	2.3
University of London (Institutes and activities)	11,785	225	52.4
Post-1992	**412,019**	**644,715**	**0.6**
Anglia Ruskin University	8,995	17545	0.5
Birmingham City University	12,426	20350	0.6
Bournemouth University	6,577	13575	0.5
Coventry University	12,460	23580	0.5
De Montfort University	9,657	16795	0.6
Edinburgh Napier University	6,048	10680	0.6
Glasgow Caledonian University	6,397	15050	0.4
Kingston University	13,565	19425	0.7
Leeds Beckett University	14,410	22560	0.6
Liverpool John Moores University	11,319	19900	0.6
London South Bank University	8,924	16670	0.5
Middlesex University	6,023	17095	0.4
Oxford Brookes University	14,552	14650	1.0
Sheffield Hallam University	12,566	27780	0.5
Staffordshire University	11,063	13680	0.8
Teesside University	8,110	14105	0.6
The Manchester Metropolitan University	17,556	30000	0.6
The Nottingham Trent University	16,950	23495	0.7
The Robert Gordon University	10,792	8990	1.2
The University of Brighton	11,415	18615	0.6
The University of Central Lancashire	14,737	20625	0.7
The University of East London	7,724	15305	0.5
The University of Greenwich	8,734	16840	0.5

The University of Huddersfield	9,382	16650	0.6
The University of Lincoln	8,225	12695	0.6
The University of Portsmouth	14,448	19275	0.7
The University of Sunderland	9,590	12740	0.8
The University of the West of Scotland	8,722	14235	0.6
The University of West London	3,261	9840	0.3
The University of Westminster	13,128	18695	0.7
The University of Wolverhampton	12,140	16945	0.7
University of Abertay Dundee	3,244	4630	0.7
University of Derby	9,794	13475	0.7
University of Hertfordshire	21,923	20215	1.1
University of Northumbria at Newcastle	19,393	24400	0.8
University of Plymouth	10,343	20335	0.5
University of the West of England, Bristol	17,428	23275	0.7
2nd Wave New Universities	**171,221**	**277,125**	**0.6**
Bath Spa University	2,773	6470	0.4
Bishop Grosseteste University	1,041	2250	0.5
Buckinghamshire New University	3,971	7680	0.5
Canterbury Christ Church University	7,357	14675	0.5
Cardiff Metropolitan University	5,312	9370	0.6
Edge Hill University	7,155	14970	0.5
Falmouth University	4,533	3895	1.2
Glyndŵr University	3,653	6375	0.6
Harper Adams University	2,162	2695	0.8
Leeds Trinity University	1,998	3245	0.6
Liverpool Hope University	4,768	5920	0.8
London Metropolitan University	6,586	14645	0.4
Newman University	1,247	2845	0.4
Norwich University of the Arts	767	1765	0.4
Queen Margaret University, Edinburgh	2,515	5005	0.5
Roehampton University	6,564	8545	0.8
Royal Agricultural University	1,396	1140	1.2
Southampton Solent University	7,007	11180	0.6
St Mary's University, Twickenham	3,119	4990	0.6
The Arts University Bournemouth	1,442	2920	0.5
The University of Bolton	3,097	5230	0.6
The University of Chichester	2,853	5170	0.6
The University of Northampton	7,048	11505	0.6
The University of Winchester	3,593	6530	0.6
University College Birmingham	4,248	4485	0.9
University for the Creative Arts	4,482	5030	0.9
University of Bedfordshire	7,393	14640	0.5
University of Chester	8,835	12040	0.7
University of Cumbria	5,159	8210	0.6
University of Gloucestershire	3,494	7130	0.5
University of South Wales	15,027	23760	0.6
University of St Mark and St John	2,607	2520	1.0
University of the Arts, London	11,613	16540	0.7
University of Wales Trinity Saint David	7,735	9670	0.8
University of Worcester	4,636	8400	0.6
York St John University	4,037	5685	0.7

Other	**90,861**	**52,435**	**1.7**
Conservatoire for Dance and Drama	1,921	1260	1.5
Cranfield University	14,710	3835	3.8
Guildhall School of Music and Drama	2,294	880	2.6
Leeds College of Art	1,131	1130	1.0
Ravensbourne	1,584	1850	0.9
Rose Bruford College	558	620	0.9
Royal College of Music	987	790	1.2
Royal Northern College of Music	1,419	790	1.8
The Liverpool Institute for Performing Arts	986	720	1.4
The Open University	12,992	475	27.4
Trinity Laban Conservatoire of Music and Dance	1,552	950	1.6
University Campus Suffolk	1,850	3460	0.5
University of Durham	32,251	16180	2.0
University of Ulster	14,614	18730	0.8
Writtle College	2,012	765	2.6

Appendix 3. GHG Emissions Associated with Inbound Student and VFR Flights in Comparison to Mandatorily and Voluntarily reported GHG Emissions in the EMR Return

Note 1. While 27 institutions reported against all EMR reporting categories, the voluntarily reported emissions appeared anomalously high for 1 institution (27.6 tCO_2e/student.yr), and anomalously low (0.3 tCO_2e/student.yr) for another, when compared to the remaining 25 institutions (range 1.2-6.4 tCO_2e/student.yr, average 2.7±1.3 tCO_2e/student.yr, weighted average 2.9 tCO_2e/student.yr) and were therefore excluded from the analysis. For the University of the Arts, London, there are indications that both staff commuting and student commuting have been erroneously entered in $kgCO_2e$ (as opposed to the reporting unit of tCO_2e), being 3 orders of magnitude greater (on a per student basis) than the average at other institutions. At the UAL, student commuting is dominated by public transport via rail (328,527 tCO_2e), bus (17,536 tCO_2e) and underground (5,895 tCO_2e). The reported emissions via these travel modes (assuming all buses are London local buses) are equivalent to 422,681 km travelled per student per year. If it is assumed that all students travel to university 5 days a week for 2 x 10 week terms, this would be equivalent to a daily journey of 4,227 km – or ca. 3 times the distance from Land's End to John O'Groats (a journey which traverses the whole length of the island of Great Britain from the extreme southwest to northeast). Rose Bruford College is one of the smallest UK HEIs, being a specialist drama school with 770 registered students in 2013/14. While the mandatorily reported emissions fall within the range reported by other institutions (on a per student basis), the voluntarily reported emissions are an order of magnitude lower. In particular, procurement emissions appear anomalously low, being ~48 times lower than the weighted average across the 25 institutions included in the analysis (between 1 to 2 orders of magnitude). While these reported emissions may reflect the small size and specialist nature of the institution, they do not appear to be representative of the UK HE sector as a whole, and are excluded from the analysis presented in the paper.

Note 2. Procurement emissions reported in the table below are based on the 'Scope 3 carbon emissions from supply chain' reported in the EMR Return (HESA, 2014b), which are estimated from HEI procurement data (HEFCE, 2012b). Scope 3 carbon emissions from supply chain waste and water have been excluded to avoid double counting with the separately reported water supply and waste water treatment and waste categories (HEFCE, 2012b). Construction procurement is shown separately as this is the single largest component of procurement emissions. Included in 'Other' procurement are Scope 3 supply chain emissions associated with procurement of business services, paper products, other manufactured products, manufactured fuels, chemicals, and gases, food and catering, information and communication technologies, medical and precision instruments, and other and unclassified procurement (HESA, 2014b).

Note 3. There is a significant variation in waste emissions reported by these institutions, which vary over 4-5 orders of magnitude on an absolute and per student basis. It is believed that a significant proportion of this variation is due to differences in data quality and the completeness of the estimate. However, no clear relationship was found between reported emissions and the calculation methodology employed (HEIs can elect one of three calculation methodologies of increasing complexity). Thus, the data has been included in the analysis presented in the paper, where we note that actual waste emissions may be substantially different to the total reported here.

UK Higher Education Institution	Mission Group / Association[a]	Student Population[b] Total #	International #	International (%)	People & Planet University League Scores[c] C Management	C Reduction	Total	GHG Emissions Reported in the 2013/14 EMR Return (tCO_2e/yr) Mandatorily Reported Estates Emissions Scope 1	Scope 2	Scope 3	Total Mand.	Voluntarily Reported Scope 3 Emissions Travel Business travel	Staff commute	Student commute	Waste	Procurement Construction	Other	Total Volun.	Total Reported Emissions	Inbound Student Air Travel Emissions (tCO_2e/yr)[e] Scope 3 Student	Other VFR	Total Inbound
University of Bedfordshire	Million+	17,835	4,470	(25%)	65	10	67.1	1,878	5,515	63	7,456	689	71	1,579	22	8,601	19,675	30,637	38,093	16,464	11,785	28,249
The University of Birmingham	Russell Group	32,335	7,717	(24%)	10	35	35.1	28,702	18,823	529	48,053	4,588	5,698	7,514	330	18,476	33,834	70,441	118,494	31,428	22,589	54,016
The University of Bradford	University Alliance	12,505	2,062	(16%)	65	90	64.9	5,179	2,685	48	7,911	1,308	1,294	2,138	9	4,231	17,498	26,477	34,388	6,962	5,224	12,186
The University of Brighton		20,700	2,938	(14%)	85	0	65.0	4,152	7,263	116	11,531	4,859	1,411	5,861	19	10,391	17,448	39,988	51,519	8,956	6,848	15,804
Brunel University London		14,330	4,423	(31%)	60	35	44.0	6,683	12,007	445	19,136	228	3,218	1,257	28	3,112	22,161	30,004	49,140	16,693	12,117	28,810
De Montfort University	University Alliance	19,645	2,504	(13%)	60	38	67.7	2,511	7,146	77	9,734	2,138	2,001	7,140	887	1,487	13,751	27,403	37,137	9,358	6,911	16,268
The University of Greenwich	Million+	21,950	4,375	(20%)	60	60	66.5	2,814	5,921	70	8,804	2,946	661	1,232	21	13,892	46,635	65,387	74,191	15,279	11,184	26,463
University of Hertfordshire	University Alliance	25,295	4,343	(17%)	35	13	47.6	10,771	11,152	276	22,199	1,822	6,850	46,903	3,566	3,362	18,329	80,832	103,031	16,694	12,023	28,717
Kingston University	University Alliance	23,055	4,364	(19%)	0	20	34.2	4,044	9,520	203	13,768	2,883	3,190	3,726	528	5,803	67,294	83,424	97,192	13,036	9,921	22,956
The University of Leeds	Russell Group	30,975	5,855	(19%)	45	75	60.3	5,409	48,990	733	55,132	8,152	4,106	2,288	282	16,452	54,715	85,995	141,127	23,319	16,764	40,083
The University of Lincoln	University Alliance	13,400	1,634	(12%)	35	25	34.6	2,578	5,647	102	8,327	590	1,560	3,262	68	6,914	28,095	40,489	48,816	6,636	4,752	11,387
Liverpool Hope University	Cathedrals Group	6,240	271	(4%)	50	45	30.0	1,959	2,808	81	4,848	295	473	1,844	592	1,544	5,408	10,156	15,004	744	541	1,285
Loughborough University		15,965	3,213	(20%)	50	25	42.3	15,881	7,912	372	24,164	4,137	2,140	611	62	12,239	34,797	53,986	78,151	12,398	8,979	21,377
Manchester Metropolitan University	University Alliance	32,160	2,179	(7%)	90	35	73.1	4,786	12,770	168	17,724	1,250	2,303	12,607	33	13,412	24,445	54,050	71,774	7,132	5,451	12,584
The University of Manchester	Russell Group	37,925	11,604	(31%)	0	33	29.8	25,989	50,989	899	77,877	15,677	9,828	4,823	6,510	65,915	138,646	241,399	319,277	47,811	34,589	82,399
Middlesex University	Million+	19,880	4,863	(24%)	45	100	62.9	1,450	4,573	49	6,072	1,462	1,859	5,876	9	4,043	19,664	32,913	38,985	15,188	11,407	26,594
University of Newcastle-upon-Tyne	Russell Group	22,410	6,361	(28%)	90	33	67.5	11,672	32,293	408	44,374	4,103	2,401	479	78	7,697	31,664	46,421	90,795	26,534	19,123	45,657
University of Nottingham	Russell Group	33,270	7,510	(23%)	25	53	53.1	16,841	45,881	852	63,573	4,296	4,697	3,452	0	24,884	56,685	94,014	157,587	30,425	22,044	52,469
The Nottingham Trent University	University Alliance	26,845	3,706	(14%)	60	48	72.6	3,928	13,022	131	17,080	1,945	3,702	5,880	18	3,296	30,573	45,414	62,495	13,809	9,986	23,795
The University of Reading		13,595	3,369	(25%)	60	50	47.6	5,010	11,251	267	16,527	6,222	2,448	2,293	26	8,810	38,179	57,978	74,506	13,114	9,593	22,707
The University of Sheffield	Russell Group	26,600	7,897	(30%)	50	0	37.2	7,028	36,813	535	44,376	1,465	3,359	3,837	76	37,571	79,988	126,296	170,672	34,128	24,489	58,617
The University of Westminster		20,200	5,737	(28%)	35	33	35.3	4,620	8,075	122	12,818	1,187	306	1,778	102	2,882	28,396	34,650	47,468	17,520	13,205	30,725
University of Worcester		10,295	617	(6%)	60	40	76.7	1,729	2,907	44	4,680	230	928	3,970	48	1,027	6,608	12,811	17,491	1,614	1,300	2,914
The University of Edinburgh	Russell Group	27,625	9,461	(34%)	55	20	51.6	34,649	46,881	696	82,226	9,609	5,156	4,302	306	20,389	83,972	123,734	205,959	32,208	23,771	55,979
The University of Strathclyde		19,960	3,203	(16%)	60	43	33.9	9,793	19,520	176	29,489	2,993	1,635	16,806	1,241	2,498	46,394	71,567	101,056	10,795	8,058	18,853
SAMPLE TOTAL / AVERAGE		544,995	114,676	(21%) #	50±24	38±24	52±16	# 220,054	430,365	7,460	657,879	85,073	71,295	151,459	14,860	298,927	964,854	1,586,468	2,244,347	428,243	312,654	740,897
UK TOTAL / AVERAGE		2,299,355	435,500	(19%)	41±24	38±26	44±16	862,043	1,505,325	25,184	2,392,552									1,561,837	1,143,967	2,705,804

(a) see www.millionplus.ac.uk, www.russellgroup.ac.uk, www.unialliance.ac.uk and cathedralsgroup.org.uk (b) student population data obtained from HESA (2015a; 2015b) (c) see peopleandplanet.org/university-league/2015/tables (d) footprint data obtained from HESA (2014b), (e) Emissions from student flights were calculated from inbound student data by country of domicile (HESA 2015a) and the average flight frequencies for students from Europe and the RoW, and their associated VFR, as discussed in this paper.

Data for institutions excluded from the analysis presented in the paper

UK Higher Education Institution	Mission Group / Association[a]	Student Population[b] Total #	International #	International (%)	People & Planet University League Scores[c] C Management	C Reduction	Total	GHG Emissions Reported in the 2013/14 EMR Return (tCO_2e/yr) Mandatorily Reported Estates Emissions Scope 1	Scope 2	Scope 3	Total Mand.	Voluntarily Reported Scope 3 Emissions Travel Business travel	Staff commute	Student commute	Waste	Procurement Construction	Other	Total Volun.	Total Reported Emissions	Inbound Student Air Travel Emissions (tCO_2e/yr)[e] Scope 3 Student	Other VFR	Total Inbound
University of the Arts, London	UKADIA	17,135	7,730	(45%)	70	0	46.3	3,363	9,048	112	12,523	1,642	75,870	352,111	26	8,684	35,161	43,870	56,393	29,210	21,354	50,564
Rose Bruford College	UKADIA	770	93	(12%)	0	80	24.9	179	380	6	564	7	96	78	25	4	33	62	626	236	183	419

Appendix 4. Student Survey

ALL STUDENTS STUDYING AT A UK UNIVERSITY - COMPLETE A SURVEY FOR YOUR CHANCE TO WIN AN IPAD MINI...

I would be extremely grateful if you would spend 10 minutes of your time to complete this survey, which forms part of my PhD research project looking at student motives for choosing where to study, attitudes towards environmental issues and sustainability, and current behaviours with regard to travel.

There are no right or wrong answers, so please do answer as frankly and honestly as you can. The survey is anonymous and the data collected will only be used for research purposes.

At the end of the questionnaire, there will be an option for you to enter a prize draw for a chance to win an iPad Mini.

All complete responses are eligible to enter, where the draw will take place on February 27th 2015 and the winner will be notified by email. If you do not wish to enter the draw, there is no need for you to provide an email address.

If you would like any further information please do not hesitate to contact me at:

jonathan.davies@mmu.ac.uk

or my supervisor, Dr Rachel Dunk:

r.dunk@mmu.ac.uk

Thank you in advance

Jonathan Davies
PhD Student
School of Science and the Environment
The Manchester Metropolitan University

1. **Are you currently studying at a UK university for your degree or as a visiting student?**

If you are registered at a UK university and currently studying abroad, please answer Yes.

○ ○ No

2. **Please tell us how important each of the following factors are to you when choosing where to study.** *Please select one answer per row.*

Graduate employment rates	○	○	○	○	○	○
The proximity of the university to home	○	○	○	○	○	○
Academic reputation of the university and/or lecturers	○	○	○	○	○	○
Quality of student facilities (e.g. halls of residence, etc.)	○	○	○	○	○	○
Teaching methods	○	○	○	○	○	○
The position of the university in world league tables (e.g. Academic Ranking of World Universities)	○	○	○	○	○	○
The commitment of the university to environmental issues	○	○	○	○	○	○
Access to leisure / social activities (e.g. nightlife)	○	○	○	○	○	○

If there are any other factors that are important to you when choosing where to study (e.g. advice from other people), please tell us in the box below:

The next section asks for your thoughts on a range of environmental issues.

3. **How much of a problem do you consider the following global environmental issues to be?** *Please select one answer per row.*

	Very serious problem	Serious problem	Reasonably serious problem	Not very serious problem	Not at all a problem	*Don't know / unsure*
Shortages of fresh water	◯	◯	◯	◯	◯	◯
Water pollution	◯	◯	◯	◯	◯	◯
Depletion of natural resources	◯	◯	◯	◯	◯	◯
Air pollution	◯	◯	◯	◯	◯	◯
Loss of biodiversity	◯	◯	◯	◯	◯	◯
Climate change	◯	◯	◯	◯	◯	◯
Vehicle emissions	◯	◯	◯	◯	◯	◯

4. **On the subject of climate change, please select the statement below that best describes what you think.** *Please select one answer.*

[redacted]

◯ [redacted]

◯ [redacted]

◯ [redacted]

◯ [redacted]

◯ [redacted]

[redacted]

Your carbon footprint can be defined as:

'a measure of the total amount of greenhouse gas emissions (such as carbon dioxide) that are caused, either directly or indirectly, by your activities'

Thinking about your carbon footprint...

5. **Please tell us how important reducing your carbon footprint is to you personally.** *Please select one answer.*

- Very important
- Important
- Moderately important
- Of little importance
- Not at all important
- Don't know / unsure

6. **Please tell which of the following actions to reduce your carbon footprint you already do, or would consider doing, during your remaining time at university.** *Please select one answer per row.*

Take fewer trips/holidays overseas					
Walk, cycle or use public transport instead of driving					
Switch off laptop and TV, do not leave on standby					
Buy, sell or swap second hand goods					
Wash clothes at a cold temperature					

7. **To help us direct you to the right part of the survey, please tell us if you are...**

- ...a UK citizen studying at a UK university (including UK citizens on study abroad) **(Directed to Q8)**
- ...an international student from a country within the EU studying at a UK university **(Directed to Q45)**
- ...an international student from a country outside the EU studying at a UK university **(Directed to Q34)**

8. **Is there an opportunity for you to undertake a period of study abroad within your course?**

- Yes - I have already participated in a study abroad program **(Directed to Q9)**
- Yes - I am currently studying abroad **(Directed to Q9)**
- Yes - I have arranged a period of study abroad **(Directed to Q9)**
- Yes - and I am thinking about studying abroad in the future **(Directed to Q70)**
- Yes - but I do not plan to study abroad **(Directed to Q70)**
- No **(Directed to Q70)**
- Don't know / unsure **(Directed to Q70)**

9. **Please indicate your study abroad region**:

- Africa **(Directed to Q10 and Q11)**
- Caribbean **(Directed to Q12 and Q13 – not shown as it mimics Q10 and 11)**
- Central America **(Directed to Q14 and Q15 – not shown as it mimics Q10 and 11)**
- North America **(Directed to Q16 and Q17 – not shown as it mimics Q10 and 11)**
- South America **(Directed to Q18 and Q19 – not shown as it mimics Q10 and 11)**
- Europe **(Directed to Q20 and Q21 – not shown as it mimics Q10 and 11)**
- Asia **(Directed to Q22 and Q23 – not shown as it mimics Q10 and 11)**
- Oceania **(Directed to Q24 and Q25 – not shown as it mimics Q10 and 11)**

10. **Please select your study abroad destination from the list:**

11. **Please state which airport you arrived to (or plan to arrive to) in your study abroad**

destination. *For those who have a period of study abroad arranged, If you do not know which airport, please state the city you will be studying in.*

This section asks for your thoughts on the importance of study abroad and air travel frequency.

26. **How long is/was your period of study at an overseas university?**

- [ ] More than one academic year
- [ ] One academic year
- [ ] Less than one academic year

27. **How important is the study abroad aspect of the course to you?**

- [ ] Very important
- [ ] Important
- [ ] Moderately important
- [ ] Of little importance
- [ ] Not at all important
- [ ] Don't know / unsure

28. **Not including travelling from and to the UK at the start and end of your study visit, how many additional return flights home have you made (or plan to make) during your period of study at an overseas university?** *For example, if you do not fly home during your study visit that would be 0 additional flights. Alternatively, if you fly home once for a weekend break, that would be 1 additional flight. Please select one option:*

- [ ] 0
- [ ] 2
- [ ] 4
- [ ] 1
- [ ] 3
- [ ] 5+

29. **How many flights have friends and family from home made (or plan to make) to visit you during your period of study at an overseas university? Please count each person and each visit.** *For example, if 4 family members visit you at the same time that would be 4 flights. Alternatively, if 2 family members visit you at one time, and 3 friends visit you on another occasion, that would be 5 flights. Please select one option:*

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8
- ◯ 9
- ◯ 10
- ◯ 11+

There are schemes that allow people to compensate for the climate impacts of their flights (and other activities) by purchasing a 'carbon offset'.

These schemes raise money from the sale of carbon offsets, and invest the money in projects that prevent or reduce greenhouse gas emissions, either in the UK or in other parts of the world.

There are a range of project types, including installing low carbon energy supplies (e.g. building wind or solar farms), improving energy efficiency (e.g. installing low energy light bulbs or insulation), and protecting or enhancing natural carbon stores (e.g. restoring peat bogs or planting trees).

The climate impacts of flying depend on the distance travelled. Example costs for compensating for a return flight from the UK to different regions of the world are shown below (source: www.climatecare.org).

Europe:
£1 (Paris, France) - £5 (Nicosia, Cyprus)

Middle East:
£6 (Tel Aviv, Israel) - £12 (Muscat, Oman)

Africa:
£4 (Tunis, Tunisia) - £21 (Cape Town, South Africa)

Asia:
£13 (Islamabad, Pakistan) - £21 (Tokyo, Japan)

Australasia:

£42 (Sydney, Australia) - £48 (Wellington, New Zealand)

North America:
£11 (Ottawa, Canada) - £12 (Washington, USA)

Caribbean:
£14 (San Juan, Puerto Rico) - £15 (Nassau, The Bahamas)

South America:
£16 (Caracas, Venezuela) - £26 (Santiago, Chile)

30. **Who do you think should pay to compensate for the climate change impacts of a return flight from the UK to your study abroad location?** *Please tick all that apply.*

- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]

[redacted]

31. **Given the estimates shown above, what proportion of the total compensation cost for a return flight from the UK to your study abroad destination would you be willing to pay?** *If you are unsure, please select 'other proportion' and write unsure.*

- ○ [redacted]
- ○ [redacted]
- ○ [redacted]
- ○ [redacted]
- ○ [redacted]
- ○ [redacted]

32. **Is there a maximum amount you would be willing to pay – regardless of the distance of the flight – for compensating for the climate change impacts of your flight?** *If you are unsure, please select 'other amount' and write unsure.*

- ○ [redacted]
- ○ [redacted]
- ○ [redacted]
- ○ [redacted]
- ○ [redacted]

Universities face a potential conflict between the importance of reducing their greenhouse gas emissions and the importance of offering their students opportunities to study abroad and experience other cultures (which increases the amount of air travel and therefore increases greenhouse gas emissions). In response to this conflict, some universities are looking to compensate for the greenhouse gas emissions associated with the air travel of study abroad programmes by establishing carbon compensation schemes.

33. **The table below lists a range of different types of project that a university carbon compensation scheme could fund or invest in. Please indicate your level of support or opposition for each of these ideas.** *Please select one answer per row.*

			Neither			
[redacted]						
Invest in carbon reduction projects on campus / within the university estate	○	○	○	○	○	○
[redacted]	○	○	○	○	○	○
Provide a free online sustainability course for anyone to access	○	○	○	○	○	○
[redacted]	○	○	○	○	○	○
Purchase offsets from a conventional carbon offset provider (the money would likely be used to fund projects in developing countries)	○	○	○	○	○	○
[redacted]	○	○	○	○	○	○
Fund a university international education charity	○	○	○	○	○	○

Respondents directed to question 70.

34. **Please indicate which region of the world you are from**:

- Africa **(Directed to Q35 and Q36)**
- Caribbean **(Directed to Q37 and Q38 – not shown as it mimics Q10 and Q11)**
- Central America **(Directed to Q39 and Q40 – not shown as it mimics Q10 and Q11)**
- North America **(Directed to Q41 and Q42 – not shown as it mimics Q10 and Q11)**
- South America **(Directed to Q43 and Q44 – not shown as it mimics Q10 and Q11)**
- Europe **(Directed to Q45 and Q46 – not shown as it mimics Q10 and Q11)**
- Asia **(Directed to Q47 and Q48 – not shown as it mimics Q10 and Q11)**
- Oceania **(Directed to Q49 and Q50 – not shown as it mimics Q10 and Q11)**

35. **Please select your home country from the list:**

36. **Please state which airport in your home country you usually fly from:**

51. **Are you...**

- Studying for a full degree in the UK **(Directed to Q52)**
- Studying in the UK for one year **(Directed to Q59)**
- Studying in the UK for part of a year **(Directed to Q62)**

52. **What level of importance do you place on the following.** *Please select one answer per row.*

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]						
[redacted]						

53. **As alternatives to studying for a full degree in the UK, how attractive are the following.** *Please select one answer per row.*

	Much more attractive	Somewhat more attractive	Neither more nor less attractive	Somewhat less attractive	Much less attractive	*Don't know / unsure / not relevant*
Study for a dual/joint degree awarded by both a university in your home country and a UK university with all of the study in your home country	◯	◯	◯	◯	◯	◯
Study for a dual/joint degree awarded by both a university in your home country and a UK university with study split between your home country and the UK	◯	◯	◯	◯	◯	◯
Study for a degree awarded by a university in your home country, which offers you the opportunity to study at a UK university for a period of up to one year	◯	◯	◯	◯	◯	◯
Study for a degree awarded by a UK university, and delivered at a branch campus located in your home country	◯	◯	◯	◯	◯	◯
Study for a degree awarded by a UK university, and delivered at a branch campus located in your world region	◯	◯	◯	◯	◯	◯
Study for a degree awarded by a UK university and delivered via distance learning	◯	◯	◯	◯	◯	◯
Study for a degree awarded by a UK university and delivered by a university in your home country	◯	◯	◯	◯	◯	◯

If you would like to comment on your response, please do so in the box below:

54. **Not including travelling to and from the UK at the start and end of the academic year, how many additional return flights home have you made (or plan to make) during this academic year?**

For example, if you do not fly home for a visit during the academic year that would be 0 additional flights. Alternatively, if you fly home once during the Christmas vacation and once during the Easter vacation that would be 2 additional flights. Please select one option:

◯ 0 ◯ 2 ◯ 4

◯ 1 ◯ 3 ◯ 5+

55. **How many flights have friends and family from home made (or plan to make) to visit you during this academic year? Please count each person and each visit.** *For example, if 4 family members visit you during the Christmas vacation that would be 4 flights. Alternatively, if 2 family members visit you during the Christmas vacation and 3 friends visit you during the Easter vacation that would be 5 flights. Please select one option:*

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8
- ◯ 9
- ◯ 10
- ◯ 11+

There are schemes that allow people to compensate for the climate impacts of their flights (and other activities) by purchasing a 'carbon offset'.

These schemes raise money from the sale of carbon offsets, and invest the money in projects that prevent or reduce greenhouse gas emissions, either in the UK or in other parts of the world.

There are a range of project types, including installing low carbon energy supplies (e.g. building wind or solar farms), improving energy efficiency (e.g. installing low energy light bulbs or insulation), and protecting or enhancing natural carbon stores (e.g. restoring peat bogs or planting trees).

The climate impacts of flying depend on the distance travelled. Example costs for compensating for a return flight from the UK to different regions of the world are shown below (source: www.climatecare.org).

Europe:
£1 (Paris, France) - £5 (Nicosia, Cyprus)

Middle East:
£6 (Tel Aviv, Israel) - £12 (Muscat, Oman)

Africa:
£4 (Tunis, Tunisia) - £21 (Cape Town, South Africa)

Asia:
£13 (Islamabad, Pakistan) - £21 (Tokyo, Japan)

Australasia:
£42 (Sydney, Australia) - £48 (Wellington, New Zealand)

North America:
£11 (Ottawa, Canada) - £12 (Washington, USA)

Caribbean:
£14 (San Juan, Puerto Rico) - £15 (Nassau, The Bahamas)

South America:
£16 (Caracas, Venezuela) - £26 (Santiago, Chile)

56. **Who do you think should pay to compensate for the climate change impacts of a return flight from your home country to the UK for the purpose of studying at university?** *Please tick all that apply.*

- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]

[redacted]

57. **Given the estimates shown above, what proportion of the total compensation cost for a return flight from your home country to the UK would you be willing to pay?** *If you are unsure, please select 'other proportion' and write unsure.*

- ○ [redacted]
- ○ [redacted]
- ○ [redacted]
- ○ [redacted]
- ○ [redacted]
- ○ [redacted]

58. **Is there a maximum amount you would be willing to pay – regardless of the distance of the flight – for compensating for the climate change impacts of your flight?** *If you are unsure, please select 'other amount' and write unsure.*

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

Respondents directed to question 69.

59. **How important is the opportunity to live and study in the UK to you?**

- Very important
- Important
- Moderately important
- Of little importance
- Not at all important
- Don't know / unsure

60. **Not including travelling to and from the UK at the start and end of the academic year, how many additional return flights home have you made (or plan to make) during this academic year?**

For example, if you do not fly home for a visit during the academic year that would be 0 additional flights. Alternatively, if you fly home once during the Christmas vacation and once during the Easter vacation that would be 2 additional flights. Please select one option:

- 0
- 1
- 2
- 3
- 4
- 5+

61. **How many flights have friends and family from home made (or plan to make) to visit you during this academic year? Please count each person and each visit.** *For example, if 4 family members visit you during the Christmas vacation that would be 4 flights. Alternatively, if 2 family members visit you during the Christmas vacation and 3 friends visit you during the Easter vacation that would be 5 flights. Please select one option:*

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8
- ◯ 9
- ◯ 10
- ◯ 11+

Respondents directed to question 66.

62. **To the nearest month, how long is your period of study at a UK university?**

- ◯ 1 month
- ◯ 2 months
- ◯ 3 months
- ◯ 4 months
- ◯ 5 months
- ◯ 6 months
- ◯ 7 months
- ◯ 8 months
- ◯ 9 months

63. **How important is the opportunity to live and study in the UK to you?**

- ◯ Very important
- ◯ Important
- ◯ Moderately important
- ◯ Of little importance
- ◯ Not at all important
- ◯ Don't know / unsure

64. **Not including travelling to and from the UK at the start and end of your study visit, how many additional return flights home have you made (or plan to make) during your period of study at a UK university?** *For example, if you do not fly home during your study visit that would be 0 additional flights. Alternatively, if you fly home once for a weekend break, that would be 1 additional flight. Please select one option:*

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5+

65. **How many flights have friends and family from home made (or plan to make) to visit you during your period of study at a UK university? Please count each person and each visit.** *For example, if 4 family members visit you at the same time that would be 4 flights. Alternatively, if 2 family members visit you at one time, and 3 friends visit you on another occasion, that would be 5 flights. Please select one option:*

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8
- ◯ 9
- ◯ 10
- ◯ 11+

There are schemes that allow people to compensate for the climate impacts of their flights (and other activities) by purchasing a 'carbon offset'.

These schemes raise money from the sale of carbon offsets, and invest the money in projects that prevent or reduce greenhouse gas emissions, either in the UK or in other parts of the world.

There are a range of project types, including installing low carbon energy supplies (e.g. building wind or solar farms), improving energy efficiency (e.g. installing low energy light bulbs or insulation), and protecting or enhancing natural carbon stores (e.g. restoring peat bogs or planting trees).

The climate impacts of flying depend on the distance travelled. Example costs for compensating for a return flight between the UK and different regions of the world are shown below (source: www.climatecare.org).

Europe:
£1 (Paris, France) - £5 (Nicosia, Cyprus)

Middle East:
£6 (Tel Aviv, Israel) - £12 (Muscat, Oman)

Africa:
£4 (Tunis, Tunisia) - £21 (Cape Town, South Africa)

Asia:
£13 (Islamabad, Pakistan) - £21 (Tokyo, Japan)

Australasia:
£42 (Sydney, Australia) - £48 (Wellington, New Zealand)

North America:

£11 (Ottawa, Canada) - £12 (Washington, USA)

Caribbean:
£14 (San Juan, Puerto Rico) - £15 (Nassau, The Bahamas)

South America:
£16 (Caracas, Venezuela) - £26 (Santiago, Chile)

66. **Who do you think should pay to compensate for the climate change impacts of a return flight from your home country to the UK for the purpose of your study visit?**
Please tick all that apply.

- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]
- ☐ [redacted]

[redacted]

67. **Given the estimates shown above, what proportion of the total compensation cost for a return flight from your home country to the UK would you be willing to pay?**
If you are unsure, please select 'other proportion' and write unsure.

- ○ [redacted]
- ○ [redacted]
- ○ [redacted]
- ○ [redacted]
- ○ [redacted]
- ○ [redacted]

68. **Is there a maximum amount you would be willing to pay – regardless of the distance of the flight – for compensating for the climate change impacts of your flight?** *If you are unsure, please select 'other amount' and write unsure.*

- ○ [redacted]
- ○ [redacted]
- ○ [redacted]
- ○ [redacted]
- ○ [redacted]

    [ ]

UK universities face a potential conflict between the importance of recruiting overseas students (offering them the opportunity to live and study in the UK and enriching the university experience for all students) and the importance of reducing their greenhouse gas emissions (which will increase with increased air travel as overseas student numbers grow).

In response to this conflict, some universities are looking to compensate for the greenhouse gas emissions associated with the air travel of overseas students by establishing carbon compensation schemes.

69. **The table below lists a range of different types of project that a university carbon compensation scheme could fund or invest in. Please indicate your level of support or opposition for each of these ideas.** *Please select one answer per row.*

	Strongly support	Somewhat support	Neither support nor oppose	Somewhat oppose	Strongly oppose	*Don't know / unsure*
Invest in carbon reduction projects on campus / within the university estate	◯	◯	◯	◯	◯	◯
Fund carbon reduction projects in the local community	◯	◯	◯	◯	◯	◯
Provide a free online sustainability course for anyone to access	◯	◯	◯	◯	◯	◯
Provide free workshops for the local community on climate change and how to reduce carbon footprints	◯	◯	◯	◯	◯	◯
Purchase offsets from a conventional carbon offset provider (the money would likely be used to fund projects in developing countries)	◯	◯	◯	◯	◯	◯
Provide grants to students from developing countries to attend a sustainability related course at the university	◯	◯	◯	◯	◯	◯
Fund a university international education charity	◯	◯	◯	◯	◯	◯

Please tell us a little about yourself. As noted previously, all data is anonymous and will only be used for the purposes of this research.

70. Please select your age range:

◯ 18-20 years

◯ 21-24 years

◯ 25-29 years

◯ 30-40 years

◯ 41-54 years

◯ 55-64 years

◯ 65+ years

◯ Rather not say

71. What is your gender?

◯ Male

◯ Female

◯ Self-defined as other

◯ Rather not say

72. Which UK university do you attend?

73. Please select from the list your level of study:

- ◯ Undergraduate 1st Year
- ◯ Undergraduate 2nd Year
- ◯ Undergraduate 3rd Year
- ◯ Undergraduate 4th Year
- ◯ Undergraduate 5th Year or greater
- ◯ Postgraduate (Research)
- ◯ Postgraduate (Taught)

74. Please state the title of your degree programme (e.g. BSc (Hons) Geography):

75. If you have any other comments regarding the impact of overseas study and air travel's impact on climate change, please tell us in the box below:

Appendix 5. Case Study Protocol

The use of a case study protocol containing rules and procedures for the researcher to follow was a way of increasing the reliability of the case study research (Tellis, 1997; Yin, 2014).

Case study Objectives and Research Questions

Objective 2. To critically appraise institutional awareness of and willingness to engage with the Conflict.

RQ3. What are the dominant motivations for UK HEIs to recruit international students and promote study abroad for UK students?

RQ4. How advanced are HEIs in engaging with the carbon management agenda?

RQ5. How advanced are UK HEIs in engaging with the Conflict between the internationalisation and carbon management agendas and what factors influenced this?

Objective 3. To assess perceptions of responsibility for student flight emissions and evaluate preferences for potential mitigation and compensation options.

RQ6. How should responsibility for student flight emissions be allocated between students, HEIs and other beneficiaries?

RQ7. How do both students and HEIs view potential mitigation and compensation actions?

Field procedures

Contacting potential interviews

Send the introductory letter and accompanying information sheet explaining the purpose of the interview, the interview process, why they were selected, and confidentiality information.

The interview

The interviewee must read and sign the consent form prior to the interview commencing. If they are happy for the interview to be recorded, the recorder is switched on along with the phone voice recorder as a backup device. The interview begins by providing a background to the study followed by the HEI specific questions.

Case study report guide

Background

This section will contain general background information to contextualise the case study HEI. Information will include type of university, type of campus, student numbers, staff numbers, financial situation and breakdown of income sources, research activities and UK/world university league position.

Degree of internationalisation

This section will explore the degree of internationalisation at the HEI. The rating for the HEI will be presented (high, medium or low) based on the number of international students as a percentage of the total student population, and TNE students as an equivalent to students studying in the UK. The HEI's internationalisation strategy will be discussed and the main drivers and motivations for international student recruitment and study abroad examined.

Carbon management

This section will begin by presenting the results of the carbon assessment and ratings based on overall performance and carbon reduction progress. The main drivers and motivations for carbon management at the HEI will be examined followed by a discussion of carbon reduction progress. Finally, engagement with Scope 3 emissions will be evaluated including motivations, barriers and boundary setting.

Institutional response to the Conflict

This section will report the results exploring institutional awareness and engagement with the Conflict specifically, whether they have accounted for student air travel emissions, perceptions of responsibility for mitigation and compensation, and view on various mitigation and compensation opportunities. Factors influencing the HEI's position towards the Conflict will be identified and reported here.

Appendix 6. Sample Case Study Invitation Email

Dear [Interviewee Name]:

I would like to invite you to take part in a short interview as part of a PhD study examining the potential conflict and trade-offs between the recruitment of international students and the carbon reduction agenda at UK HEIs.

Over the last decade, [HEI name] has been proactive in implementing measures to reduce the carbon impact of its operations and has set sector leading emissions reduction targets. In addition, the University has committed to internationalisation, particularly through international student recruitment and study abroad schemes. However, any increase in international student and study abroad numbers conflicts with the carbon reduction goals of the University.

The interview will seek your views on [HEI name] engagement with this issue and potential approaches for reconciling the Conflict. The intended outcome of this research is to provide best practice guidance for HEIs to enhance corporate social responsibility policies and contribute to improved environmental sustainability across the UK HE sector.

The interview will last approximately 30 minutes and could take place in your office. The result of the research study will be included in a PhD thesis submitted to the Manchester Metropolitan University and associated publications. More information can be found in the attached document. If you would be willing to participate in this study, I would be grateful if you would contact me by email, Jonathan.Davies@mmu.ac.uk. If you would like any further information, please do not hesitate to contact me, or one of my supervisory team:

Professor Callum Thomas (c.s.thomas@mmu.ac.uk)
Professor Paul Hooper (p.d.hooper@mmu.ac.uk)
Dr Liz Price (e.price@mmu.ac.uk)
Dr Rachel Dunk (r.dunk@mmu.ac.uk)

Yours Sincerely,
Jonathan Davies

Appendix 7. Sample Participant Information Sheet

In the academic year 2013/14, international student air travel added 5,000 t/CO_2e to [HEI name] carbon footprint; this is equivalent to 25% of direct energy related emissions. If [HEI name] achieves both carbon reduction and international student recruitment targets in the academic year 2020/21, international student air travel would add 11,000 t/CO_2e to the University's footprint, equivalent to 90% of direct energy related emissions.

I would like to invite you to take part in an interview as part of a research study examining the potential conflict and trade-offs between the recruitment of international students and the carbon reduction agenda at UK HEIs and to evaluate the efficacy of a range of approaches to reconciling them.

What is the purpose of the study?

The HE sector is key in helping the transition to a low carbon economy. Over the last two decades, HEIs have started to implement measures to reduce the carbon impact of their operations. In addition, HEIs have been actively 'internationalising' their campuses through the recruitment of international students and study abroad activities, which deliver numerous economic and social benefits to universities and students. However, any increase in international student and study abroad numbers leads to increased emissions from air travel thus contradicting the carbon reduction goals of the university. The purpose of this study is to explore the Conflict between the carbon reduction and internationalisation agendas at UK higher education institutions and to evaluate the efficacy of a range of approaches to reconciling them.

Will my taking part in the study be kept confidential?

The data collected for this project will be via interview and individual data will be strictly confidential. In the final thesis and associated publications, I will be naming broad job roles but interviewees will remain anonymous as will the institution, except identification by broad characteristics e.g. large/small, post-1992/pre-1992 etc. If you allow, all interviews will be recorded and stored on a password-protected computer that only myself and my supervisory team, will have access to. After five years, all recordings will be destroyed. With your permission, specific quotes from you will be used to support conclusions in this study but you will be quoted anonymously.

Further information

If you have any questions about this study, please contact me, by phone on 07800XXXXXX, or by e-mail at jonathan.davies@mmu.ac.uk. Alternatively, you can contact a member of my supervisory team:

Dr Rachel Dunk (DoS) (r.dunk@mmu.ac.uk), Prof. Callum Thomas (c.thomas@mmu.ac.uk), Dr Liz Price (e.price@mmu.ac.uk), or Prof. Paul Hooper (p.hooper@mmu.ac.uk).

Appendix 8. Example of Theme Relationships

Domain	Theme	Sub-themes
Air travel	Focus on other sources of emissions/environmental problems before air travel	Mitigation efforts should focus on other larger sources
		There are more significant environmental problems to focus on first
		Air travel accounts for a small fraction of global emissions
	Own 'sacrifice' has no value	Flight scheduled anyway
		Any change needs to happen at a global level
	Socio-economic benefits outweigh environmental costs	Air travel is crucial to the UK economy
		Stronger ties between countries
	Unaware of environmental impacts of air travel	Little information
		Never thought about this before
	Lack of understanding of the relative impact of air travel	Small changes in other areas of daily life can offset any air travel
Drivers and motivations for carbon management	Financial	Rising energy prices
		HEFCE funding
		Financial resilience
	Reputational	People and Planet University League
		Staff and student recruitment
		Leading 'green' university
	Moral	Right thing to do
		Role model

Appendix 9. Carbon Assessment Methodology

Theme	Weighting	Question	Question Code	Scoring description	Score (%)
Environmental Policy	10%	Does the university have a publicly available environmental policy?	EP1	Yes	10
				No	0
Leadership commitments	5%	Is carbon management a part of the corporate strategy?	LC1	Yes	2.5
				No	0
		Is the carbon management plan endorsed by executive leadership?	LC2	Yes	2.5
				No	0
Governance	10%	Does the university have a dedicated environment (sustainability) team?	G1	2+ FTE staff/5,000 students	10
				1+ FTE staff/5,000 students	5
				< 1 FTE staff/5,000 students	2
				0 FTE staff/5,000 students	0
Planning	30%	Does the university has a reduction target for Scope 1 and 2 emissions?	P1	Surpasses the HEFCE target	10
				Meets the HEFCE target	7
				Fails to meet the HEFCE target	4
				No target	0
		Has the university set interim reduction targets?	P2	Yes	5
				No	0
		Has the university offered a grant or loan scheme that provides up-front capital for implementing carbon reduction projects?	P3	Yes	5
				No	0
		Has the university outlined projects to meet its reduction target?	P4	Yes, to meet reduction target	10
				Yes, but not to meet reduction target	5
				No	0
Reduction progress	20%	Annual percentage reduction in emissions between baseline year (2005/06) and 2013/14	RP1	2.87%+	20
				2.15%+	16
				1.44%+	12
				0.72%+	8
				Up to 0.71	4
				0 or increase	0
Scope 3 emissions	20%	Has the university submitted Scope 3 data to the EMR?	ST1	Business travel	1
				Staff commuting	1
				Student commuting	1
				Water supply and treatment	1
				Waste	1
				Supply chain	1
		Has the university included Scope 3 emissions in the carbon management plan?	ST2	Business travel	1
				Staff commuting	1
				Student commuting	1
				Water supply and treatment	1
				Waste	1
				Supply chain	1
				Home to term time address student travel: UK students	1
				Home to term time address student travel: international students	1
				Study abroad student air travel	1
		Has the university outlined initiatives to reduce Scope 3 emissions?	ST3	Business travel	1
				Staff/student commuting	1
				Waste/water	1
				Supply chain	1
				Home to term time address travel: international and UK students	1
Monitoring and reporting	5%	Does the university monitor emissions annually?	MR1	Yes	2.5
				No	0
		Does the university produce a publicly available annual progress report?	MR2	Yes	2.5
				No	0

Formulation of the carbon assessment drew on previous work from Shi and Lai (2013), the PPUL (2015), and Robinson et al. (2015).

Methodology Clarifications

LC1. There must be a specific reference to carbon management. Will not accept broad references to sustainability.

LC2. There must be a foreword from executive leadership in the carbon management plan.

G1. This methodology followed the guidance from the People and Planet University League methodology:

> *While larger institutions require more staff, research and consultation has demonstrated that economies of scale enable larger universities to manage their environmental impacts effectively with less staff per 5,000 students – to recognise this there is an upper limit of 15,000 FTE students.*

P1. The HEFCE target is a 43% reduction in Scope 1 and 2 emissions by 2020/21, from a 2005/06 baseline.

RP1. Based on the HEFCE target, HEIs would need to deliver reductions averaging at 2.87% per year for 15 years. Thus, the scores are based on the HEIs meeting or surpassing the HEFCE target – 2.87%/year, meeting 75% of the target – 2.15%/year, meeting 50% of the target – 1.44%/year, and meeting 25% of the target – 0.72%/year. Data was sourced from HESA (2014b) for both the baseline figure and 2013/14 Scope 1 and 2 emissions figure.

ST2. The university must have reported Scope 3 emissions in the carbon management plan or other documentation (e.g. annual report, travel plan etc.). A commitment to calculating Scope 3 emissions in the future was not accepted.

MR1. The university must have submitted Scope 1 and 2 emissions data to the HESA EMR for all the years available (2008/09-2013/14).

MR2. The university must reported emissions in an annual report (e.g. sustainability report, environmental report, or embedded within financial statements) for at least two consecutive years, with the last report being 2013/14 or 2014/15.

Appendix 10. Institutional Data for 2012/13

Higher Education Institution	Students/ Staff	International students/ Staff	tCO_2e/ Staff	Income/ Staff (£)	Research income/ Staff (£)	Research students/ Staff
Aberystwyth University	15.4	2.0	13.7	121,040	26,150	0.4
Anglia Ruskin University	20.4	3.1	8.6	173,394	3,691	0.4
Aston University	12.9	3.6	14.0	151,124	22,883	0.3
Bangor University	24.0	2.3	12.0	136,927	27,463	0.6
Bath Spa University	15.7	0.5	5.2	105,052	2,128	0.2
Birkbeck College	14.3	1.3	3.3	83,344	16,726	0.7
Birmingham City University	16.6	1.8	9.9	120,039	3,040	0.2
Bishop Grosseteste University	21.0	0.0	9.6	153,096	896	0.1
Bournemouth University	22.7	3.2	8.1	152,435	6,252	0.5
Brunel University	12.9	4.0	16.0	154,903	26,248	0.8
Buckinghamshire New University	23.5	1.8	9.7	157,496	3,157	0.1
Canterbury Christ Church University	27.3	1.6	12.2	184,712	2,908	0.3
Cardiff Metropolitan University	20.6	2.0	8.7	133,798	5,957	0.4
Cardiff University	10.2	2.0	13.8	147,778	43,382	0.5
Central School of Speech and Drama	15.4	3.5	8.6	217,200	7,877	0.5
Courtauld Institute of Art	10.9	3.8	19.0	348,550	59,225	2.0
Coventry University	14.4	3.6	7.0	116,631	5,642	0.2
Cranfield University	5.9	3.2	22.9	242,125	77,327	1.1
De Montfort University	16.9	2.1	8.2	127,213	8,013	0.4
Edge Hill University	21.1	0.3	7.1	123,342	977	0.1
Edinburgh Napier University	17.3	3.8	9.0	144,792	9,636	0.2
Falmouth University	23.6	1.3	22.9	283,211	4,011	0.3
Glasgow Caledonian University	21.4	2.6	10.4	151,879	11,760	0.6
Glyndŵr University	24.0	10.4	11.1	123,617	5,473	0.3
Goldsmiths College(#9)	15.4	4.0	11.2	173,078	24,960	1.1
Guildhall School of Music and Drama	1.2	0.3	1.8	28,330	420	0.0
Harper Adams University	39.8	1.9	14.3	264,592	17,915	0.3
Heriot-Watt University	14.9	5.4	22.6	235,588	53,046	0.8
Heythrop College	9.7	1.1	9.6	70,284	1,284	0.3
Imperial College of Science, Technology and Medicine	4.2	1.8	19.8	215,367	112,134	0.9
Institute of Education	15.7	2.4	7.1	208,397	61,362	2.4

King's College London	6.6	1.8	10.2	142,984	54,033	0.6
Kingston University	14.2	2.5	7.6	118,877	3,523	0.2
Leeds Beckett	17.9	1.3	10.4	131,180	3,161	0.2
Leeds Trinity University	27.2	1.1	16.9	197,042	742	0.0
Liverpool Hope University	22.6	1.2	17.6	178,359	2,500	0.4
Liverpool John Moores University	18.1	1.6	9.0	138,457	10,158	0.3
London Business School	16.9	12.0	30.6	1,007,463	45,973	0.7
London Metropolitan University	25.7	4.4	12.3	180,670	6,746	0.5
London School of Economics and Political Science	6.3	4.2	8.6	166,065	26,211	0.4
London School of Hygiene and Tropical Medicine	1.6	0.8	4.3	174,929	136,358	0.5
London South Bank University	21.6	1.9	8.8	150,660	5,716	0.3
Loughborough University	9.3	1.9	14.6	146,233	35,985	0.6
Middlesex University	25.3	6.3	7.7	216,186	7,369	0.4
Newman University	18.2	0.2	7.5	131,032	794	0.0
Norwich University of the Arts	12.5	0.5	5.8	104,229	1,043	0.1
Oxford Brookes University	14.6	2.6	11.1	135,141	5,798	0.3
Queen Margaret University, Edinburgh	24.8	5.1	10.5	162,060	18,665	0.6
Queen Mary University of London	7.4	2.2	12.0	157,092	54,860	0.5
Roehampton University	19.9	2.6	14.8	167,993	6,778	0.7
Royal Academy of Music	2.7	1.3	3.7	67,636	1,989	0.1
Royal Agricultural University	19.3	2.8	24.4	272,450	2,117	0.2
Royal College of Art	9.5	5.0	14.0	228,097	27,561	0.9
Royal College of Music	2.7	1.4	4.1	75,893	1,922	0.1
Royal Holloway and Bedford New College	8.4	2.5	9.5	125,093	26,050	0.6
Royal Northern College of Music	2.5	0.6	4.7	57,146	881	0.0
Sheffield Hallam University	16.5	2.3	5.9	117,766	5,728	0.2
Southampton Solent University	16.5	2.2	9.0	140,947	678	0.1
St George's Hospital Medical School	10.1	0.4	21.1	165,080	38,704	0.3
St Mary's University College	18.3	0.4	14.7	154,283	17	0.0
St Mary's University College, Twickenham	13.4	0.8	7.9	104,514	749	0.1

Staffordshire University	22.2	1.6	11.7	123,017	2,472	0.2
Stranmillis University College	24.3	0.7	33.9	222,750	3,967	0.0
Swansea University	16.2	1.8	16.9	153,835	41,195	0.6
Teesside University	28.9	1.7	11.5	181,397	6,229	0.2
The Arts University Bournemouth	9.2	1.2	4.9	93,839	52	0.0
The City University	10.3	3.9	4.9	115,479	12,230	0.4
The Institute of Cancer Research	0.5	0.0	12.9	163,729	116,984	0.2
The Liverpool Institute for Performing Arts	12.2	2.9	14.2	162,017	0	0.0
The Manchester Metropolitan University	14.3	1.0	8.0	105,746	4,472	0.3
The Nottingham Trent University	17.4	2.0	10.0	131,191	5,875	0.3
The Open University	24.5	0.1	2.0	65,285	3,590	0.0
The Queen's University of Belfast	14.7	1.4	17.0	186,765	61,309	1.0
The Robert Gordon University	18.7	4.0	13.2	136,421	7,987	0.3
The Royal Veterinary College	8.5	1.2	26.6	289,576	62,863	0.4
The School of Oriental and African Studies	6.4	3.0	2.3	84,250	11,996	0.6
The University of Aberdeen	9.6	2.6	15.6	141,009	52,712	0.6
The University of Bath	12.8	3.9	17.5	177,140	38,005	1.0
The University of Birmingham	11.0	2.5	17.8	176,568	52,673	0.9
The University of Bolton	25.4	1.9	11.2	152,902	7,807	0.5
The University of Bradford	22.2	3.9	13.5	215,738	23,598	0.5
The University of Brighton	13.3	1.9	7.2	110,732	8,882	0.2
The University of Bristol	7.5	1.7	18.0	175,925	67,027	0.8
The University of Cambridge	3.9	1.3	15.4	292,624	91,950	1.0
The University of Central Lancashire	22.4	2.5	12.0	151,385	6,929	0.4
The University of Chichester	12.2	0.3	6.5	99,985	927	0.1
The University of Dundee	10.8	1.9	17.2	153,609	62,230	0.4
The University of East Anglia	8.2	2.0	10.9	120,896	22,615	0.5
The University of East London	25.0	3.6	9.5	197,866	4,871	0.2
The University of Edinburgh	7.9	2.6	22.8	211,703	84,236	0.8
The University of Essex	13.0	4.2	15.2	158,059	27,032	0.7
The University of Exeter	12.1	3.3	16.4	191,373	47,197	0.9

The University of Glasgow	10.1	0.0	16.2	176,963	67,083	0.7
The University of Greenwich	20.4	4.0	8.5	160,365	10,996	0.4
The University of Huddersfield	19.7	2.9	8.4	137,706	6,978	0.7
The University of Hull	18.0	3.5	17.6	167,619	17,538	0.7
The University of Keele	13.4	2.1	14.8	157,986	25,690	0.5
The University of Kent	11.0	2.5	8.9	112,152	13,552	0.6
The University of Lancaster	8.8	2.7	10.8	137,388	30,695	0.9
The University of Leeds	9.7	1.7	18.3	175,233	56,632	0.6
The University of Leicester	8.7	2.4	16.9	142,499	37,857	0.6
The University of Lincoln	15.7	1.4	10.4	127,206	6,272	0.4
The University of Liverpool	8.8	2.3	17.1	199,790	68,185	0.6
The University of Manchester	8.4	2.4	17.3	181,552	62,311	0.7
The University of Newcastle-upon-Tyne	8.4	2.3	17.5	165,432	51,096	0.7
The University of Northampton	18.6	2.1	9.0	135,058	2,340	0.3
The University of Northumbria at Newcastle	21.1	2.7	14.7	165,117	6,395	0.4
The University of Nottingham	10.5	2.7	17.6	165,453	47,649	0.8
The University of Oxford	4.3	1.2	12.0	182,208	93,937	0.8
The University of Plymouth	23.4	2.5	7.0	177,789	16,327	0.6
The University of Portsmouth	16.2	2.8	10.3	132,142	8,440	0.4
The University of Reading	8.4	2.0	9.9	139,906	31,369	0.6
The University of Salford	14.1	2.1	8.9	130,423	10,046	0.4
The University of Sheffield	9.2	2.5	15.7	175,339	57,429	0.8
The University of Southampton	8.5	2.3	12.5	164,419	54,099	0.9
The University of St Andrews	8.7	4.0	22.4	168,714	54,158	0.8
The University of Stirling	11.7	2.7	15.5	114,107	18,224	0.6
The University of Strathclyde	15.2	2.2	21.4	184,428	53,511	0.9
The University of Sunderland	20.3	6.4	13.0	168,842	5,294	0.3
The University of Surrey	10.5	3.2	18.5	161,869	33,647	0.8
The University of Sussex	8.5	2.6	13.0	130,163	27,066	0.6
The University of the West of Scotland	27.7	2.0	17.5	175,614	8,609	0.6

The University of Wales, Newport	24.2	1.7	9.6	117,673	1,415	0.2
The University of Warwick	14.2	4.7	30.0	249,798	63,895	1.2
The University of West London	16.8	3.3	5.3	111,399	2,194	0.1
The University of Westminster	15.2	4.0	9.2	128,632	6,451	0.2
The University of Winchester	12.4	0.7	6.8	102,196	2,155	0.3
The University of Wolverhampton	24.5	2.6	16.1	198,160	6,087	0.3
The University of Worcester	18.4	1.3	8.2	128,798	3,504	0.2
The University of York	10.8	2.4	17.0	197,786	50,609	0.8
Trinity Laban Conservatoire of Music and Dance	2.7	0.7	4.4	67,336	145	0.1
University College Birmingham	38.9	5.3	15.7	166,641	0	0.0
University College London	4.8	1.9	10.3	170,913	81,710	0.8
University for the Creative Arts	14.4	1.7	12.6	159,500	2,108	0.1
University of Abertay Dundee	22.5	3.1	16.6	175,391	10,600	0.3
University of Bedfordshire	29.2	7.7	10.2	192,076	5,986	0.5
University of Chester	28.7	1.3	18.5	175,614	2,090	0.6
University of Cumbria	23.4	0.6	13.5	179,429	1,317	0.1
University of Derby	14.4	1.2	8.0	112,216	924	0.1
University of Durham	10.8	2.7	21.2	182,237	48,725	0.8
University of Glamorgan	14.6	2.0	7.1	94,934	4,832	0.2
University of Gloucestershire	15.3	1.0	6.3	126,064	3,282	0.5
University of Hertfordshire	14.4	2.7	12.1	135,790	8,536	0.3
University of St Mark and St John	21.3	1.4	21.0	191,280	160	0.0
University of the Arts, London	8.8	3.2	5.9	102,774	3,393	0.1
University of the West of England, Bristol	17.6	1.7	10.4	142,711	10,385	0.2
University of Ulster	16.1	2.5	8.9	116,904	21,963	0.3
University of Wales Trinity Saint David	23.5	2.5	12.7	141,682	2,218	0.3
Writtle College	8.1	0.8	22.4	150,545	827	0.0
York St John University	22.4	1.4	15.4	182,141	1,844	0.2

Appendix 11. Extended Analysis of Potential Case Study HEIs

HEI	Type of Campus	Location	Foreign branch campus (as of 2012/13)	Collaborative agreements with overseas institutions (as of 2012/13)	Transnational student numbers (2012/13)	PPUL position (2013)
1	Multiple	City	No	Yes	1572	1-20
2	Campus	City	Yes	Yes	4039	81-100
3	Multiple	City	No	Yes	4408	21-40
4	Campus	City	No	Yes	253	81-100
5	Multiple	City	No	Yes	4332	21-40
6	Multiple	City	No	Yes	759	41-60
7	Multiple	City	No	Yes	2957	21-40
8	Campus	City	Yes	Yes	15734	101-120
9	Multiple	City	No	Yes	1405	61-80
10	Campus	City	No	Yes	293	41-60
11	Campus	City	No	Yes	5761	81-100
12	Campus	City	Yes	Yes	790	1-20
13	Multiple	City/ countryside	No	No	0	81-100
14	Campus	Countryside	Yes	Yes	5389	81-100
15	Multiple	City/ countryside	No	No	7	21-40
16	Campus	Countryside	No	Yes	410	81-100
17	Multiple	City	No	Yes	1644	1-20
18	Non-campus	City	No	Yes	314	41-60
19	Multiple	City/ countryside	No	Yes	3636	21-40
20	Campus	City	No	No	131	21-40
21	Multiple	City	No	Yes	261664	1-20
22	Non-campus	City	No	No	2165	121-140
23	Campus	City	Yes	Yes	9482	41-60
24	Multiple	City	No	Yes	561	81-100
25	Campus	City	No	Yes	13	61-80
36	Multiple	City/ countryside	Yes	Yes	656	81-100
27	Multiple	City/ countryside	No	Yes	655	1-20
28	Multiple	City	Yes	Yes	10340	61-80
29	Multiple	City	No	Yes	10508	41-60
30	Campus	City	No	Yes	864	101-120

Appendix 12. Methodology for Estimating Inbound Student Air Travel Emissions at the Case Study HEIs

HEFCE guidance includes a methodology for estimating emissions from student air travel (HEFCE, 2010b). Following a standard approach, student flight emissions (F_S) can be estimated as:

$F_S = [D \times (1 + A)] \times CF$

Where D is the return flight trip distance, (1+A) is the number of return flights per year, where 1 represents the flight at the start and end of the study period and A is the number of additional flights, and CF is the appropriate conversion factor (short-haul or long-haul) as published by the UK Government (DEFRA/DECC, 2014a).

In the HEFCE guidance (HEFCE, 2010b), D is estimated as twice the great circle distance (GCD) between London Heathrow (LHR) and the capital city of the overseas country. Where the country of origin was unknown a weighted average distance was used.

With regard to flight frequency, A is assumed to be 3.1 for inbound (international) students from Europe, and 2 for other inbound students (based on results from Chapter 4). F_S was then multiplied by the number of inbound students from each country using institutional data from HESA (2015a) in order to calculate the total emissions from inbound student air travel at each case study HEI.

The following table presents the country specific information on flight distance, conversion factor and number of student trips.

Region	Country	Capital City	AIRPORT, TRIP DISTANCE, EMISSIONS FACTOR, EMISSIONS PER FLIGHT & FLIGHT FREQUENCY					
			From www.gcmap.com			Defra/DECC (2014 version)	Emissions Per Flight	# Student Trips
			IATA CODE	Great Circle LHR-XXX	Round Trip	Economy Emissions Factor (SH/LH)		
			XXX	km	km/trip.student	kg CO_2e/km	kg CO_2e/trip. student	# Trips
EU-28	Austria	Vienna	VIE	1,279	2,558	0.15835	405	3.1
EU-28	Belgium	Brussels	BRU	352	704	0.15835	111	3.1
EU-28	Bulgaria	Sofia	SOF	2,045	4,090	0.15835	648	3.1
EU-28	Croatia	Zagreb	ZAG	1,371	2,742	0.15835	434	3.1
EU-28	Cyprus (European Union)	Nicosia	ECN	3,254	6,508	0.15835	1,031	3.1
EU-28	Czech Republic	Prague	PRG	1,047	2,094	0.15835	332	3.1
EU-28	Denmark	Copenhagen	CPH	982	1,964	0.15835	311	3.1
EU-28	Estonia	Tallinn	TLL	1,812	3,624	0.15835	574	3.1
EU-28	Finland	Helsinki	HEL	1,853	3,706	0.15835	587	3.1
EU-28	France {includes Corsica}	Paris	CDG	348	696	0.15835	110	3.1
EU-28	Germany	Berlin	TXL	950	1,900	0.15835	301	3.1
EU-28	Greece	Athens	ATH	2,431	4,862	0.15835	770	3.1
EU-28	Hungary	Budapest	BUD	1,493	2,986	0.15835	473	3.1
EU-28	Ireland	Dublin	DUB	450	900	0.15835	143	3.1
EU-28	Italy {Includes Sardinia, Sicily}	Rome	FCO	1,446	2,892	0.15835	458	3.1
EU-28	Latvia	Riga	RIX	1,695	3,390	0.15835	537	3.1
EU-28	Lithuania	Vilnius	VNO	1,751	3,502	0.15835	555	3.1
EU-28	Luxembourg	Luxembourg	LUX	515	1,030	0.15835	163	3.1
EU-28	Malta	Valletta	MLA	2,104	4,208	0.15835	666	3.1
EU-28	Netherlands	Amsterdam	AMS	371	742	0.15835	117	3.1
EU-28	Poland	Warsaw	WAW	1,471	2,942	0.15835	466	3.1
EU-28	Portugal {includes Madeira, Azores}	Lisbon	LIS	1,565	3,130	0.15835	496	3.1
EU-28	Romania	Bucharest	OTP	2,110	4,220	0.15835	668	3.1
EU-28	Slovakia	Bratislava	BTS	1,320	2,640	0.15835	418	3.1
EU-28	Slovenia	Ljubljana	LJU	1,238	2,476	0.15835	392	3.1
EU-28	Spain {includes Ceuta, Melilla}	Madrid	MAD	1,244	2,488	0.15835	394	3.1
EU-28	Sweden	Stockholm	ARN	1,466	2,932	0.15835	464	3.1
EU-OMR	Canary Islands	Tenerife	TFS	2,930	5,860	0.15835	928	3.1
EU-Special case	Åland Islands {Ahvenamaa}	Mariehamn	MHQ	1,588	3,176	0.15835	503	3.1
EU-Special case	Gibraltar	Gibraltor	GIB	1,747	3,494	0.15835	553	3.1
EU-Special case	Cyprus not otherwise specified	Nicosia	ECN	3,254	6,508	0.15835	1,031	3.1
							0	
EEA	Iceland	Reykyavik	RKV	1,883	3,766	0.15835	596	3.1
EEA	Liechtenstein	Vaduz (used Zurich)	ZRH	790	1,580	0.15835	250	3.1
EEA	Norway	Oslo	OSL	1,207	2,414	0.15835	382	3.1

Other Europe	Albania	Tirana	TIA	1,902	3,804	0.15835	602	3.1
Other Europe	Andorra	Andorra La Vella (used Montferrer, Catalonia)	LEU	1,025	2,050	0.15835	325	3.1
Other Europe	Armenia	Yerevan	EVN	3,640	7,280	0.15835	1,153	3.1
Other Europe	Azerbaijan	Baku	GYD	4,012	8,024	0.15054	1,208	3.1
Other Europe	Belarus	Minsk	MHP	1,900	3,800	0.15835	602	3.1
Other Europe	Bosnia and Herzegovina	Sarajevo	SJJ	1,641	3,282	0.15835	520	3.1
Other Europe	Cyprus (Non-European Union)	Nicosia	ECN	3,254	6,508	0.15835	1,031	3.1
Other Europe	Faroe Islands	Torshavn (used Sorvag)	FAE	1,249	2,498	0.15835	396	3.1
Other Europe	Georgia	Tbilisi	TBS	3,583	7,166	0.15835	1,135	3.1
Other Europe	Kosovo	Pristina	PRN	1,900	3,800	0.15835	602	3.1
Other Europe	Macedonia	Skopje	SKP	1,980	3,960	0.15835	627	3.1
Other Europe	Moldova	Chisinau	KIV	2,185	4,370	0.15835	692	3.1
Other Europe	Monaco	Monaco (used Nice)	NCE	1,042	2,084	0.15835	330	3.1
Other Europe	Montenegro	Podgorica	TGD	1,803	3,606	0.15835	571	3.1
Other Europe	Russia	Moscow	SVO	2,516	5,032	0.15835	797	3.1
Other Europe	San Marino	San Marino (used Rimini)	RMI	1,281	2,562	0.15835	406	3.1
Other Europe	Serbia	Belgrade	BEG	1,706	3,412	0.15835	540	3.1
Other Europe	Svalbard and Jan Mayen	Longyearbyen	LYR	3,053	6,106	0.15835	967	3.1
Other Europe	Switzerland	Bern	BRN	770	1,540	0.15835	244	3.1
Other Europe	Turkey	Ankara	ESB	2,857	5,714	0.15835	905	3.1
Other Europe	Ukraine	Kiev	KBP	2,192	4,384	0.15835	694	3.1
Other Europe	Vatican City	Vatican City (used Rome)	FCO	1,446	2,892	0.15835	458	3.1
RoW	Afghanistan	Kabul	KBL	5,743	11,486	0.15054	1,729	2
RoW	Algeria	Algiers	ALG	1,668	3,336	0.15835	528	2
RoW	American Samoa	Pago Pago	PPG	15,793	31,586	0.15054	4,755	2
RoW	Angola	Luanda	LAD	6,813	13,626	0.15054	2,051	2
RoW	Anguilla	The Valley	AXA	6,553	13,106	0.15054	1,973	2
RoW	Antigua and Barbuda	St. John's	ANU	6,557	13,114	0.15054	1,974	2
RoW	Argentina	Buenos Aires	EZE	11,111	22,222	0.15054	3,345	2
RoW	Aruba	Oranjestad	AUA	7,516	15,032	0.15054	2,263	2
RoW	Australia	Canberra	CBR	17,005	34,010	0.15054	5,120	2
RoW	Bahamas, The	Nassau	NAS	6,988	13,976	0.15054	2,104	2
RoW	Bahrain	Manama	BAH	5,100	10,200	0.15054	1,536	2
RoW	Bangladesh	Dhaka	DAC	8,029	16,058	0.15054	2,417	2
RoW	Barbados	Bridgetown	BGI	6,752	13,504	0.15054	2,033	2

RoW	Belize	Belmopan (used Belize City)	BZE	8,355	16,710	0.15054	2,516	2
RoW	Benin	Porto-Novo (used Littoral)	COO	5,009	10,018	0.15054	1,508	2
RoW	Bermuda	Hamilton (used Bermuda)	BDA	5,531	11,062	0.15054	1,665	2
RoW	Bhutan	Thimphu (used Paro)	PBH	7,668	15,336	0.15054	2,309	2
RoW	Bolivia	Sucre	SRE	10,018	20,036	0.15054	3,016	2
RoW	Bonaire, Sint Eustatius and Saba	kralendijk	BON	7,428	14,856	0.15054	2,236	2
RoW	Botswana	Gabarone	GBE	8,809	17,618	0.15054	2,652	2
RoW	Brazil	Brasilia	BSB	8,762	17,524	0.15054	2,638	2
RoW	British Virgin Islands	Road Town	EIS	6,634	13,268	0.15054	1,997	2
RoW	Brunei	Bandar Seri Begawan	BWN	11,290	22,580	0.15054	3,399	2
RoW	Burkina	Ouagadougou	OUA	4,340	8,680	0.15054	1,307	2
RoW	Burma	Naypyidaw	NYT	8,772	17,544	0.15054	2,641	2
RoW	Burundi	Bujumbura	BJM	6,697	13,394	0.15054	2,016	2
RoW	Cambodia	Phnom Penh	PNH	10,046	20,092	0.15054	3,025	2
RoW	Cameroon	Yaounde	NSI	5,411	10,822	0.15054	1,629	2
RoW	Canada	Ottawa	YOW	5,362	10,724	0.15054	1,614	2
RoW	Cape Verde	Praia	RAI	4,544	9,088	0.15054	1,368	2
RoW	Cayman Islands	George Town (used Grand Cayman)	GCM	7,729	15,458	0.15054	2,327	2
RoW	Central African Republic	Bangui	BGF	5,509	11,018	0.15054	1,659	2
RoW	Chad	N'Djamena	NDJ	4,583	9,166	0.15054	1,380	2
RoW	Chile	Santiago	SCL	11,631	23,262	0.15054	3,502	2
RoW	China	Beijing	PEK	8,175	16,350	0.15054	2,461	2
RoW	Christmas Island	Flying Fish Cove (Christmas Island)	XCH	12,029	24,058	0.15054	3,622	2
RoW	Cocos (Keeling) Islands	West Island (West Island)	CCK	11,563	23,126	0.15054	3,481	2
RoW	Colombia	Bogota	BOG	8,473	16,946	0.15054	2,551	2
RoW	Comoros	Moroni	HAH	8,151	16,302	0.15054	2,454	2
RoW	Congo	Brazzaville	BZV	6,354	12,708	0.15054	1,913	2
RoW	Congo (Democratic Republic) {formerly Zaire}	Kinshasa	FIH	6,373	12,746	0.15054	1,919	2
RoW	Cook Islands	Avarua	RAR	16,201	32,402	0.15054	4,878	2
RoW	Costa Rica	San Jose	SJO	8,713	17,426	0.15054	2,623	2
RoW	Cuba	Havana	HAV	7,495	14,990	0.15054	2,257	2
RoW	Djibouti	Djibouti City	JIB	5,917	11,834	0.15054	1,781	2
RoW	Dominica	Roseau	DCF	6,684	13,368	0.15054	2,012	2
RoW	Dominican Republic	Santo Domingo	SDQ	6,990	13,980	0.15054	2,105	2
RoW	East Timor	Dili	DIL	13,186	26,372	0.15054	3,970	2
RoW	Ecuador	Quito	UIO	9,181	18,362	0.15054	2,764	2
RoW	Egypt	Cairo	CAI	3,536	7,072	0.15835	1,120	2
RoW	El Salvador	San Salvador	SAL	8,754	17,508	0.15054	2,636	2
RoW	Equatorial Guinea	Malabo	SSG	5,358	10,716	0.15054	1,613	2
RoW	Eritrea	Asmara	ASM	5,321	10,642	0.15054	1,602	2
RoW	Ethiopia	Addis Ababa	ADD	5,914	11,828	0.15054	1,781	2
RoW	Falkland Islands	Stanley	PSY	12,637	25,274	0.15054	3,805	2

RoW	Fiji	Suva	SUV	16,293	32,586	0.15054	4,905	2
RoW	French Guiana	Cayenne	CAY	7,038	14,076	0.15054	2,119	2
RoW	French Polynesia	Pape'ete	PPT	15,370	30,740	0.15054	4,628	2
RoW	Gabon	Libreville	LBV	5,730	11,460	0.15054	1,725	2
RoW	Gambia, The	Banjul	BJL	4,474	8,948	0.15054	1,347	2
RoW	Ghana	Accra	ACC	5,085	10,170	0.15054	1,531	2
RoW	Greenland	Nuuk	GOH	3,241	6,482	0.15835	1,026	2
RoW	Grenada	St. George	GND	6,999	13,998	0.15054	2,107	2
RoW	Guadeloupe	Basse-Terre	BBR	6,650	13,300	0.15054	2,002	2
RoW	Guam	Hagatna (used Agana)	GUM	12,066	24,132	0.15054	3,633	2
RoW	Guatemala	Guatemala City	GUA	8,758	17,516	0.15054	2,637	2
RoW	Guinea	Conakry	CKY	4,799	9,598	0.15054	1,445	2
RoW	Guinea-Bissau	Bissau	OXB	4,600	9,200	0.15054	1,385	2
RoW	Guyana	Georgetown	GEO	7,255	14,510	0.15054	2,184	2
RoW	Haiti	Port au Prince	PAP	7,159	14,318	0.15054	2,155	2
RoW	Honduras	Tegucigalpa	TGU	8,575	17,150	0.15054	2,582	2
RoW	Hong Kong (Special Administrative Region of China)	Hong Kong	HKG	9,647	19,294	0.15054	2,905	2
RoW	India	New Delhi	DEL	6,744	13,488	0.15054	2,030	2
RoW	Indonesia	Jakarta	CGK	11,722	23,444	0.15054	3,529	2
RoW	Iran	Tehran	THR	4,424	8,848	0.15054	1,332	2
RoW	Iraq	Baghdad	BGW	4,114	8,228	0.15054	1,239	2
RoW	Israel	Jerusalem (Tel Aviv)	TLV	3,593	7,186	0.15835	1,138	2
RoW	Ivory Coast	Yamoussoukro	ASK	4,963	9,926	0.15054	1,494	2
RoW	Jamaica	Kingston	KIN	7,525	15,050	0.15054	2,266	2
RoW	Japan	Tokyo	NRT	9,614	19,228	0.15054	2,895	2
RoW	Jordan	Amman	AMM	3,688	7,376	0.15835	1,168	2
RoW	Kazakhstan	Astana	TSE	4,812	9,624	0.15054	1,449	2
RoW	Kenya	Nairobi	NBO	6,828	13,656	0.15054	2,056	2
RoW	Kiribati	South Tarawa (used Tarawa Island)	TRW	14,115	28,230	0.15054	4,250	2
RoW	Korea (North)	Pyongyang	FNJ	8,681	17,362	0.15054	2,614	2
RoW	Korea (South)	Seoul	ICN	8,883	17,766	0.15054	2,674	2
RoW	Kuwait	Kuwait City	KWI	4,682	9,364	0.15054	1,410	2
RoW	Kyrgyzstan	Bishkek	FRU	5,495	10,990	0.15054	1,654	2
RoW	Laos	Vientiane	VTE	9,331	18,662	0.15054	2,809	2
RoW	Lebanon	Beirut	BEY	3,487	6,974	0.15835	1,104	2
RoW	Lesotho	Maseru	MSU	9,377	18,754	0.15054	2,823	2
RoW	Liberia	Monrovia	ROB	5,099	10,198	0.15054	1,535	2
RoW	Libya	Tripoli	TIP	2,365	4,730	0.15835	749	2
RoW	Macao (Special Administrative Region of China)	Macao	MFM	9,643	19,286	0.15054	2,903	2
RoW	Madagascar	Antananarivo	TNR	9,072	18,144	0.15054	2,731	2
RoW	Malawi	Lilongwe	LLW	7,953	15,906	0.15054	2,394	2
RoW	Malaysia	Kuala Lumpur	KUL	10,610	21,220	0.15054	3,194	2
RoW	Maldives	Male	MLE	8,539	17,078	0.15054	2,571	2
RoW	Mali	Bamako	BKO	4,372	8,744	0.15054	1,316	2
RoW	Martinique	Fort-de-France	FDF	6,721	13,442	0.15054	2,024	2
RoW	Mauritania	Nouakchott	NKC	3,947	7,894	0.15054	1,188	2
RoW	Mauritius	Port Louis (used Mauritius)	MRU	9,765	19,530	0.15054	2,940	2

RoW	Mayotte	Mamoudzou (used Dzaoudzi)	DZA	8,376	16,752	0.15054	2,522	2
RoW	Mexico	Mexico City	MEX	8,917	17,834	0.15054	2,685	2
RoW	Micronesia	Palikir (used Pohnpei)	PNI	13,214	26,428	0.15054	3,978	2
RoW	Mongolia	Ulaanbataar	ULN	7,011	14,022	0.15054	2,111	2
RoW	Montserrat	Brades (used Gerald's Park)	MNI	6,614	13,228	0.15054	1,991	2
RoW	Morocco	Rabat	RBA	2,001	4,002	0.15835	634	2
RoW	Mozambique	Maputo	MPM	9,163	18,326	0.15054	2,759	2
RoW	Namibia	Windhoek	WDH	8,378	16,756	0.15054	2,522	2
RoW	Nepal	Kathmandu	KTM	7,373	14,746	0.15054	2,220	2
RoW	Netherlands Antilles	Willemstad	CUR	7,470	14,940	0.15054	2,249	2
RoW	New Caledonia	Noumea	NOU	16,539	33,078	0.15054	4,980	2
RoW	New Zealand	Wellington	WLG	18,820	37,640	0.15054	5,666	2
RoW	Nicaragua	Managua	MGA	8,666	17,332	0.15054	2,609	2
RoW	Niger	Niamey	NIM	4,221	8,442	0.15054	1,271	2
RoW	Nigeria	Abuja	ABV	4,762	9,524	0.15054	1,434	2
RoW	Niue	Alofi	IUE	16,293	32,586	0.15054	4,905	2
RoW	Norfolk Island	Kingston (used Norfolk Island)	NLK	17,334	34,668	0.15054	5,219	2
RoW	Northern Mariana Islands	Saipan	GSN	15,919	31,838	0.15054	4,793	2
RoW	Occupied Palestinian Territories {formerly West Bank (including East Jerusalem) and Gaza Strip}	Used Jerusalem	JRS	3,627	7,254	0.15835	1,149	2
RoW	Oman	Muscat	MCT	5,840	11,680	0.15054	1,758	2
RoW	Pakistan	Islamabad	ISB	6,080	12,160	0.15054	1,831	2
RoW	Palau	Melekeok (used Babelthuap Island)	ROR	12,206	24,412	0.15054	3,675	2
RoW	Panama	Panama City	PTY	8,457	16,914	0.15054	2,546	2
RoW	Papua New Guinea	Port Moresby	POM	14,498	28,996	0.15054	4,365	2
RoW	Paraguay	Asuncion	ASU	10,159	20,318	0.15054	3,059	2
RoW	Peru	Lima	LIM	10,140	20,280	0.15054	3,053	2
RoW	Philippines	Manila	MNL	10,781	21,562	0.15054	3,246	2
RoW	Puerto Rico	San Juan	SJU	6,736	13,472	0.15054	2,028	2
RoW	Qatar	Doha	DOH	5,247	10,494	0.15054	1,580	2
RoW	Réunion	Saint-Denis	RUN	9,690	19,380	0.15054	2,917	2
RoW	Rwanda	Kigali	KGL	6,590	13,180	0.15054	1,984	2
RoW	Samoa	Apia	APW	15,760	31,520	0.15054	4,745	2
RoW	Sao Tome and Principe	Sao Tome	TMS	5,703	11,406	0.15054	1,717	2
RoW	Saudi Arabia	Riyadh	RUH	4,946	9,892	0.15054	1,489	2
RoW	Senegal	Dakar	DKR	4,350	8,700	0.15054	1,310	2
RoW	Seychelles	Victoria (used Mahe)	SEZ	8,165	16,330	0.15054	2,458	2
RoW	Sierra Leone	Freetown	FNA	4,894	9,788	0.15054	1,473	2
RoW	Singapore	Singapore	SIN	10,887	21,774	0.15054	3,278	2
RoW	Sint Maarten (Dutch part)	Philipsburg	SXM	6,570	13,140	0.15054	1,978	2
RoW	Solomon Islands	Honiara	HIR	15,016	30,032	0.15054	4,521	2
RoW	Somalia	Mogadishu	MGQ	6,941	13,882	0.15054	2,090	2
RoW	South Africa	Cape Town	CPT	9,648	19,296	0.15054	2,905	2

RoW	South Sudan	Juba	JUB	5,957	11,914	0.15054	1,794	2
RoW	Sri Lanka	Colombo	CMB	8,718	17,436	0.15054	2,625	2
RoW	St Barthélemy	Gustavia	SBH	6,564	13,128	0.15054	1,976	2
RoW	St Helena, Ascension and Tristan da Cunha	Jamestown (used Georgetown, Ascension)	ASI	6,721	13,442	0.15054	2,024	2
RoW	St Kitts and Nevis	Basseterre	SKB	6,605	13,210	0.15054	1,989	2
RoW	St Lucia	Castries	SLU	6,771	13,542	0.15054	2,039	2
RoW	St Martin (French Part)	used Saint Maarten (Dutch part)	SXM	6,570	13,140	0.15054	1,978	2
RoW	St Pierre and Miquelon	St Pierre	FSP	4,001	8,002	0.15054	1,205	2
RoW	St Vincent and The Grenadines	Kingstown	SVD	6,861	13,722	0.15054	2,066	2
RoW	Sudan	Khartoum	KRT	4,944	9,888	0.15054	1,489	2
RoW	Suriname	Paramaribo	PBM	7,154	14,308	0.15054	2,154	2
RoW	Swaziland	Lobamba (used Manzini)	MTS	9,184	18,368	0.15054	2,765	2
RoW	Syria	Damascus	DAM	3,586	7,172	0.15835	1,136	2
RoW	Taiwan	Taipei	TPE	9,802	19,604	0.15054	2,951	2
RoW	Tajikistan	Dushanbe	DYU	5,431	10,862	0.15054	1,635	2
RoW	Tanzania	Dodoma	DOD	7,260	14,520	0.15054	2,186	2
RoW	Thailand	Bangkok	BKK	9,589	19,178	0.15054	2,887	2
RoW	Togo	Lome	LFW	5,026	10,052	0.15054	1,513	2
RoW	Tonga	Nuku'alofa	TBU	16,617	33,234	0.15054	5,003	2
RoW	Trinidad and Tobago	Port of Spain	POS	7,092	14,184	0.15054	2,135	2
RoW	Tunisia	Tunis	TUN	1,832	3,664	0.15835	580	2
RoW	Turkmenistan	Ashgabat	ASB	4,752	9,504	0.15054	1,431	2
RoW	Turks and Caicos Islands	Cockburn Town (used Providenciales)	PLS	6,893	13,786	0.15054	2,075	2
RoW	Tuvalu	Funafuti	FUN	15,241	30,482	0.15054	4,589	2
RoW	Uganda	Kampala	EBB	6,484	12,968	0.15054	1,952	2
RoW	United Arab Emirates	Abu Dhabi	AUH	5,523	11,046	0.15054	1,663	2
RoW	United States	Washington DC	IAD	5,917	11,834	0.15054	1,781	2
RoW	United States Virgin Islands	Charlotte Amalie	STT	6,673	13,346	0.15054	2,009	2
RoW	Uruguay	Montevideo	MVD	10,991	21,982	0.15054	3,309	2
RoW	Uzbekistan	Tashkent	TAS	5,275	10,550	0.15054	1,588	2
RoW	Vanuatu	Port Vila	VLI	16,129	32,258	0.15054	4,856	2
RoW	Venezuela	Caracas	CCS	7,472	14,944	0.15054	2,250	2
RoW	Vietnam	Hanoi	HAN	9,253	18,506	0.15054	2,786	2
RoW	Wallis and Futuna	Mata-Utu (used Wallis)	WLS	15,746	31,492	0.15054	4,741	2
RoW	Western Sahara	El Aaiun	EUN	2,906	5,812	0.15835	920	2
RoW	Yemen	Sanaa	SAH	5,619	11,238	0.15054	1,692	2
RoW	Zambia	Lusaka	LUN	7,915	15,830	0.15054	2,383	2
RoW	Zimbabwe	Harare	HRE	8,280	16,560	0.15054	2,493	2

Note. LHR: London Heathrow. SH: Short haul. LH: Long haul. OMR: Outermost Region. RoW: Rest of the World

Appendix 13. Information on Interviewees and Documentation from the Verification Case Studies

HEI	Code	Documents/interviewee	Date
Newtown	E01	Carbon Management Plan	2005-2020
	E02	Reducing Energy Use and Carbon Emissions	2011
	E03	Environmental Policy	2014
	E04	Sustainable Procurement Policy	2014
	E05	Procurement Strategy	2014
	E06	Travel Plan	2011
	E07	Corporate Strategy	2015-2020
	E08	Estates Strategy	2008-2013
	E09	Internationalisation Strategy	2015
	E10	Recruitment Plan	2015
	E11	Financial Statement	2013
	E12	Financial Statement	2014
	E13	Financial Statement	2015
	RE1	Telephone interview with Environmental and Sustainability Manager	Jul-15
Lakeside	F01	Carbon Management Plan	2011
	F02	Sustainability Policy	2015
	F03	Sustainable Buildings Policy	2013
	F04	Travel Plan	2013
	F05	Travel Plan Objectives	2014
	F06	Strategic Plan	2015-2020
	F07	Financial Statement	2013
	F08	Financial Statement	2014
	F09	Financial Statement	2015
	RF1	Telephone interview with member of Carbon Management Group (Leading accounting side of CMP)	Aug-15
Parkway	G01	Carbon Management Plan	2010
	G02	Carbon Management Plan	2013-2020
	G03	Environmental Policy	2014
	G04	Sustainability Strategy	2008-2012
	G05	Sustainability Plan	2013-2020
	G06	Annual Sustainability Report	2012
	G07	Annual Sustainability Report	2014
	G08	Travel Plan	2012
	G09	Waste Plan	2011
	G10	Water Reduction Plan	2012

	G11	Corporate Strategy	2015-2020
	G12	Erasmus Policy	2014
	G13	Financial Statement	2013
	G14	Financial Statement	2014
	G15	Financial Statement	2015
	RG1	Face-to-face interview with the Assistant Vice Chancellor for Environment and Sustainability	Jun-15
Woodhouse	H01	Carbon Management Plan	2011
	H02	Carbon Management Plan Progress Report	2012
	H03	Carbon Management Plan Update	2013
	H04	Environmental Policy	2015
	H05	Sustainability Strategy	2014-2020
	H06	Sustainability Plan	2014-2020
	H07	Travel Plan	2013
	H08	Sustainable Construction Plan	2014
	H09	Waste Policy	2006
	H10	Purchasing Policy	2009
	H11	Strategic Plan	2015-2020
	H12	Internationalisation Strategy	2010
	H13	Financial Statement	2013
	H14	Financial Statement	2014
	H15	Financial Statement	2015
	RH1	Telephone interview with Environment Manager	Jul-15

Appendix 14. Research Output

Oral presentations

Davies, J. C. (2014). An Analysis of the Sustainability of Different Methods of Delivering Higher Education. *World Symposium on Sustainable Development at Universities 2014*. Manchester, UK.

Davies, J. C., Hooper, P., Paling, C., Preston, H. and Thomas, C. (2014). Compensating for the international aviation carbon emissions of staff and international students at universities. Can carbon compensation shemes contribute to the development of sustainability in higher education? *International Sustainable Development Research Conference 2014*. Trondheim, Norway.

Poster presentations

Davies, J. C. (2015). Investigating the carbon impact of student air travel. *School of Science and the Environment Research Day 2015*. Manchester Metropolitan University, UK.

Other output

Davies, J. C. (2014). Investigating the carbon impact of student air travel. *In MMU Scientist,* 3 pp. 8-9.

Journal articles

Davies, J. C. and Dunk, R. M. (2016) "Flying along the supply chain: accounting for emissions from student air travel in the higher education sector." *Carbon Management*, 6(5-6) pp. 233–246.

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Flying along the supply chain: accounting for emissions from student air travel in the higher education sector

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ABSTRACT

Higher education institutions (HEIs) can play a key role in facilitating the transition to a low carbon economy, where reporting greenhouse gas emissions is an important step in this process. While most UK HEIs are required to report estate emissions, engagement with supply chain emissions has been inconsistent. This research examined emissions arising from the air travel of international and study-abroad students and their visiting friends and relatives (VFR). Survey results demonstrated that flight frequencies were substantially higher than those assumed in sector guidance. An analysis of 25 UK HEIs found student and VFR flight emissions were significant, each being greater than other Scope 3 travel and comparable to Scope 2 emissions. Scenario analysis suggests that by 2020/2021, increases in flight emissions are likely to exceed reductions in estate emissions unless HEIs reinvigorate efforts to achieve reduction targets, and/or there is close to zero growth in inbound and outbound student numbers. It is thus imperative that HEIs develop an accurate picture of these emissions in order to inform their carbon management and internationalization strategies. In doing so, the risk of a rebound-type effect must also be considered, where if action is taken to reduce student flights, VFR flights may increase.

KEYWORDS

Scope 3, higher education, student air travel, visiting friends and relatives, rebound

Introduction

Globally, the higher education (HE) sector can play a key role in facilitating the transition to a low-carbon economy. As organizations, higher education institutions (HEIs) can be considered analogous to small cities with significant environmental impacts [1], where in recent years many have started to embed sustainable practices into their systems [2]. While campus greening is often an area of focus [3], the potential contribution of HEIs is not limited to the operation of their estates, but extends to a wider sphere of influence through their role as educators, researchers and community leaders [101]. Although a number of tools have been developed for sustainability assessment across core HEI activities (operations, education, research, out-reach), sustainability management remains in its early stages with few HEIs producing sustainability reports [4, 5]. However, HEIs are increasingly reporting their car-bon footprint (the GHG emissions arising from their activities) as a measure of sustainability [6]. While taking action on climate change is only one aspect of the sustainable development agenda, it is widely recognized that the two are intrinsically linked [7]; thus, GHG emissions reporting can be viewed as an important first step for HEIs that enables the identification of sustainability initiatives and, ultimately, improved performance [8]. The focus of this research is on carbon management in the UK HE sector, examining the significance of student air travel in the context of GHG emissions reporting.

UK HE sector GHG emissions reporting

All UK HEIs are expected to contribute to the ambitious national targets to reduce emissions, although specific requirements vary across the funding councils and devolved governments (Table 1). Robust approaches for the measurement of GHG emissions are thus needed to identify the best options to reduce emissions, for target setting, and to assess the impact of mitigation measures [9].

The GHG Protocol provides some of the most widely used guidance in GHG accounting, where the Corporate Standard [102] introduces the concept of “scopes” to assist in defining operational boundaries. Scope 1 (direct) emissions arise from sources owned or con-trolled by an organization, Scope 2 (energy indirect) emissions arise from the generation of purchased energy and Scope 3 (other indirect) emissions are all other sup-ply-chain emissions that arise as a consequence of the activities of an organization. Under the Corporate Standard, the minimum reporting boundary includes all Scope 1 and 2 emissions, while under the supplemental Scope 3 Standard, the boundary should be extended to include all significant Scope 3 emissions [110]. Evaluating these Scope 3 emissions is recognized as a sizeable challenge due to issues relating to boundary setting, data

Table 1. Summary of the size of the UK higher education sector and GHG emissions in 2013/2014, and 2020 GHG reduction targets, for the four countries of the United Kingdom.

	HEIs		Total students		International students		Mandatorily Reported GHG Emissions ($ktCO_2e/yr$)				
Country	#	*(% UK)*	#	*(% UK)*	#	*(% UK)*	Scope 1	Scope 2	Scope 3	Total	*(% UK)*
United Kingdom	**159**		**2,299,355**		**435,500**		**862.0**	**1,505.3**	**25.2**	**2,392.6**	
GHG target:	The UK Climate Change Act (2008) sets a national 2020 target of a 34% reduction in GHG emissions against a 1990 baseline [10]. The higher education funding bodies are required by the UK and devolved governments to contribute to these reduction targets.										
England	**130**	*(82%)*	**1,875,020**	*(82%)*	**355,585**	*(82%)*	**661.9**	**1,232.7**	**20.7**	**1,915.3**	*(80%)*
GHG target:	The Higher Education Funding Council for England (HEFCE) has set a sector wide target for academic year 2020/21 of a 34% reduction in Scope 1 and 2 GHG emissions against a 1990/91 baseline, re-expressed as a 43% reduction against 2005/6 [103]. HEIs are required to individually set targets for Scope 1 and 2 emission reductions, but are not required to individually meet the sector target [103]. In 2013/14, reported HEI commitments for 2020/21 were equivalent to a 38% reduction below the 2005/6 baseline [104].										
Scotland	**17**	*(11%)*	**230,805**	*(10%)*	**48,360**	*(11%)*	**142.3**	**176.3**	**2.8**	**321.4**	*(13%)*
GHG targets:	The Climate Change Scotland Act (2009) sets a more stringent Scottish 2020 target of a 42% reduction in GHG emissions against a 1990 baseline [11]. The Act also places duties on public bodies to act in the way best calculated to contribute to the delivery of this target, where HEIs are identified as ‘major players’ and are required to develop carbon management plans to measure and reduce their impact. The Scottish Funding Council (SFC) Outcome Agreements, which set out what HEIs plan to deliver in return for their funding, include carbon reduction targets, however, the baseline year, target year, and level of ambition, vary by HEI [105].										
Wales	**8**	*(5%)*	**137,135**	*(6%)*	**25,605**	*(6%)*	**38.5**	**71.8**	**1.2**	**111.5**	*(5%)*
GHG targets:	The Welsh Assembly Government [106] Climate Change Strategy for Wales aims to reduce carbon emissions by 3% per annum from 2011 across all devolved areas based on a baseline of average carbon emissions between 2006-2010. The Higher Education Funding Council for Wales (HECFW) Carbon Management Policy requires HEIs to publish a carbon management strategy, including an identified target for Scope 1 and 2 emissions [107]. However, the level of ambition in terms of carbon reduction and choice of baseline year are considered matters for individual institutions to establish, although in setting targets HEIs should reflect upon national policy [107].										
Northern Ireland	**4**	*(3%)*	**56,395**	*(2%)*	**5,950**	*(1%)*	**19.4**	**24.5**	**0.5**	**44.4**	*(2%)*
GHG targets:	The Northern Ireland Executive’s [108] Programme for Government commits to working towards a reduction in GHG emissions of at least 35% by 2025 against a 1990 baseline. The Executive’s Greenhouse Gas Action Plan, which outlines how each department will contribute towards meeting the 2025 target, states that the HEIs have targets to reduce GHG emissions by at least 34% by 2020 [109].										

availability and calculation reliability [12, 13]. With specific reference to the HE sector, a number of studies have highlighted the importance of sector-level guidance to help address these issues (thus ensuring consistency and enabling comparability) by setting clearly defined boundaries and identifying appropriate calculation methodologies [8, 14, 15].

In terms of sector reporting, HEIs in England, Wales and Northern Ireland are required to make an environ-mental management record (EMR) return to the Higher Education Statistics Agency (HESA). Making an EMR return is optional for Scottish HEIs, although in practice the majority choose to do so. Within the EMR return, it is mandatory to report all Scope 1 and 2 emissions, along with Scope 3 emissions from water supply and wastewater treatment [111]. Introduced in the 2013/ 2014 reporting year, HEIs can also voluntarily submit data for Scope 3 emissions sources associated with waste, travel and procurement [111], where guidance has been produced to assist in the consistent calculation of these emissions [112, 114]. The Higher Education Funding Council for England (HEFCE) recommends reporting on all of these Scope 3 sources, and has signalled that mandatory reporting may be extended to include these sources in the future [115].

In the 2013/2014 EMR return [104], only 27 of 159 HEIs reported on all available Scope 3 sources, where the emissions reported by two HEIs appeared erroneous (Appendix 1, available as Supplemental material). For the remaining 25 institutions, the voluntarily reported emissions accounted for 71% of total reported emissions (51 to 88% on an institutional basis). This clearly illustrates the significance of Scope 3 sources, where narrowly set boundaries can significantly underestimate emissions and thus provide a misleading picture of an organization's carbon footprint [13, 16].

Extending the reporting boundary - the case for accounting for student air travel

While extending mandatory reporting across all current EMR Scope 3 categories would clearly represent an improvement in UK HE-sector reporting, there are other potentially significant emission sources that fall outside of this boundary. Specifically, student travel emissions are presently limited to commuting, defined as travel between the term-time address and the HEI [116]. Thus, emissions associated with student travel between home and term-time addresses, or to participate in study abroad programs, are not included. Although not part of the EMR return, HEFCE good practice guidance does include accounting for international and study abroad student air travel [117], likely the most significant component of these additional emissions. However, according to the People and Planet University League (PPUL), only nine HEIs have included these emissions in their carbon management plans [118].

Extending the reporting boundary to account for student air travel may prove challenging for (or be challenged by) HEIs for a number of reasons. First, given that there are minimal alternatives to air trans-port, these emissions will likely increase in line with the continued internationalization of the sector and the drive to increase inbound and outbound student numbers [8, 17]. Second, questions can be asked regarding responsibility for the associated emissions, where the guidance provided by the GHG Protocol is potentially open to interpretation regarding whether or not they are attributable to the HEIs.

According to the Scope 3 Standard [110], organizations should report downstream emissions resulting from the use of sold products, where the critical issue in setting boundaries is to consider the purpose that the service fulfills, and service delivery "encompasses all operations required to complete a service" [119], p. 40]. HEIs are explicitly providing education for over-seas students and study-abroad opportunities as service offerings, where students are required to travel in order to access these services. Thus, at a minimum, travel between the UK and the overseas country at the start and end of the study period should be included in an HEI's Scope 3 emissions. Whether or not any additional flights that students elect to make are attributable to the HEI is more questionable. It could be argued that these emissions form part of the service-use profile (and are therefore attributable), or that the students bear responsibility for any additional flights as non-essential travel. When offering a service of over-seas education that is delivered over an extended period, it is reasonable to expect that students would travel home during that period. As such, the position adopted here is that additional flights form part of the service-use profile.

Following similar reasoning, there are questions as to whether the reporting boundary should be extended further to include emissions arising from the flights of visiting friends and relatives (VFR). VFR trip generation has been identified as a key socio-economic benefit associated with the UK international student population, where, according to Bischoff and Koenig-Lewis [18], for 73% of VFR the sole motivation for travel was a wish to see the student concerned (with 27% holding joint motivations, combining a student visit with a holiday or event in the area). Thus, if action were taken to encourage fewer student flights, it is conceivable that the number of VFR flights might increase, decreasing or negating any expected reduction in economy-wide emissions (cf. rebound and back-fire effects [19]). Thus, although VFR travel may be considered a leakage or secondary market effect, and to fall outside of an HEI's "scopes" [102], it is suggested that the significance of VFR travel should be evaluated, and potentially acknowledged under "Other" emissions.

Accounting for student air travel - calculation reliability

Notwithstanding the arguments presented above, in order to have an informed debate regarding responsibility for student and VFR travel emissions, and the efficacy of potential mitigation measures, it is necessary to understand the significance of those emissions, where this requires robust accounting practices.

While HEFCE guidance includes a methodology for estimating emissions from student air travel [117], the robustness of the assumptions regarding trip distance and flight frequency are questionable. Following a standard approach, student flight emissions (FS) can be estimated as:

$$FS = [D \times (1+A)] \times CF \qquad (1)$$

where D is the return flight trip distance; (1 + A) is the number of return flights per year, where 1 represents the flight at the start and end of the study period and A is the number of additional flights; and CF is the appropriate conversion factor (short-haul or long-haul) as published by the UK Government [120].

In the HEFCE guidance, D is estimated as twice the great circle distance (GCD) between London Heathrow (LHR) and the capital city of the overseas country [117]. However, if the overseas country is unknown, the GCD is assumed to be 400 miles for short-haul flights and 4000 miles for long-haul flights [117]. With regard to flight frequency, A is assumed to be 1 for inbound (international) students from the European Union (EU), and 0 for other inbound and all outbound (study-abroad) students [117]. However, there is no prior research on which to base these assumptions [121] where there may or may not be differences in the travel behavior of different student groups, and average trip distances and flight frequencies may be substantially different, particularly if both student and VFR flights are considered.

This paper seeks to address these issues and to assess the significance of student air travel emissions. The paper first reports the results of a survey examining student and VFR travel behavior. This is followed by a sensitivity analysis of the HEFCE [117] methodology to assess the appropriateness of the recommended assumptions. Student and VFR flight emissions are then contextualized by examining their significance in comparison to GHG emissions for those HEIs who reported against all available categories in the 2013/14 EMR return. Next, the paper evaluates the magnitude of these emissions for the UK HE sector in 2013/14 and examines the potential future significance in 2020/21 under a range of scenarios. Finally, recommendations are presented regarding reporting of student air travel emissions and areas for future research are identified.

Student travel behavior

The survey instrument was an online, self-administered questionnaire targeting international (inbound) and study-abroad (outbound) students registered at UK HEIs. In addition to demographic questions, respondents were asked to identify their overseas airport, their flight frequency and the flight frequency of VFR. A copy of the questionnaire is provided in Appendix 2, available as Supplemental material.

In total, 673 useable responses were received from students registered at 26 UK HEIs between December 2014 and February 2015. Table 2 presents a breakdown of respondents by study group and region in which the UK HEI of enrollment is located. An analysis of student and VFR flight frequency is provided below, and both the overseas airport and flight frequency are utilized in the sensitivity analysis.

Table 2. Survey respondents by region of institution with a comparison to the 2013/2014 UK international student population [124].

	Inbound[a]			Outbound[b,c]	
Region	*n*	% Respondents	% All inbound students	*n*	% Respondents
North East	39	8%	5%	6	3%
North West	62	12%	8%	5	3%
Yorkshire & The Humber	53	11%	8%	25	14%
East Midlands	14	3%	6%	2	1%
West Midlands	4	1%	8%	0	0%
East of England	75	15%	7%	70	40%
London	59	12%	23%	16	9%
South East	9	2%	11%	3	2%
South West	124	25%	6%	42	24%
Scotland	24	5%	11%	2	1%
Wales	2	0%	6%	0	0%
Northern Ireland	0	0%	1%	0	0%
Did not specify	33	7%	—	4	2%
TOTAL	498			175	

[a]Inbound students refers to all overseas students studying in the UK for a minimum of one year.
[b]Outbound students refers to all UK registered students on study abroad schemes.
[c]Institutional level data on study abroad numbers was not available, thus there is no comparison to the UK sector data.

Student flight frequency

Inbound students

Table 3 presents the average number of additional flights made by inbound students by region of domicile and level of study. A Kruskal-Wallis test revealed some significant differences between world regions for all students (n = 498, H = 138.954, p < 0.001), for undergraduates (n = 142, H = 26.011, p < 0.001) and for postgraduates (n = 324, H = 95.464, p < 0.001). Follow-up pairwise comparisons indicated significant differences between European regions (EU-28 and Other Europe) and North America, Asia and the Middle East, Africa, South America, and Oceania. Conversely, the European regions were not statistically different from each other, nor were there any significant differences between the other world regions. It is therefore suggested that average flight frequency can be well described using domicile groups of "Europe" and "rest of the world" (RoW).

For RoW nationals, there were no significant differences in the average number of flights according to the level of study. However, for European nationals, postgraduates made more flights than undergraduates (n = 179, U = 3814.000, p = 0.006), where this most likely reflects the difference in typical academic year length (postgraduates: 12 months; undergraduates: 9 months), with both groups displaying a similar flight frequency of ~0.2 flights per month. As the proportion of undergraduate and postgraduate students in the survey sample differed from that in the UK student population, a weighted average of flight frequency was calculated, where European students made 2.1 additional flights per year, and RoW students made 1.0 additional flight per year (Table 3).

Table 3. Average number of additional return flights made by inbound students during the academic year by region of domicile and level of study.

Region of Domicile	All Students[a]		Undergraduates		Postgraduates		All Students Weighted Average[d]		
	n	Ave. ± Std. Dev.	*n*	Ave. ± Std. Dev.	*n*	Ave. ± Std. Dev.	%UG	%PG	W.Ave.
All Europe	***193***	**2.4 ± 1.4**	***45***	**1.8 ± 1.2**	***134***	**2.5 ± 1.5**	***62%***	***38%***	**2.1**
EU-28[b]	*181*	2.3 ± 1.4	*43*	1.8 ± 1.2	*125*	2.5 ± 1.5			
Other Europe[c]	*12*	2.9 ± 1.2	*2*	2.0 ± 0.0	*9*	3.2 ± 1.3			
Rest of the World	***305***	**1.0 ± 1.1**	***97***	**0.9 ± 1.0**	***190***	**1.0 ± 1.1**	***49%***	***51%***	**1.0**
Central America	*5*	2.0 ± 1.0	*0*	–	*5*	2.0 ± 1.0			
North America	*51*	1.4 ± 1.1†,‡	*10*	1.5 ± 1.4	*39*	1.3 ± 1.1†,‡			
Asia and the Middle East	*206*	0.9 ± 1.1†,‡	*81*	0.9 ± 1.0†	*113*	1.0 ± 1.1†,‡			
Africa	*23*	0.9 ± 1.1†,‡	*3*	1.3 ± 1.2	*18*	0.8 ± 1.2†,‡			
South America	*14*	0.6 ± 0.6†,‡	*3*	0.3 ± 0.6	*11*	0.7 ± 0.6†,‡			
Oceania	*6*	0.2 ± 0.4†,‡	*0*	–	*4*	0.3 ± 0.5†,‡			

[a]The sum of undergraduate and postgaduate students does not equal the total as some respondents did not specify degree level.
[b]EU-28 refers to the 28 member states of the European Union and includes the Canary Islands, the Åland Islands and Gibraltar. Although officially part of the EU, the Overseas Departments of the French Republic have been classed here on a geographic rather than politicial basis and are included in the RoW category.
[c]In line with HESA definitions, 'Other Europe' includes the European Economic Area countries of Iceland, Liechenstein and Norway in addition to Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Cyprus (Non-European-Union), Faroe Islands, Georgia, Kosovo, Macedonia, Moldova, Monaco, Montenegro, Russia, San Marino, Serbia, Svalbard and Jan Mayen, Switzerland, Turkey, Ukraine, and Vatican Ciy.
[d]Here the number of additional flights was calculated as a weighted average of the number of additional flights made by postgraduates and undergraduates based on the overall proportion of inbound students for the sector [123]; †indicates a significant difference to EU-28. ‡ indicates a significant difference to Other Europe ($p < 0.03$). No other significant differences were observed.
NOTE. UG: Undergraduates; PG: Postgraduates; EU: European Union.

Outbound students

Table 4 presents the average number of additional flights made by outbound students by period of study and region of destination (no significant differences according to level of study; data not shown). For those studying abroad for one year, a Kruskal-Wallis test revealed some significant differences between world regions (n = 107, H = 28.791, p < 0.001). Follow-up pairwise comparisons indicated significant differences between EU-28 and Oceania (p < 0.001) and North America (p = 0.007). No significant differences between world regions were found for students studying abroad for less than a year. However, nothing was found to contradict the European and RoW groupings identified for inbound students, and when these were applied, significant differences were found (one year: n = 107, U = 2191.000, p < 0.001; less than a year: n = 68, U = 582.000, p = 0.011). Thus, using these destination groupings, on average students studying abroad for one year made 2.4 additional flights if studying in Europe and 0.9 additional flights if studying in the RoW, while students studying abroad for less than one year made 1.1 additional flights if studying in Europe and 0.4 additional flights if studying in the RoW.

Table 4. Average number of additional return flights per year or within the study period for outbound students by region of destination and duration of study period.

	1 year		<1 year	
Region of Domicile	*n*	Ave. ± Std. Dev.	*n*	Ave. ± Std. Dev.
All Students	**107**	**1.6 ± 1.6**	**68**	**0.6 ± 1.2**
All Europe	**50**	**2.4 ± 1.7**	**18**	**1.1 ± 1.4**
EU-28	49	2.4 ± 1.6	16	1.2 ± 1.5
Other Europe	1	5.0	2	0.0 ± 0.0
Rest of the World	**57**	**0.9 ± 1.3**	**50**	**0.4 ± 1.1**
Central America	0	–	2	0.5 ± 0.7
North America	26	0.9 ± 1.2†	9	0.9 ± 1.8
Asia and the Middle East	8	0.8 ± 0.7	12	0.0 ± 0.0
Africa	5	1.6 ± 1.5	8	0.1 ± 0.4
South America	3	1.3 ± 2.3	4	0.0 ± 0.0
Oceania	15	0.5 ± 1.3†	15	0.7 ± 1.5

†indicates a significant difference to EU-28 (p < 0.007).

VFR flight frequency

This section considers the total number of flights made by VFR, as all VFR flights can be considered additional to the return flight made by the student at the start and end of the study period.

Table 5 presents descriptive statistics for the number of VFR flights by study group and the domicile/destination groupings identified above (no significant differences according to level of study; data not shown). For inbound students, 77% of Europeans and 56% of RoW nationals received at least one visitor, with averages of 2.9 and 1.4, respectively (n = 498, U = 38,920.500, p < 0.001), where these results are comparable to previously reported values [16]. For outbound students studying abroad for one year, 78% of those studying in Europe and 65% of those studying in the RoW received at least one visitor with averages of 4.0 and 2.2, respectively (n = 107, U = 1859.000, p = 0.006). For those studying abroad for less than a year, the number of visitors is considerably lower, where only 43% of students received at least one visitor with an average of 1.0 (with no significant difference between students visiting Europe and the RoW).

Table 5. Descriptive statistics for the number of return flights made by visiting friends and relatives during the academic year.

Student Group	n	# of VFR flights (%) 0	1	2	3	4	5+	Ave. ± Std. Dev.
Inbound								
All Europe	193	22.8	15.0	18.7	13.0	7.3	23.3[a]	2.9 ± 2.9
Rest of the World	305	43.9	18.0	17.4	6.2	8.9	5.6[a]	1.4 ± 1.9
Outbound (1 year)								
All Europe	50	22.0	4.0	10.0	10.0	20.0	34.0[a]	4.0 ± 3.4
Rest of the World	57	35.1	7.0	21.1	12.3	5.3	19.3[b]	2.2 ± 2.2
Outbound (<1 year)								
All Regions	68	57.4	16.2	11.8	7.4	4.4	2.9	1.0 ± 1.4

[a]maximum = 11.
[b]maximum = 7.
[c]maximum = 6.

Sensitivity analysis of the HEFCE assumptions

This section presents a sensitivity analysis of the HEFCE [117] methodology for estimating GHG emissions from student air travel, where the appropriateness of the recommended assumptions relating to trip distance and flight frequency was tested against the results of the student survey. For completeness, assumptions incorporated in the conversion factors were also tested. In each test, the parameter in question was changed while keeping all other parameters fixed. The test parameters and results of the sensitivity analysis are presented in Table 6 and discussed below, where differences in estimated GHG emissions are expressed relative to the standard HEFCE estimate for the student survey sample of 1222 tCO2e.

Trip distance

All UK HEIs hold data on the country of domicile or destination of their students; thus, for the standard HEFCE estimate a GCD between LHR and the over-seas capital city was adopted [117]. However, the GCDs recommended by HEFCE [117] in cases where the overseas country is not known were also tested (UK-Europe D 400 miles; UK–RoW = 4000 miles; Table 6, simple HEFCE estimate). It can be seen that these simplifying assumptions result in a significantly lower estimate of emissions and are thus not only unnecessary but also inappropriate. In comparison, the average GCDs for the study sample were 725 miles for UK-Europe flights and 5285 miles for UK-RoW flights.

The sensitivity analysis tested the impact of using the GCD between LHR and the actual overseas airport identified by each student in the survey. While a significant proportion (46% of inbound and 65% of out-bound) of students did not fly to or from the capital city in their country of domicile or destination, the sensitivity of estimated emissions to this parameter was low, with a revised estimate only 2% higher than the standard HEFCE estimate at 1247 tCO2e.

Table 6 . Sensitivity analysis of assumptions within the Higher Education Funding Council for England methodology for estimating student flight emissions [118].

		Standard HEFCE estimate	Simple HEFCE estimate	Sensitivity Tests						
					Flight Frequency		Conversion Factor Assumptions			
								Impact of emissions at altitude		
				Trip Distance	Actual no. of flights	Average no. of flights	Uplift factor	Low	Central	High
Calculation Parameters										
Trip Distance:	Great circle distance (one-way)	LHR-overseas capital city	SH = 400 miles LH = 4000 miles	LHR-actual						
	Uplift factor multiplier	All regions = 1.08					SH = 1.14 LH = 1.06			
Flight frequency:	Inbound	EU-28 = 2 non-EU = 1				Europe = 3.1 RoW = 2.0				
	Outbound (1 year)	EU-28 = 1 non-EU = 1			Actual # of flights	Europe = 3.4 RoW = 1.9				
	Outbound (<1 year)	EU-28 = 1 non-EU = 1				Europe = 2.2 RoW = 1.4				
Effects of emissions at altitude multiplier		1.90						1.30	1.95	2.60
Estimated GHG Emissions (tCO_2e)										
Inbound		883	668	899	1,678	1,703	878	604	906	1,208
Outbound (1 year)		178	121	184	337	360	176	122	183	244
Outbound (<1year)		161	101	164	234	229	159	110	165	221
Total		1,222	889	1,247	2,249	2,292	1,213	836	1,254	1,673
% change from standard HEFCE estimate		–	-27%	2%	84%	87%	-1%	-32%	3%	37%

NOTE: All UK-Europe flights are short-haul (SH), while all UK-RoW flights are long-haul (LH). EU: European Union; LHR: London Heathrow.

Flight frequency

The standard HEFCE estimate applied the recommended assumptions that inbound EU students make two return trips during the academic year (one additional flight), while all other students make one return trip (no additional flights).

The sensitivity analysis tested the impact of using the actual number of additional flights reported in the survey by each student, where this resulted in estimated emissions of 2249 tCO2e, 84% higher than the standard HEFCE estimate. Using the average number of additional flights (as reported above) by study group and domicile/destination group was also tested. This gave excellent agreement (within 2%) to the estimate based on the actual number of flights, thus lending confidence to the use of these revised average flight frequencies in calculating emissions.

Conversion factor assumptions

The standard HEFCE estimate applied the recommended DEFRA/DECC (Department for Environment, Food and Rural Affairs/Department of Energy and Climate Change) [120] conversion factors which incorporate a distance uplift of 8% to compensate for lateral inefficiencies in flight tracks (deviations away from the GCD due to stacking, flying around military air space, etc.) and a “best-estimate” multiplier of 1.9 to account for the additional impacts of aviation emissions.

A recent analysis suggests that lateral inefficiencies as a percentage of GCD may differ substantially depending on flight route, with average values of 14% for flights within Europe, 7% for flights departing Asia and arriving in Europe, and 5% for North Atlantic flights [20]. Thus in the sensitivity analysis uplift factors of 14% for UK–Europe flights and 6% for UK–RoW flights were applied. Estimated emissions were 1213 tCO_2e, only 1% less than the standard HEFCE estimate.

As noted in DEFRA/DECC [120], there is significant uncertainty regarding the magnitude of the additional impacts of aviation emissions. The current recommended multiplier of 1.9 is based on the radiative forcing (RF) index (the ratio of total RF to the RF from CO_2 alone) for all aviation emissions to the year 2000, and does not include aviation-induced cloudiness (AIC) [21, 123]. Notwithstanding that this estimate excludes AIC and is now somewhat dated, the RF index represents a backward-looking perspective that considers the present-day impact of historical aviation emissions. As such, this conflicts with the forward-looking perspective typically adopted in GHG emissions accounting (and all UK conversion factors), which considers the present and future global warming potential of emissions over a 100-year time horizon (GWP100). Recent estimates of an alternative multiplier including AIC and based on the GWP100 metric are in broad agreement, with Lee et al. [22] reporting a range of 1.9 to 2.0, and Azar and Johansson [23] reporting a range of 1.3 to 2.6. In the sensitivity analysis the full range of these reported values were adopted, with a central estimate of 1.95. Thus, while accounting for the uncertainty in the additional impacts of aviation emissions at altitude results in estimated emissions ranging from 32% less to 37% more than the standard HEFCE estimate, the central estimate results in only a small increase of 3%.

Recommended assumptions

The sensitivity of estimated emissions to the choice of overseas airport is low (2%); thus, given the additional complexity introduced by accounting for differences in flight route, the HEFCE assumption of a flight route between LHR and the capital city of the overseas country is reasonable. Similarly, the sensitivity of estimated emissions to assumptions regarding uplift factor (1%) and the additional impacts of aviation emissions at altitude (central estimate 3%) is also low; thus, the use of the standard UK government conversion factors is recommended, in order to align with the national reporting framework. However, the HEFCE assumptions regarding flight frequency are not appropriate, where utilizing the actual number of flights increases the estimated emissions by 84%. It is therefore recommended that HEIs should base emissions estimates on actual flight frequency as determined by a student travel sur-vey, or employ the revised estimates of average flight frequency reported here.

The significance of inbound student air travel emissions

This section contextualizes student flight emissions by examining their significance in comparison to the emissions for 25 UK HEIs who reported on all available categories in the 2013/2014 EMR return [116]. This analysis was limited to inbound students, as outbound student data by country of destination was not avail-able at an institutional level.

The reporting HEIs spanned the continuum from research-intensive to teaching-led universities, one of the key determinants of HEI emissions [6, 15]. Collectively, these HEIs accounted for 27% of mandatorily reported emissions, and had a moderately higher mandatory emissions intensity (1.2 tCO_2e/student) and slightly higher proportion of international students (21%) than the sector as a whole (1.04 tCO_2e/student and 19%). With respect to carbon management and reduction, the range in scores awarded to these HEIs by the PPUL [118] was comparable to the UK average (see

Appendix 1). Thus, while no claim is made that this sample is statistically representative, it provides a reasonable picture of the UK HE sector.

For each institution, emissions from student flights were calculated from inbound student data by country of domicile [124] and the average flight frequencies (by domicile group) presented in Table 2. Results are presented in Figure 1 and Appendix 1.

Overall, estimated inbound student flight emissions were equivalent to 65% of mandatorily, 27% of voluntarily and 19% of total reported emissions. If VFR flights were included, these increased to 113, 47 and 33%, respectively. This analysis clearly demonstrates the significance of student air travel in comparison to all emissions categories reported in the EMR, where student flights and VFR flights were the third and fourth most significant sources of emissions, after other procurement and Scope 2 emissions (Figure 1). Furthermore, emissions within all current EMR reporting categories could realistically be expected to decrease over time given both the potential to reduce emissions and sec-tor reduction targets. Conversely, international and study-abroad student numbers are expected to increase [125], and there are extremely limited options to decrease the associated travel emissions through increased efficiency of aviation or substitution of flying with alternative modes of travel [8]. As such, it is important to evaluate the current and potential future emissions associated with student and VFR air travel for the HE sector as a whole in order to inform debate and identify appropriate approaches to emissions reductions.

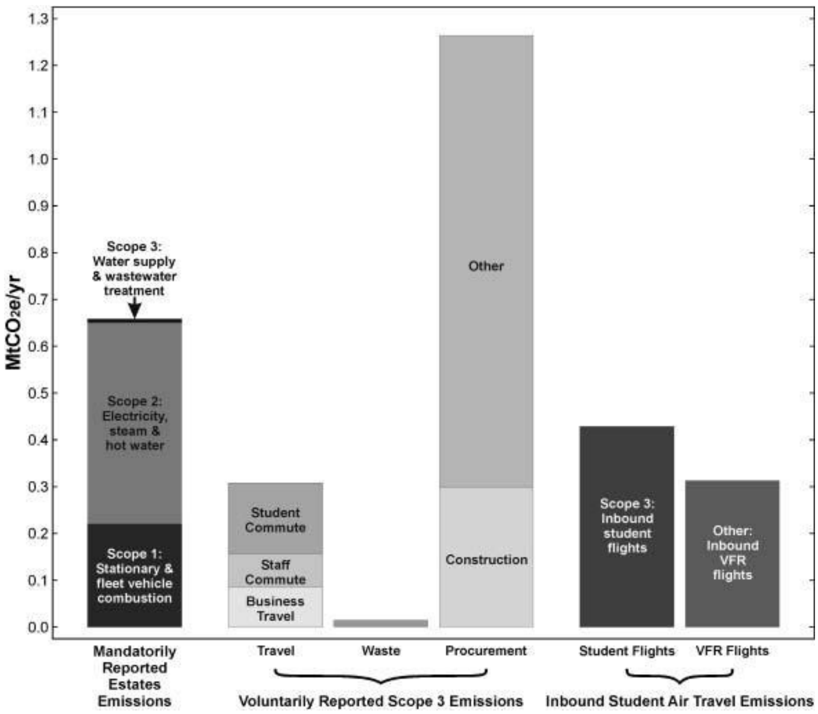

Figure 1. Inbound student air travel emissions in comparison to emissions reported in the 2013/2014 EMR return for 25 UK higher education institutions. VFR: Visiting friends and relatives.

The potential significance of student air travel for UK HE sector GHG emissions to 2020/2021

This section considers the current and potential future emissions from student and VFR flights in comparison to mandatorily reported emissions [116] for the UK HE sector. Emissions for 2013/14 were estimated based on inbound and outbound student data by country of domicile or destination [124] and the average flight frequencies presented above. Future emissions in 2020/ 21 were then estimated based on three forecasts for growth in student air travel and three storylines for GHG reduction.

For forecasts of student air travel, low (0.7%), medium (3.7%) and high (6.7%) annual growth rates were used, based on projected growth in international student enrolments [125] and assuming a similar growth in study-abroad student numbers. As a first-order estimate, it was assumed there was no change in student demographics or student and VFR travel behaviors.

For forecasts of GHG reduction, the no-reduction storyline holds HEI estate emissions and aviation fuel efficiency at 2013/2014 levels. In the aspirational storyline, HEIs achieve Scope 1 and 2 targets (institutional targets against the 2005/2006 baseline where reported in HESA [116], otherwise a 3% annual reduction assumed in line with national tar-gets) and emissions from water supply and waste-water treatment decrease by 3% per year (in line with national targets). In the realistic storyline, HEI estate reductions are equivalent to 50% of the tar-gets, in line with a recent report assessing current progress [126]. For aviation fuel efficiency, the realis-tic and aspirational storylines reflect the industry target and aspirational goal, respectively (1.5 and 2.0% improvement per year [127]).

Figure 2 presents average student flight emissions in 2013/2014 on a per-student basis. Figure 3 illustrates the change in sector emissions from 2013/2014 to the 2020/2021 central scenario (realistic GHG reduction and medium growth in student air travel), and emissions in all future scenarios are shown in Figure 4.

Inbound students and their VFRs account for 95% of estimated total air travel emissions (Figure 3), reflecting the much higher number of students in this group. However, if emissions are considered on a per-student basis (Figure 2), then the highest impact is associated with outbound students studying abroad for one year in RoW destinations. While the emissions from student flights for this group are broadly comparable to those associated with inbound students from the RoW, the VFR emissions are much greater. This difference is mainly driven by a higher average flight frequency (as opposed to differences in average trip distance), which may reflect the relative wealth of outbound VFRs when compared to inbound VFRs.

Considering absolute emissions (Figure 3), in 2013/ 2014, student flight emissions slightly exceeded Scope 2 emissions and were equivalent to 68% of all estate emissions. If VFR flights are included, then total student air travel emissions exceeded estate emissions by 0.45 MtCO2e, or ~19%. From 2013/2014 to the 2020/2021 central scenario, estate emissions decreased by 0.32 to 2.08 MtCO2e, while student flight emissions increased by 0.26 to 1.89 MtCO2e (equivalent to 91% of estate emissions). Thus, in this scenario, estate emissions reductions compensate for the growth in student flights. However, if estate emissions reductions are used to offset the growth in flights, then the net estate emissions reduction is only 0.05 MtCO2e (equivalent to a 2.5% reduction below the 2005/2006 Scope 1 and 2 baseline). Furthermore, if emissions from VFR flights are included, then overall emissions increase by 0.14 MtCO2e.

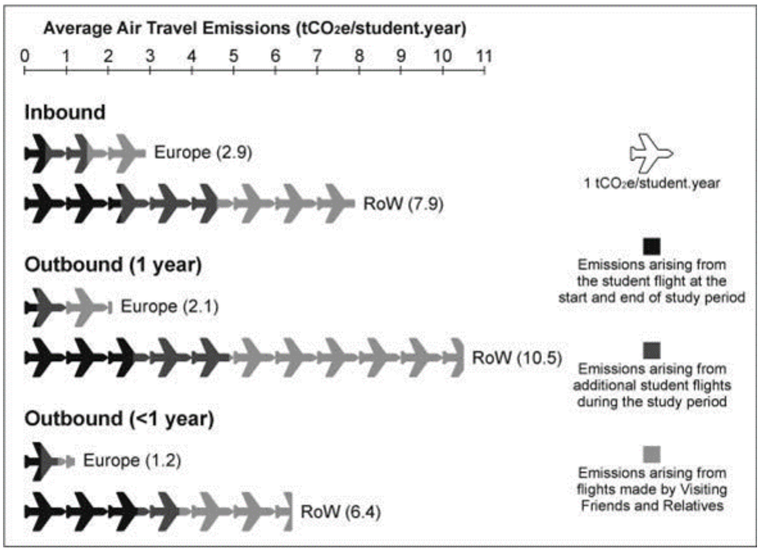

Figure 2. Average air travel emissions for inbound and outbound students. RoW: Rest of the world.

In all 2020/2021 scenarios, the relative significance of student flight emissions increases over time, ranging from 72% (no reduction-low growth) to 136% (aspirational-high growth) of estate emissions (Figure 4). Reductions in estate emissions compensate for the growth in emissions from student flights in all of the aspirational scenarios and the realistic low- and medium-growth scenarios. For the remaining scenarios, the growth in student flight emissions outstrips the estate reductions, where in the realistic high-growth scenario, emissions from student flights could reach ~2.31 MtCO2e by 2020/2021 (equivalent to 111% of estate emissions). If VFR flights are included, then reductions in estate emissions only compensate for the growth in student numbers in the aspirational low- and medium- and realistic low-growth scenarios, with a net increase in all other cases.

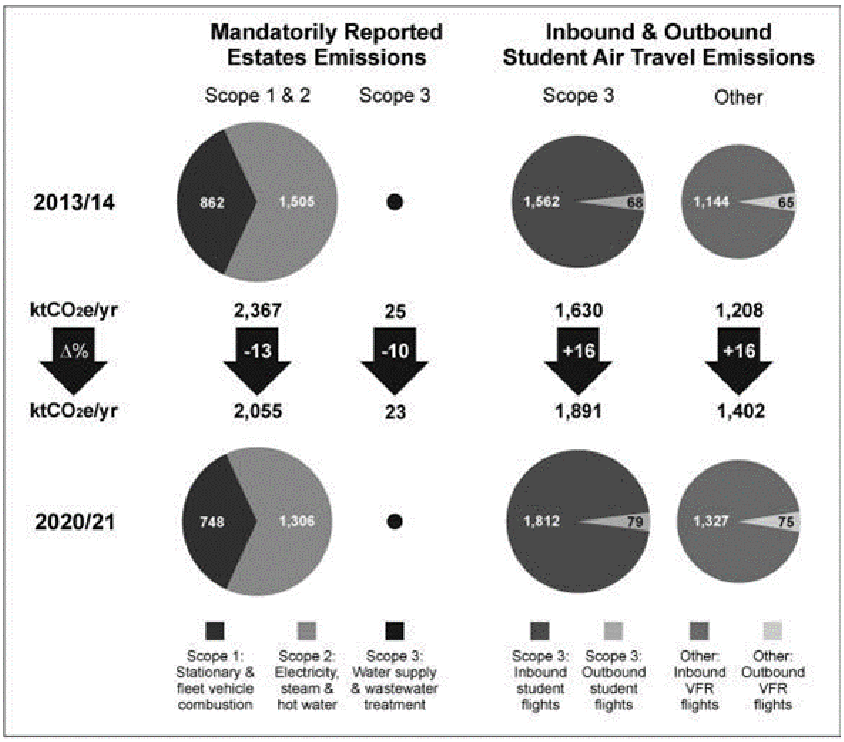

Figure 3. Change in higher education estate emissions and student air travel emissions from 2013/2014 to 2020/2021 based on realistic reductions in GHG emissions and medium growth in inbound and outbound student numbers (central scenario). VFR: Visiting friends and relatives.

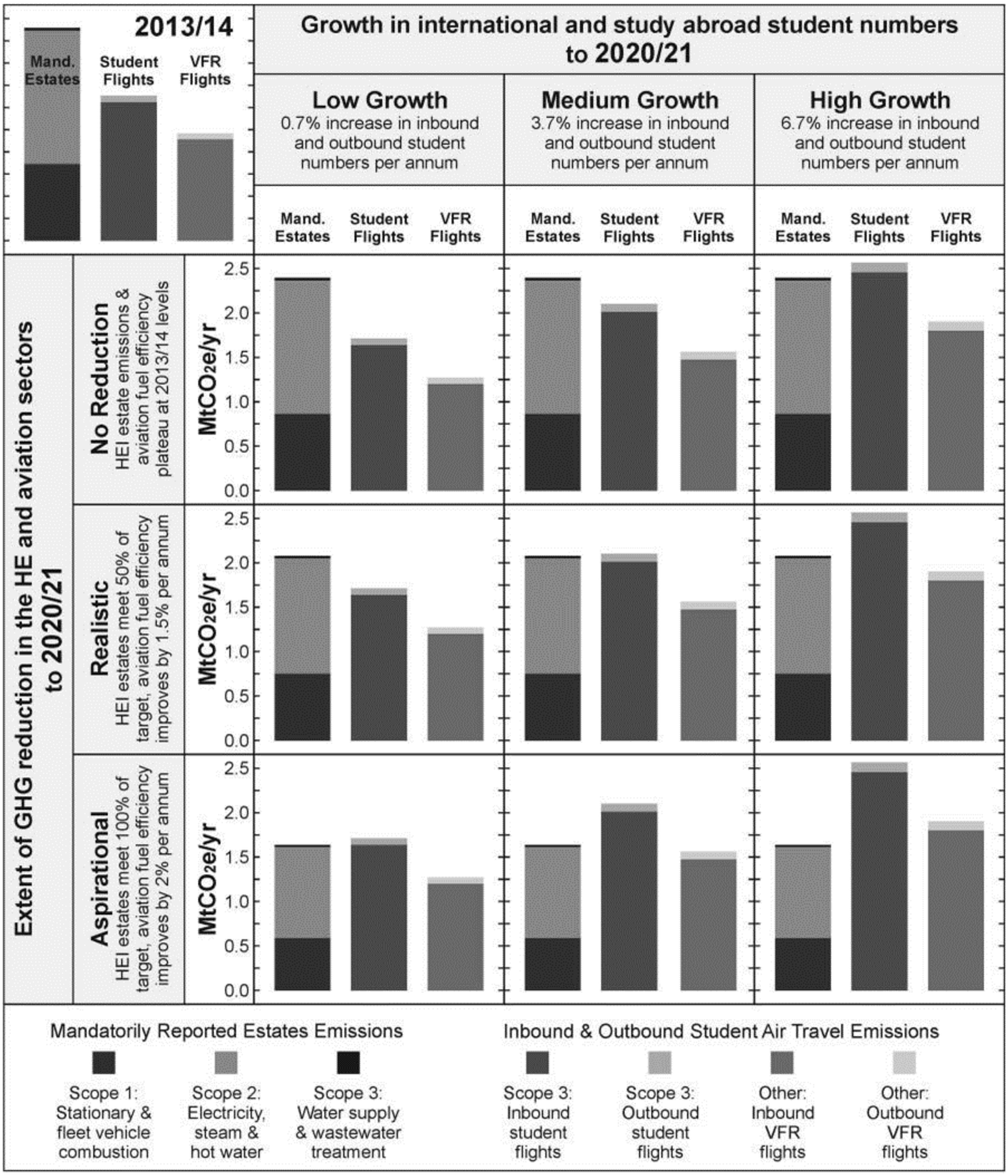

Figure 4. Nine scenarios illustrating the potential change in higher education-sector emissions from 2013/2014 to 2020/2021 based on the extent of GHG reduction in the higher education and aviation sectors and growth in inbound and outbound student numbers. HE: Higher education; HEI: Higher education institutions; VFR: Visiting friends and relatives.

Conclusions and recommendations

This research has clearly demonstrated the current and potential future significance of GHG emissions arising from the air travel of international and study abroad students and their associated VFRs when compared to other components of the carbon footprint for UK HEIs. Indeed, scenario analysis suggests that by 2020/2021, increases in student and VFR flight emissions are likely to exceed the reductions achieved in estate emissions unless HEIs reinvigorate efforts to achieve their ambitious reduction targets, and/or there is close to zero annual growth in inbound and outbound student numbers.

It is acknowledged that HEI responsibility for these emissions can be questioned. However, the flight made by the student at the start and end of the study period is clearly induced by HEI service offerings, and should therefore be included within Scope 3 emissions. With respect to additional flights, it is argued that when offering overseas education over an extended period, it is reasonable to expect that students may travel home during that period, and therefore additional flights should be evaluated. Furthermore, it is highlighted that if HEIs took action to encourage fewer student flights, it is conceivable that a behavioral rebound-type effect might occur, where the number of VFR flights increased to maintain a similar degree of student-VFR contact. Indeed, a backfire effect, where the increase in VFR emissions exceeds the decrease in student flight emissions, would be plausible.

Given the significance of student and VFR flights and the potential for rebound and backfire effects, "it is considered imperative that UK HEIs develop an accurate picture of these emissions in order to identify effective reduction options (that deliver a net reduction in global emissions) and inform both their carbon management and internationalization strategies. It is therefore recommended that funding bodies and devolved governments should encourage HEIs to estimate and report these emissions based on a survey of student travel behavior or the estimates of average flight frequencies presented in this study.

It is acknowledged that this study adopted a particular perspective on accounting for student air travel emissions, arguing that all student flights are induced by HEI service offerings and should therefore be accounted for by HEIs. Further work examining alternative approaches to determining attributable emissions would make a valuable contribution to the responsibility debate, and would help define the extent to which the HE sector should (or could) mitigate or compensate for these emissions. In particular, evaluating incremental emissions (based on a comparison of flight frequency, including leisure trips, between those who do and do not study overseas), and examining perceived responsibility and potential approaches to allocating emissions among the various beneficiaries (students, UK and over-seas partner HEIs, airports, airlines) may prove helpful.

Perhaps most importantly, there is a need to identify and examine alternative internationalization strategies that have the potential to offer a reduced carbon footprint while providing equivalent access to and quality of tertiary education and opportunities to experience other cultures. In theory, the provision of transnational education through branch campuses and collaborative delivery mechanisms may offer such an alternative. However, whether these initiatives result in a net decrease in travel emissions is questionable and requires evaluating, where they may even result in a net increase (cf. [24]).

Even if all reasonable options for reducing the carbon consequences of the internationalization agenda were considered and implemented, it seems virtually certain that substantial student and VFR flight emissions would remain. Thus, if HEIs are to deliver a significant reduction in total emissions, offsetting will likely prove necessary. Thus, further work should also be undertaken to examine the acceptability of offsetting emissions from the perspective of both the HEI and the students.

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Appendix 1. GHG Emissions Associated with Inbound Student and VFR Flights in Comparison to Mandatorily and Voluntarily reported GHG Emissions in the EMR Return

Note 1. While 27 institutions reported against all EMR reporting categories, the voluntarily reported emissions appeared anomalously high for 1 institution (27.6 tCO2e/student.yr), and anomalously low (0.3 tCO2e/student.yr) for another, when compared to the remaining 25 institutions (range 1.2-6.4 tCO2e/student.yr, average 2.7±1.3 tCO2e/student.yr, weighted average 2.9 tCO2e/student.yr) and were therefore excluded from the analysis. For the University of the Arts, London, there are indications that both staff commuting and student commuting have been erroneously entered in kgCO2e (as opposed to the reporting unit of tCO2e), being 3 orders of magnitude greater (on a per student basis) than the average at other institutions. At the UAL, student commuting is dominated by public transport via rail (328,527 tCO2e), bus (17,536 tCO2e) and underground (5,895 tCO2e). The reported emissions via these travel modes (assuming all buses are London local buses) are equivalent to 422,681 km travelled per student per year. If it is assumed that all students travel to university 5 days a week for 2 x 10 week terms, this would be equivalent to a daily journey of 4,227 km – or ca. 3 times the distance from Land's End to John O'Groats (a journey which traverses the whole length of the island of Great Britain from the extreme southwest to northeast). Rose Bruford College is one of the smallest UK HEIs, being a specialist drama school with 770 registered students in 2013/14. While the mandatorily reported emissions fall within the range reported by other institutions (on a per student basis), the voluntarily reported emissions are an order of magnitude lower. In particular, procurement emissions appear anomalously low, being ~48 times lower than the weighted average across the 25 institutions included in the analysis (between 1 to 2 orders of magnitude). While these reported emissions may reflect the small size and specialist nature of the institution, they do not appear to be representative of the UK HE sector as a whole, and are excluded from the analysis presented in the paper.

Note 2. Procurement emissions reported in the table below are based on the 'Scope 3 carbon emissions from supply chain' reported in the EMR Return (HESA, 2014b), which are estimated from HEI procurement data (HEFCE, 2012b). Scope 3 carbon emissions from supply chain waste and water have been excluded to avoid double counting with the separately reported water supply and waste water treatment and waste categories (HEFCE, 2012b). Construction procurement is shown separately as this is the single largest component of procurement emissions. Included in 'Other' procurement are Scope 3 supply chain emissions associated with procurement of business services, paper products, other manufactured products, manufactured fuels, chemicals, and gases, food and catering, information and communication technologies, medical and precision instruments, and other and unclassified procurement (HESA, 2014b).

Note 3. There is a significant variation in waste emissions reported by these institutions, which vary over 4-5 orders of magnitude on an absolute and per student basis. It is believed that a significant proportion of this variation is due to differences in data quality and the completeness of the estimate. However, no clear relationship was found between reported emissions and the calculation methodology employed (HEIs can elect one of three calculation methodologies of increasing complexity). Thus, the data has been included in the analysis presented in the paper, where we note that actual waste emissions may be substantially different to the total reported here.

UK Higher Education Institution	Mission Group / Association[a]	Student Population[b] Total #	Student Population[b] International #	International (%)	People & Planet University League Scores[c] C Man-agement	C Red-uction	Total	GHG Emissions Reported in the 2013/14 EMR Return (tCO_2e/yr): Mandatorily Reported Estates Emissions Scope 1	Scope 2	Scope 3	Total Mand.	Voluntarily Reported Scope 3 Emissions: Travel Business travel	Staff commute	Student commute	Waste	Procurement Construc-tion	Other	Total Volun.	Total Reported Emissions	Inbound Student Air Travel Emissions (tCO_2e/yr)[e] Scope 3 Student	Other VFR	Total Inbound
University of Bedfordshire	Million+	17,835	4,470	(25%)	65	10	67.1	1,878	5,515	63	7,456	689	71	1,579	22	8,601	19,675	30,637	38,093	16,464	11,785	28,249
The University of Birmingham	Russell Group	32,335	7,717	(24%)	10	35	35.1	28,702	18,823	529	48,053	4,588	5,698	7,514	330	18,476	33,834	70,441	118,494	31,428	22,589	54,016
The University of Bradford	University Alliance	12,505	2,062	(16%)	65	90	64.9	5,179	2,685	48	7,911	1,308	1,294	2,138	9	4,231	17,498	26,477	34,388	6,962	5,224	12,186
The University of Brighton		20,700	2,938	(14%)	85	0	65.0	4,152	7,263	116	11,531	4,859	1,411	5,861	19	10,391	17,448	39,988	51,519	8,956	6,848	15,804
Brunel University London		14,330	4,423	(31%)	60	35	44.0	6,683	12,007	445	19,136	228	3,218	1,257	28	3,112	22,161	30,004	49,140	16,693	12,117	28,810
De Montfort University	University Alliance	19,645	2,504	(13%)	60	38	67.7	2,511	7,146	77	9,734	2,138	2,001	7,140	887	1,487	13,751	27,403	37,137	9,358	6,911	16,268
The University of Greenwich	Million+	21,950	4,375	(20%)	60	60	66.5	2,814	5,921	70	8,804	2,946	661	1,232	21	13,892	46,635	65,387	74,191	15,279	11,184	26,463
University of Hertfordshire	University Alliance	25,295	4,343	(17%)	35	13	47.6	10,771	11,152	276	22,199	1,822	6,850	46,903	3,566	3,362	18,329	80,832	103,031	16,694	12,023	28,717
Kingston University	University Alliance	23,055	4,364	(19%)	0	20	34.2	4,044	9,520	203	13,768	2,883	3,190	3,726	528	5,803	67,294	83,424	97,192	13,036	9,921	22,956
The University of Leeds	Russell Group	30,975	5,855	(19%)	45	75	60.3	5,409	48,990	733	55,132	8,152	4,106	2,288	282	16,452	54,715	85,995	141,127	23,319	16,764	40,083
The University of Lincoln	University Alliance	13,400	1,634	(12%)	35	25	34.6	2,578	5,647	102	8,327	590	1,560	3,262	68	6,914	28,095	40,489	48,816	6,636	4,752	11,387
Liverpool Hope University	Cathedrals Group	6,240	271	(4%)	50	45	30.0	1,959	2,808	81	4,848	295	473	1,844	592	1,544	5,408	10,156	15,004	744	541	1,285
Loughborough University		15,965	3,213	(20%)	50	25	42.3	15,881	7,912	372	24,164	4,137	2,140	611	62	12,239	34,797	53,986	78,151	12,398	8,979	21,377
Manchester Metropolitan University	University Alliance	32,160	2,179	(7%)	90	35	73.1	4,786	12,770	168	17,724	1,250	2,303	12,607	33	13,412	24,445	54,050	71,774	7,132	5,451	12,584
The University of Manchester	Russell Group	37,925	11,604	(31%)	0	33	29.8	25,989	50,989	899	77,877	15,677	9,828	4,823	6,510	65,915	138,646	241,399	319,277	47,811	34,589	82,399
Middlesex University	Million+	19,880	4,863	(24%)	45	100	62.9	1,450	4,573	49	6,072	1,462	1,859	5,876	9	4,043	19,664	32,913	38,985	15,188	11,407	26,594
University of Newcastle-upon-Tyne	Russell Group	22,410	6,361	(28%)	90	33	67.5	11,672	32,293	408	44,374	4,103	2,401	479	78	7,697	31,664	46,421	90,795	26,534	19,123	45,657
University of Nottingham	Russell Group	33,270	7,510	(23%)	25	53	53.1	16,841	45,881	852	63,573	4,296	4,697	3,452	0	24,884	56,685	94,014	157,587	30,425	22,044	52,469
The Nottingham Trent University	University Alliance	26,845	3,706	(14%)	60	48	72.6	3,928	13,022	131	17,080	1,945	3,702	5,880	18	3,296	30,573	45,414	62,495	13,809	9,986	23,795
The University of Reading		13,595	3,369	(25%)	60	50	47.6	5,010	11,251	267	16,527	6,222	2,448	2,293	26	8,810	38,179	57,978	74,506	13,114	9,593	22,707
The University of Sheffield	Russell Group	26,600	7,897	(30%)	50	0	37.2	7,028	36,813	535	44,376	1,465	3,359	3,837	76	37,571	79,988	126,296	170,672	34,128	24,489	58,617
The University of Westminster		20,200	5,737	(28%)	35	33	35.3	4,620	8,075	122	12,818	1,187	306	1,778	102	2,882	28,396	34,650	47,468	17,520	13,205	30,725
University of Worcester		10,295	617	(6%)	60	40	76.7	1,729	2,907	44	4,680	230	928	3,970	48	1,027	6,608	12,811	17,491	1,614	1,300	2,914
The University of Edinburgh	Russell Group	27,625	9,461	(34%)	55	20	51.6	34,649	46,881	696	82,226	9,609	5,156	4,302	306	20,389	83,972	123,734	205,959	32,208	23,771	55,979
The University of Strathclyde		19,960	3,203	(16%)	60	43	33.9	9,793	19,520	176	29,489	2,993	1,635	16,806	1,241	2,498	46,394	71,567	101,056	10,795	8,058	18,853
SAMPLE TOTAL / AVERAGE		544,995	114,676	(21%) #	50±24	38±24	52±16 #	220,054	430,365	7,460	657,879	85,073	71,295	151,459	14,860	298,927	964,854	1,586,468	2,244,347	428,243	312,654	740,897
UK TOTAL / AVERAGE		2,299,355	435,500	(19%)	41±24	38±26	44±16	862,043	1,505,325	25,184	2,392,552									1,561,837	1,143,967	2,705,804

(a) see www.millionplus.ac.uk, www.russellgroup.ac.uk, www.unialliance.ac.uk and cathedralsgroup.org.uk (b) student population data obtained from HESA (2015a; 2015b) (c) see peopleandplanet.org/university-league/2015/tables (d) footprint data obtained from HESA (2014b), (e) Emissions from student flights were calculated from inbound student data by country of domicile (HESA 2015a) and the average flight frequencies for students from Europe and the RoW, and their associated VFR, as discussed in this paper.

Data for institutions excluded from the analysis presented in the paper

UK Higher Education Institution	Mission Group / Association[a]	Student Population[b] Total #	Student Population[b] International #	International (%)	People & Planet University League Scores[c] C Man-agement	C Red-uction	Total	GHG Emissions Reported in the 2013/14 EMR Return (tCO_2e/yr): Mandatorily Reported Estates Emissions Scope 1	Scope 2	Scope 3	Total Mand.	Voluntarily Reported Scope 3 Emissions: Travel Business travel	Staff commute	Student commute	Waste	Procurement Construc-tion	Other	Total Volun.	Total Reported Emissions	Inbound Student Air Travel Emissions (tCO_2e/yr)[e] Scope 3 Student	Other VFR	Total Inbound
University of the Arts, London	UKADIA	17,135	7,730	(45%)	70	0	46.3	3,363	9,048	112	12,523	1,642	75,870	352,111	26	8,684	35,161	43,870	56,393	29,210	21,354	50,564
Rose Bruford College	UKADIA	770	93	(12%)	0	80	24.9	179	380	6	564	7	96	78	25	4	33	62	626	236	183	419