Salford University

Thesis for Masters in Philosophy

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Influence of BREEAM on Commercial Building Users of Small and Medium Enterprises in Refurbished Buildings

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BREEAM – Building Research Establishment Environmental Assessment Method
CfSH – Code for Sustainable Homes
EAM – Environmental Assessment Methods
EPBD – Energy Performance of Buildings Directive
PCR – Post Construction Review
SBEM – Simplified Building Energy Model
SME – Small and Medium Enterprise

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Abstract

BREEAM has been in existence since the early 1990s, currently there are over 550,000 BREEAM certified buildings with over 2 million registered globally (NBS, 2016). According to Rhodes, C, Ward, M (2020) there are 5.9million Small and Medium Enterprises (SMEs) in the UK with many of them looking more to BREEAM for a myriad of reasons including Planning requirements and obtaining funding. This could result in the number of BREEAM rated commercial buildings growing exponentially over the coming years.

The Royal Institute of Chartered Surveyors (RICS) suggest that the lifecycle of property is in four distinct stages from planning/procurement to construction to occupation and finally to demolition. The National Building Specification (NBS) estimate the design life of commercial buildings to be around 50 years (NBS 2015). Much of this period relates to occupation, therefore, mistakes and omissions in the design can have a profound affect for the life of the building. Currently, research is limited on how building users feel, behave and interact with environmentally rated buildings.

The following thesis analyses the responses from building users who have firstly experienced working in a none-BREEAM rated commercial building, as a benchmark, and now work in a BREEAM rated building. The focus of the thesis is primarily Small and Medium Enterprises (SMEs) where the take up from BREEAM is gathering traction. Using a case study methodology qualitative data were obtained by conducting in-depth interviews and analysing the supplied documentation across a pilot study and a case study. This included questions relating to; awareness of BREEAM, the services in the building, thoughts around travel and recycling. Interviewees were also asked about their sustainable behaviour at home as a comparison. Responses were analysed using Nvivo. Initial findings indicate that when BREEAM credits are incorrectly selected and applied to the building they have a negative impact on building users. Coupled with this is the level of automation required within BREEAM to achieve the higher ratings, as this was causing levels of discomfort and attracting complaints. It was also recognised that the assessment is seldom integrated into the working lives of the building users when many of them having little awareness of BREEAM.

The complaints identified in this study were such that a separate complaints map was produced to capture that data. This culminated in the production of a framework to assist with integrating BREEAM into the daily lives of building users by providing policy interventions at key stages. The study also alludes to a four-pillar decision making process to aide SME's with environmental sign-posts when acquiring new and managing existing space. The four pillars are namely tangibility, feedback, useable benefits and training. Following refinement and coding of the raw data loose grouping was applied. Emerging themes of each group suggested that; further training on BREEAM features is a need, feedback on the building and wider features of BREEAM is a need, where outcomes are tangible building users are more likely to engage, and finally where building users gain a benefit, regardless of BREEAM but helpful towards implementation, building users are likely to engage.

This research provides a foundation for further research in the area of occupation satisfaction in BREEAM rated buildings.

Chapter 1: Introduction

The aim of this research is to explore issues around the standard Building Research Establishment Environmental Assessment Model (BREEAM) framework used to indicate a building's environmental merit. A small but significant body of research is starting to emerge in relation to the satisfaction of building users in BREEAM buildings. The 'standardisation' of BREEAM may be resulting in negative effects that ultimately lead to complaints and dissatisfaction.

The study will concentrate on commercial buildings as these are a complex mix of businesses, culture and people housed within the same space. This view is also shared with Ferreira, J., et al. (2014), who highlight in their energy analysis study that addressing environmental, economic, social, and technical criteria is a complex task. The study continues to suggest that refurbished buildings require further consideration with a higher degree of risk and uncertainty. Could this situation be exacerbated with companies of SME status where organisational culture is generally underdeveloped or going through transformation?

The researcher is keen to explore whether the application of a single framework could impede the successful integration of BREEAM criteria. Also, could this have ramifications further down the line on several fronts including negative impacts on behaviour, the building not being used as it was intended, and ultimately not resulting in a building with reduced CO_2 levels.

The following chapter will provide some background to this issue along with a rationale for undertaking this research. The chapter will then define the overall aim and objectives of the study along with research questions.

1.1 Research Rationale

BREEAM has been in existence for over 30 years and according to the BRE the fundamental aim of BREEAM is to:

"*Ensure that its standards provide social and economic benefits whilst mitigating the environmental impacts of the built environment. In doing so, BREEAM enables developments to be recognised according to their sustainability benefits and stimulates demand for sustainable development*".

BREEAM then continues to list 10 underlying principles about how to achieve these aims:

- *Ensure **environmental quality** through an accessible, holistic and balanced measure of environmental impacts.*
- *Use **quantified measures** for determining environmental quality.*
- *Adopt a **flexible approach** that encourages and rewards positive outcomes, avoiding prescribed solutions.*
- *Use **robust science** and **best practice** as the basis for quantifying and calibrating a cost effective and rigorous performance standard for defining environmental quality.*
- *Reflect the **social and economic benefits** of meeting the environmental objectives covered.*
- *Provide a **common international framework** of assessment that is tailored to meet the 'local' context including regulation, climate and sector.*
- ***Integrate building professionals** in the development and operational processes to ensure wide understanding and accessibility.*
    - *Adopt **third party certification** to ensure independence, credibility and consistency of the label.*
    - *Adopt **existing industry tools**, practices and other standards wherever possible to support developments in policy and technology, build on existing skills and understanding and minimise costs.*
    - *Align technically and operationally with **relevant international standards**, including the suite of standards on the 'Sustainability of Construction Works' prepared by the European Committee for Standardisation Technical Committee CEN/TC 350.*
- *Engage with a representative range of **stakeholders** to inform ongoing development in accordance with the underlying principles and the pace of change in performance standards (accounting for policy, regulation and market capability).*

(BREEAM 2021)

Nowhere in the list above does it mention the satisfaction of building users who arguably interact with the building far more than any other stage of the building's life cycle. This is a

key component of this study According to the Royal Institute of Chartered Surveyors (RICS) there are four main stages of a building lifecycle:

Stage 1 – Planning and Development
Stage 2 – Construction/refurbishment
Stage 3 – Occupation
Stage 4 – Demolition

(RICS 2021)

Stages 1, 2 and 4 can have timescales from months to a several years depending on the size and complexity of the building, however, stage 3 occupation, is likely to be on average anywhere from 40 to 200 years. Any long-term benefit of BREEAM is surely borne in stage 3, yet it is missing from the fundamental principles of BREEAM. Is it possible that this lack of focus on building occupation is resulting in disgruntled building users?

1.3 Research Background

The last 20 – 30 years has seen a long-standing debate on whether climate change is manmade or a cyclical natural occurrence. According to research carried out in 2008, by University East Anglia, there is now conclusive proof that polar warming is caused by humans, therefore, bringing the focus on behaviour to the forefront. The demand for sustainable buildings grew rapidly with the ratification of the Kyoto Protocol in 2003 Quingwei et al (2012) and the subsequent introduction of the Energy Performance of Buildings Directive (EPBD) [Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002]. This pushed the need for sustainable buildings to the forefront and paved the way for a plethora of environmental assessment methods (EAMs) designed to rate the environmental credentials of new and existing buildings. Of the vast array of tools available, Forsberg & Malmborg 2003; Cole 2005; Ding 2007; Haapio & Viitaniemi 2008; Yu & Kim 2011 and Suzer, O (2019) generally agree that by far the most widely used and well known are BREEAM, LEED, CASBEE, GBTool and Green Star.

The first version of BREEAM was introduced in the UK in 1990 (Howard, 2005; Xiaoping, Huimin, & Qiming, 2009). BREEAM is essentially a credit-based system the process or

which extends to a wide range of applications covering new build construction, refurbishment, fit-out and extensions. BREEAM comprises nine major categories, each one dedicated to a particular issue within the built environment. The categories comprise; Management, Heath & Wellbeing, Energy, Transport, Water, Materials, Waste, Energy, Land use and Ecology, and Pollution BREEAM, (2011). Each major category is then divided into individual credits that are assigned differing values depending on the scheme and level of commitment required by the client. A set of environmental weightings is given to each major category to enable the credits to be collated together to produce a single overall score and, therefore, a certified rating.

The primary focus of BREEAM has generally been to measure the impact new construction activity has on the environment. Conversely, the focus on existing buildings and their impact on the environment has been somewhat trailing. BREEAM have integrated more in-use credits over the development of its framework through the procurement and contract cycle. This generally tries to condition the internal environment to induce user comfort and satisfaction. However, there is little evidence to suggest that such benefits built into the assessment are having the desired effect or impact on the building occupants. In fact, several areas highlighted through this study show that there are increasing levels of dissatisfaction among sustainable building users. This research has also highlighted that when the benefits of BREEAM are not properly considered they can have the opposite affect and create negative behaviours.

1.4 Research Aims and Objectives

Aim

The aim of this study is to develop a framework for use with BREEAM's environmental assessment method (BREEAM) to assist with integration of the system to ensure users understand the features and purposes of BREEAM to assist with sustainable user behaviour in buildings.

Objectives

1. Establish the purpose of BREEAM, in relation to commercial building refurbishments, within the wider sphere of the sustainability agenda.
2. Identify a range of factors affecting users in BREEAM certified buildings.
3. Investigate the impact of BREEAM on user behaviours in a BREEAM certified building with specific reference to Small and Medium Enterprises (SME).
4. Develop a strategic framework based on the factors identified in stage 3 to act as an aide memoire to integrating BREEAM and the wider agenda.

1.5 Research Questions

1 Is there a difference in end user behaviour between a BREEAM and non BREEAM building?

2 Does BREEAM influence end user behaviour, in the way it was intended, to achieve effective sustainability?

3 Is there a way to raise awareness of in-use issues identified at the end of the BREEAM process to inform the early stages of the process and limit the negative impact?

1.6 Research Justification

Over the 30 years of BREEAM development the framework has become more complex and all-encompassing to accommodate the myriad of different commercial building types under a single framework umbrella. However, if BREEAM seeks to standardise buildings it then follows that those users of the building should be standardised, but humans are inherently complex individuals who cannot be programmed to use any building in an identical manner. Monfared & Sharples (2011) suggest that 'human factors' should not just be considered as a notion of comfort but also such measures should be considered in the environmental assessment methods as they will consequently affect the building's performance and its sustainability.

Accommodating 'human factors' within a single framework may be too ambitious, however, it certainly warrants more attention than keep applying standard credits. This research has also highlighted that the way those credits are applied is resulting in a negative impact on behaviour. This is important as to date (2019), BRREAM have 2.2 million buildings registered and have awarded well over 500,000 certificates. Research is starting to emerge, including this study, that shows user dissatisfaction that in some cases are directly related to the BREEAM credit or the way it was chosen.

1.7 Research limitations

In 2009 BRE introduced BREEAM In-Use (BIU), a completely new scheme relevant only to commercial buildings in occupation. The scheme is essentially self-assessment and carried out by the building/facilities manager who must sit and pass an exam before they embark on the online assessment. The process can be problematic, as highlighted by Watering & Wyatt (2011) as many companies outsource their facilities management role thus diminishing overall control of the asset. The scheme consists of three major parts and uses licensed BREEAM Auditors, as opposed to Assessors, to issue final ratings.

Part 1 Asset
Part 2 Management
Part 3 Organisational Efficiency

(BRE 2011)

Much of the criteria comes direct from BREs standard scheme and tends to focus more on the asset and the way in which this is managed rather than the way users behave. The BIU system is applied to existing buildings as they are by identify any credits that fit. Traditional BREEAM selects the credits during the design stage, and they are the ones the building users are given. The focus of this study is to understand both the credits and process of BREEAM during a refurbishment project, and how those credits impact on the building user.

1.8 Research Design

Initial steps in the research design involved undertaking a pilot study in conjunction with a literature review. In order to establish some level of measurement a benchmark was

established by ensuring the building users had experience occupation in a non-BREEAM rated building and a BREEAM rated building. Due to the cyclical nature of BREEAM there is a considerable time lag of 3-4 years. This is due in part to the assessment timeline and length of occupation before issues appear and the research is undertaken. Therefore, when the researcher embarked on this study the body of research was in its infancy and a pilot study was conducted in conjunction with the literature review. Following initial results of the pilot study a case study was carried out using the same parameters as the pilot study. The building must be BREEAM excellent rated, to ensure there is a good range of credits, and the building users must have decanted from an existing non-BREEAM building as a comparison. In-depth semi-structured interviews were carried out on both studies using a non-probability technique with a combination of snowball and purposive strategy. The results were analysed using Nvivo with a combination of concept mapping and coding of the raw data.

Chapter 2: Literature Review

2.1 Introduction

The early stages of the literature review, while being replete with sustainability, offered little in the way of published research on the effects of BREEAM for commercial buildings in use, especially at SME level. One of the reasons for this could be due to the major overhaul in 2008, as highlighted in the introduction. There is a natural cycle to BREEAM in the sense that the building is initially designed, then built, then a post construction review prior to even thinking about how occupants interact and use the building. Given this natural cycle, and the lack of published research, the researcher embarked on a pilot study in tandem with the literature review. The mechanisms of the pilot study are discussed in detail in the methodology chapter. However, this chapter will discuss some of the similarities between the literature review and the findings of the pilot study. Detailed analysis for the pilot study is given in Chapter four.

This chapter begins by setting out 'sustainability' and what that encompasses. This is a significant point to make as so often the environment, energy, and sustainability are mixed up and used interchangeably. Each has extrinsic links to the other although each has quite a different purpose. Add to this the complexities of BREEAM them people become confused with the system ultimately being too complex for the lay person to fully understand and engage with and could hinder any changes in behavioural habits. This chapter aims to demystify some of the confusion around sustainability and attempts to identify where this research sits on that continuum.

2.2 What is sustainability?

In 1952 almost 12,000 people lost their life in London due to a deadly smog Excell, (2015). It is thought that this was a mix of fog and pollution from burning coal, although the true make up is still not confirmed, this eventually led to the Clean Air Act in 1956. This was a significant piece of environmental legislation in the UK that was aimed at reducing emissions and having smokeless zones.

During the 1970s chemists Mario Molina and F. Sherwood Rowland started to research Chlorofluorocarbon (CFCs). According to Gilet (2007) “these are a class of chemicals that are made up of combinations of chlorine (C), fluorine (F), and carbon atoms (C)”. These chemicals were deemed to be safe for the environment; nontoxic, non-flammable and hailed as a wonder chemical. By the 1980’s the UK was littered with bands called ‘new romantics’ whose signature was big hair with copious amounts of hair spray. At the time it did not seem to be an issue that hairspray, refrigerators and several household cleaning products contained large amounts of CFCs until Molina and Rowland started to test them on the environment and what they found was startling. CFCs, like most other gases, did not breakdown in the lower atmosphere instead they rose up to the stratospheric atmosphere still in their natural form and through the ozone layer creating a hole. The ozone layer protects the earth from dangerous UV rays therefore a hole allows such rays to get through which in turn can have devastating health consequences in humans such as skin cancer Gilet, (2007). Global concerns were raised about the depletion of the ozone layer which dominated the early part of the 1980s.

Physicist Joseph Fourier began researching the earth’s energy balance in the 1820s. He realised that energy reaching the earth, in the form of sunlight, must be balanced by energy returning to space, although not in the same form, so there must be some interruption with the earths’ atmosphere preventing the heat from the sun escaping in to space thereby keeping us warmer than we would normally be Henson, (2011). This was likened to a greenhouse where light from the sun enters the glass which the plants and soil absorb and convert it to heat which is then trapped inside. According Henson (2011), this is a slightly flawed explanation for the greenhouse effect in relation to the planet as the earth does not confine heat in the same way a greenhouse does. Instead, greenhouse gases, produced via pollution, trap some of the radiation trying to escape into space which causes the planet to heat up. Thus, the more greenhouse gases in the atmosphere the less radiation can escape and the warmer the planet becomes.

According to Lallanilla (2015) there are four significant greenhouse gases that contribute to global warming namely; Carbon dioxide, Methane, Nitrous oxide and Fluorinated gases, commonly known as F-gases. This means that these gases have a high capacity to absorb radiation trapping heat in the earths’ atmosphere which leads to global warming, therefore greenhouse gases are categorised by their global warming potential (GWP). Both Henson (2011) and Lallanilla (2015) include water vapour in the list of significant greenhouse gases

however this depends on geographical location for example the tropics. Excess amounts of water vapour in the air add to the warming cycle the higher the temperature of lakes, seas, and oceans the more water vapour is released into the atmosphere. Water vapour is not produced through human activity however its presence can be a catalyst for global warming. The Greenhouse effect is so severe that the climate is going through a change.

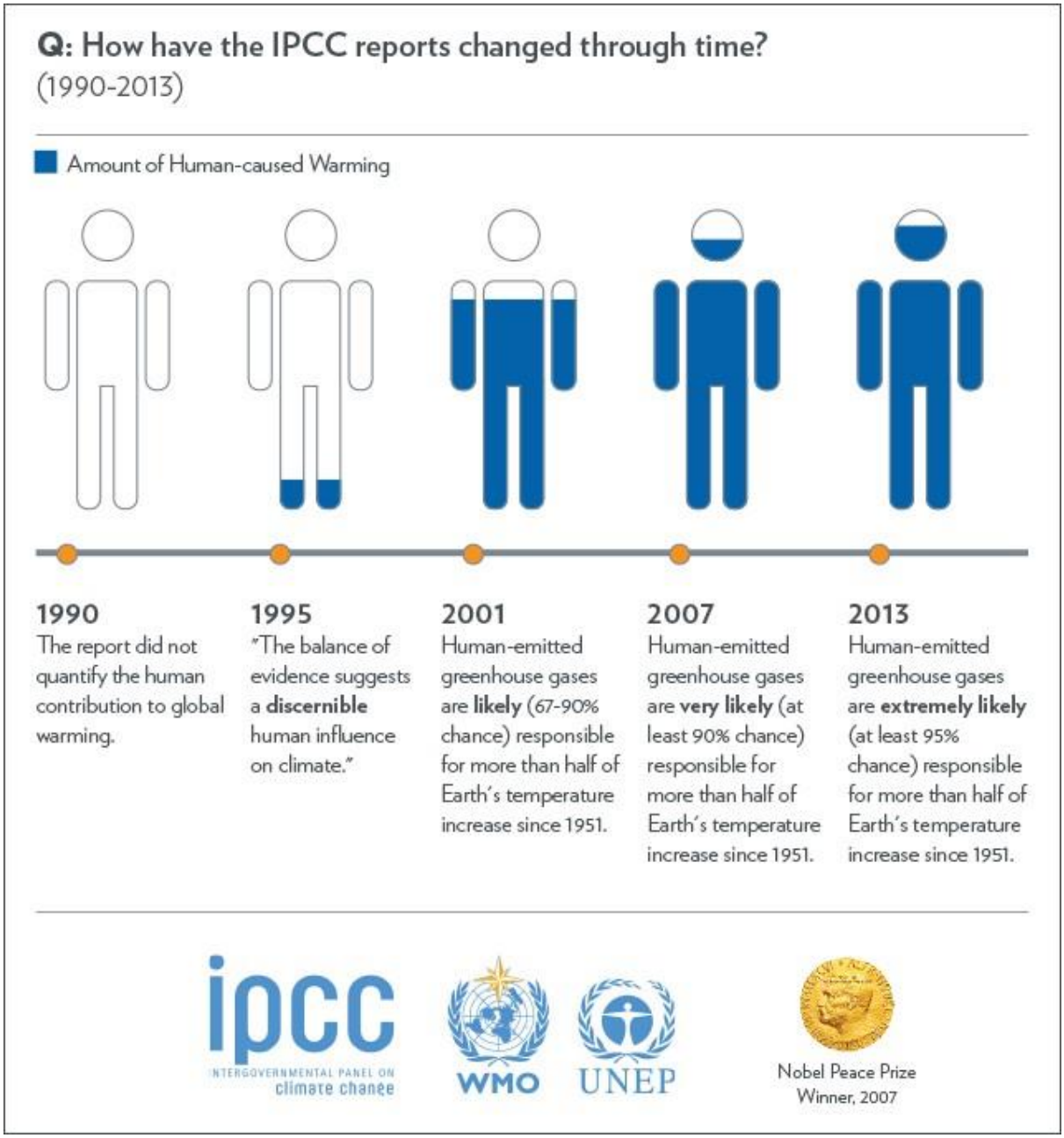
The main greenhouse gases are listed below in table 2.1 along with typical human and natural sources that cause them.

Table 2.1 Sources of Greenhouse Gases

Greenhouse gas	Issues	Source	GWP* (100 years)
Carbon dioxide	Upsets the natural balance of the carbon cycle. Contributes to global warming.	Human - cement production, deforestation and the burning of fossil fuels, transport. Natural – oceans, the sun, decomposition, volcanoes.	1
Methane	Contributes to global warming.	Human – landfill, burning fossil fuels, agriculture, biofuels, burning biomass, rice agriculture. Natural – by bacteria breakdown, wetlands, termites, oceans	25
Nitrous oxide	Upsets the natural balance of the nitrogen cycle. Contributes to global warming.	Human – agriculture, fertilized agricultural soils, livestock manure, burning fossil fuels, biomass, human sewerage Natural – soils, oceans, Atmospheric chemical reactions.	298
Fluorinated gases	Contributes to global warming.	Human - refrigerators, air-conditioners, foams and aerosol cans Natural – these gasses are man-made (Tohka, 2005)	12-4470

Sources used in table: (Jardine, Boardman, Osman, Vowles, & Palmer, 2004), Tohka, (2005), Henson, (2011), Lallanilla, (2015), United Nations Environment Programme, (2011). GWP* data taken directly from UK Government data accessed from https://www.gov.uk/government/publications/uk-greenhouse-gas-emissions-explanatory-notes 10/10/2020

Some of these gases are produced naturally as part of the carbon cycle where essentially "carbon is exchanged between the atmosphere, the oceans, and the terrestrial biosphere, and more slowly, with sediments and sedimentary rocks" Wrigly & Schimel, (2000). Photosynthesis and respiration are key parts of the cycle helping to keep everything in balance. When too much of a greenhouse gas is put into the atmosphere the natural balance is upset and cannot disperse of the additional gases resulting in global warming and ultimately a change in the climatic conditions that humans are used to living in. The natural cycle has been used previously to deny that humans are the main cause of climate change, which has slowed the progress of addressing some of the main issues. This is illustrated in Fig 2.1 which shows the changing views of the Intergovernmental Panel on Climate Change (IPCC) since 1990 each time they have released a report on climate change.



(Union of Concerned Scientists, 2017)

Fig 2.1 IPCC Report on Climate Change through time

A significant body of research is now in circulation categorising various 'climate change deniers' who for one reason or another believe that climate change is a hoax and not man-made. Australian John Cook, who received a PhD in 2016 for cognitive science, started to research climate change after losing a family argument. He encountered a myriad of mistruths and cherry-picking of the data. This led John to start 'Sceptical Science' is a not-for-profit educational organisation of global scientists whose aim is to provide scientific peer reviewed

data in support of climate change and help to debunk myths. Currently there are 197 myths listed on the sceptical science website which all have compelling counter arguments based on scientific research Cook, (2018). According to NASA (2020) the vast majority of actively publishing climate scientists, 97 percent, agree that humans are causing global warming and climate change. The point the author is making here is that climate change deniers could have put the course of action to tackle climate change back by years. It has taken the IPCC 23 years to collectively arrive at a consensus that climate change in human made. While this happens at a macro-level is it possible that is affects behaviours and attitudes at a micro-level.

This warrants a separate piece of research altogether, however, in relation to this research BREEAM has been in existence for 30 years and the UK still miss many of the targets in all sectors including construction and property. Is this just another complex piece of the background to why attitudes towards BREEAM and the wider agenda can be negative.

2.3 Policy Development

The United Nations General Assembly is one of the six principal organs of the United Nations. The organisation has been meeting annually since 1945 with the purpose of international political cooperation, threats to peace and economic development. The challenge during the early 1980s however, was to harmonise prosperity with ecology. In 1983 the General Assembly passed Resolution 38/161 'Process of preparation of the Environmental Perspective to the Year 2000 and beyond'. This was essentially a global warning sign to developing and developed Countries around the world to start preparing for change. An extract from the resolution is given below:

a) "*To propose long-term environmental strategies for achieving sustainable development to the year 2000 and beyond;*
b) *To recommend ways in which concern for the environment may be translated into greater co-operation among developing countries and between countries at different stages of economic and social development and lead to the achievement of common and mutually supportive objectives which take account of the interrelationships between people, resources, environment and development;*

c) *To consider ways and means by which the international community can deal more effectively with environmental concerns, in the light of the other recommendations in its report;*

d) *To help to define shared perceptions of long-term environmental issues and of the appropriate efforts needed to deal successfully with the problems of protecting and enhancing the environment, a long-term agenda for action during the coming decades, and aspirational goals for the world community, taking into account the relevant resolutions of the session of a special character of the Governing Council in 1982*"

(United Nations General Assembly, 1983)

The environment was now being discussed on a global stage and it was starting to emerge that this was a far-reaching agenda that could threaten human existence. Consensus had not been reached at this time whether such environmental issues were manmade or natural cyclical events, as discussed earlier. However, the year 2000 was significant as it was estimated that the worlds' population would reach 6 billion people, the actual date was 2nd October 1999 Worldometers, (2018). The resolution highlighted issues interrelated with people, resources, and the environment, therefore as the population grows resources would deplete at an exacting pace and the environment could be damaged beyond repair. The mechanisms of economic growth can exacerbate this as developing and developed Countries want to improve the living standards of their people and in doing so natural resources are exploited which in turn significantly diminish Ghafoor Awan, (2013). Evidently there had to be some reconciliation between the development of Countries and the preservation of natural resources. Following the 38/161 resolution the Brundtland Commission was established to help rally Counties to pursue the recommendations in the resolution. The commission disbanded in 1987 after they published a report called 'our common future' which became more widely known as the Bruntdland report. The phrase 'sustainable development' was coined with the first compressive definition for sustainability:

"Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs".

(Brundtland, 1987)

According to circularecology.com there are over 200 definitions of sustainability across international, national, and regional areas further demonstrating the complexities of defining what sustainability means to different stakeholders.

The report was welcomed by the General Assembly in their resolution 42/187 as a global guiding principle for rationalising economic prosperity and sustainable development. However, nothing tangible at this point had emerged to measure how these principles could be embedded within businesses. Then in the early 1990s John Elkington developed a concept call the Triple Bottom Line (TBL) as an accounting framework for businesses allowing them to record both positive and negative impacts across three domains, namely; Economic, Environment, and Social (Lederwasch & Mukheibir, 2013). Economic criteria can be used to measure the heath and wealth of a business, however with TBL environmental performance may also include measures around waste, water/air quality, biodiversity and contamination. Social impacts of the business may also include policies on well-being, living wage, culture, family, health etc (Lederwasch & Mukheibir, 2013). The TBL, or 3Ps (Planet, People, Profit) as it is also known, does not have a common unit of measurement, however several voluntary systems emerged over time to help businesses' deliver the TBL such as BREEAM and Corporate Social Responsibility (CSR).

2.4 Legislative framework

In 1992, at what is now known as the Earth Summit, the United Nations Framework Convention on Climate Change (UNFCC) set up a treaty on stabilising greenhouse gases. The treaty itself is not legally binding however; it set up a framework for 196 Counties, which make up the UNFCC, *'to act to protect the climate system through 'common but differentiated' responsibilities*' Height, (2015). Since 1995 the UNFCC has met annually and in 1997 it was decided that it was not enough to simply stabilise emissions, therefore firm targets were agreed. This gave birth to the Kyoto protocol which required parties to collectively cut emissions by 5% by 2012 when compared with 1990 levels, resulting in a 12.5% reduction for the UK. The second stage of the Kyoto agreement covered the period from 2012 – 2020. The protocol was ratified in 2003 and finally came in to force in 2005 Height, (2015). The introduction of the protocol paved the way for a raft of secondary

legislation in the form of directives issued by the European Union. Arguably the most noticeable was the Energy Performance of Buildings Directive (EPBD) [European Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002]. This directive focused mainly on energy, however, one thing it did do was to push the issue of sustainability on to a global stage in a way that had not been seen previously.
The articles of the EPBD were far reaching and sought to address the energy efficiency of both new and existing buildings. It introduced the legal requirement for energy performance and display energy certificates for certain size buildings along with a mechanism for measuring it in the form of SBEM. In addition to this air conditioning systems within existing buildings, over a certain size, now had to be tested. The directive had a staged implementation to allow member states to prepare for the changes and adopt the necessary legislative changes. This was cemented into UK Law via the The Energy Performance of Buildings (Certificates and Inspections) (England and Wales) Regulations 2007 which set out the technical details of how European Directive 2002/91/EC would work in practice.

Other pivotal legislation was introduced such as the Waste Directive 2006/12/EC calling for separation of waste (paper, metal, plastic and glass) by 2015; and to prepare for the re-use, recycling and material recovery of non-hazardous construction and demolition waste on operations such as backfilling by 2020. This was later revised to European Directive 2008/98/EC and was known as the EU Waste Framework Directive (WFD) and was transposed into UK Law via the Waste (England and Wales) Regulations 2011.

Targets set in the Kyoto protocol were not achieved and the initiative ultimately failed. In December 2015 at **COP 21** (21st session of the Conference of the Parties) all parties to the UNFCCC collectively agreed to "*keeping the global temperature rise to well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius*" UNFCC (2020).

This agreement was called the Parris Accord and unlike the Kyoto protocol it is not legally binding. All member states are there voluntarily to demonstrate their level of commitment to addressing climate change. In January 2017 following the US elections the administration changed from democrat to republican along with a new president, Donald Trump. This has resulted in the US, one of the super-powers, pulling out of the Paris Accord and, therefore, the success of the project hangs in balance.

Table 2.2 below extends table 1 introducing how some of the wide-ranging issues connect with construction.

Table 2.2 Connections between Greenhouse Gases and UK Construction

Greenhouse gas	Issues	Source	Connection with construction
Carbon dioxide	Upsets the natural balance of the carbon cycle. Contributes to global warming.	Human - cement production, deforestation and the burning of fossil fuels, transport. Natural – oceans, the sun, decomposition, volcanoes.	Both concrete and mortar are widely used in the construction industry as well as cement being prevalent in a number of secondary materials.
Methane	Contributes to global warming.	Human – landfill, burning fossil fuels, agriculture, biofuels, burning biomass, rice agriculture. Natural – by bacteria breakdown, wetlands, termites, oceans	UK construction sends 36 million tonnes of waste to landfill each year (Commissions., 2007)
Nitrous oxide	Upsets the natural balance of the nitrogen cycle. Contributes to global warming.	Human – agriculture, fertilized agricultural soils, livestock manure, burning fossil fuels, biomass, human sewerage	Construction sites are responsible for approximately 7.5% of damaging nitrogen oxide through things like dust, diggers, generators and other machines Gardiner. (2017)

		Natural – soils, oceans, Atmospheric chemical reactions.	
Fluorinated gases	Contributes to global warming.	Human - refrigerators, air-conditioners, foams and aerosol cans Natural – these gasses are man-made (Tohka, 2005)	F-gases are used in refrigerants and air-conditioning systems.

The table above demonstrates various issues facing the UK Construction Industry that spread across several areas. While some of these areas will be heavily regulated, others will not be, and they rely on market forces pushing a sustainable agenda. Systems such as BREEAM, albeit have mandatory elements, are primarily voluntary and rely on market presence. As highlighted throughout this study the UK routinely misses climate change targets, therefore, is BREEAM helping to curtail the UKs waste and fossil fuel generation given that the system has been around for more than 20 years?

2.5 What is BREEAM?

BREEAM is essentially a credit-based system and is the most widely used scheme in the UK extending to the Netherlands, Norway, Spain, and Sweden with the capacity to assess a single building anywhere in the world using Bespoke International. The process extends to a wide range of applications as given in Table 2.4 and covers new build construction, refurbishment, fit-out and extensions. The scheme comprises nine major categories, each one dedicated to a particular issue within the built environment. The categories comprise; Management, Heath & Wellbeing, Energy, Transport, Water, Materials, Waste, Energy, Land use and Ecology, and Pollution BREEAM, (2011). Each major category is then divided into individual credits that are assigned differing values depending on the scheme and level of commitment required by the client. A set of environmental weightings is given to each major category to enable the credits to be collated together to produce a single overall score and, therefore, a certified

rating. Table 4 below gives an overview of the BREEAM schemes together with the major categories, credits, and a worked example of how ratings are achieved.

Very little changed with the BREEAM scheme during the 90s and it is fair to say that it did not really take off until the early-to-mid 2000s. As a result, significant changes were made to the scheme addressing the shifting priorities of the climate change agenda. A comparison across major scheme changes is given in table 3.

2.6 A brief background of BREEAM

BREs Environment Assessment Method (BREEAM) was launched in 1990 under the umbrella of BRE as a commercial offering where independent people could train and become accredited assessors. BRE was a government funded research laboratory and in 1997 BRE became fully privatised, and a separate arm emerged called Foundation for the Built Environment. The first documentation to be published in 1990 was BREEAM 1/90 for offices which was significantly different to the BREEAM we know today. The assessment was arranged in a simple checklist comprising only three sections with further sub-categories underneath. *Global*: greenhouse gases, ozone depletion, wood products; *Neighbourhood*: legionnaire's disease, re-use of existing site; *Indoor effects*: legionnaire's disease, hazardous materials, indoor air quality, and lighting Prior, (1991). An industrial version of BREEAM was launched in 1991 followed by a retail version in 1993. The original objectives of BREEAM were threefold: to provide recognition for buildings that were friendlier to the environment; to raise awareness of the use of energy in buildings plays in global warming; and to provide a common set of targets and standards so that false claims of increased environmental friendliness are avoided.

Bordass, Bromley, and Leaman published a paper in 1993 on the initial findings of two field studies, carried out by BRE, under the Department of energy's Energy-Related Environmental Issues (EnREI) programme. Both studies comprised office buildings that reflected a diverse range of occupancies, qualities, servicing and management'. The first study of six buildings completed in the 1980s, was predominately open plan. The second study, of ten buildings, emphasised more on naturally ventilated buildings and the '*relationship between the individual and local control systems, and particular features such*

as the openable window, electronic lighting controls, and automatically-operated solar blinds' B. Bordass, et al (1993). While the field studies were technical in nature which focused on air-conditioning, passive solar, thermal mass and the like, emphasis was on controls in buildings. Data was gathered via semi/structured interviews, and questionnaires in some cases, to the management and their impressions were recorded. The initial findings suggested that overall, there are issues with user interfaces both at 'individual and building organisational management' levels. This is an important paper as it was published in 1993, based on 1991 field studies carried out by BRE who own BREEAM. The first BREEAM schemes were also published between 1991 and 1993, the researcher seeks to understand the introduction of BREEAM has addressed any of these issues' years later.

Some of the initial findings around this study indicated that speculative buildings are a problem. When this was tested in the study with two buildings of a very similar specification, they recorded very different results. The main contrast between the two is that one building was built speculatively and, therefore, had no energy brief, less efficient services (as generally services tend to be set to default positions), and a third-party management system who have no incentive to operate the building efficiently. The other was developed as a pre-let meaning that the future Tenant had a say in the design process resulting in a better managed building. Results showed that the building designed with the end user's input was three times more efficient mainly due to the absence of standard default measures. This is incredibly significant as the Bordass & leaman research identified: the importance of the end users being involved in the process, lack of control, and poor management of the building. This research has identified all the same issues causing unrest with building users some 32 years later. Automation of building controls was identified as a problem then, it is still a problem now and the BREEAM assessment process has included more and more automation over the years.

The next major update was in 1998 where more flexibility was introduced into the assessment. The structure of the assessment had also changed by focussing more on the construction process and how that relates to environmental issues. New build, refurbishment, existing occupied, and existing vacant buildings were all now catered for under a single assessment process which contained three parts. The three parts comprised core building issues (assessing the fabric and services in all cases), design and procurement issues (assessing new build and refurbishments), and management and operation issues (assessing

existing buildings). The three major sections in the previous version were replaced with nine categories covering: Management, Health and Comfort, Energy, Transport, Water, Material, Land use and Ecology, and Pollution. Under each category is a variable list of credits relevant to that category. The previous version of BREEAM implied some level of weighting, however, in the new version weightings were applied to each category on a common scale allowing, for the first time, an overall rating for the building to be achieved Baldwin, Yates, Howard, and Rao (1999). Depending on the number of credits achieved and the weighting of that category, the overall rating for a building would now fall in to either; Pass, Good, Very Good, or Excellent giving a clear indication of a building's environmental credentials.

The demand for sustainable buildings grew rapidly with the ratification of the Kyoto Protocol (Li, Syal, Turner, & Arif, 2013) and as a result BREEAM started to gain traction in the market for 'badging' commercial buildings. Between 1998 and 2006 annual updates were carried out to reflect current guidance and legislation. Further schemes were introduced, such as multi-residential, prisons, courts, and bespoke, which was also used to assess the first BRREAM certified building outside of the UK namely Central Bank in Luxembourg in 2005 BRETrust (2014).

By now BREEAM was starting to amass a presence in the UK market, however, with this came criticism. AlWaer and Kirk (2012) concluded in their study that while BREEAM is an accepted standard it falls short of a sustainability toolkit. Rigidity of the assessment process, the tick box mentality Holmes and Hudson (2001), and in particular a concept emerging called 'the energy gap'. Reason and Mashford (2014) demonstrates this with Portcullis House, built in 2001, and one of the first office buildings to achieve a BREEAM excellent rating. However, its display energy certificate, which means the energy used by the building, was a 'G' rating demonstrating poor in-use energy efficiency. Bordass B, Cohen R. and Field, J. (2004) also demonstrates this for an award-winning head office, compared with the energy use two years after completion, by showing a threefold increase between the designed energy use.

The above issues, among others, were addressed in the 2008 version of BREEAM and would be the biggest overhaul since the system began. Four major elements were introduced to the process with the intention of tightening the system and maintaining credibility. The changes

comprised, a post construction review, mandatory credits, exemplar and innovation credits, and a new rating of outstanding.

The introduction of a post construction Review (PCR) sought to address the 'energy gap' that was now emerging with rating systems. Previously the design, specification, and any other associated documentation would have been checked by a BREEAM assessor. A certificate containing a rating was issued and no further assessment was required. However, this failed to address the difference between the design on paper and the actual finished building. With the introduction of a mandatory PCR two certificates were now issued one at design stage and the other following practical completion of the building. In theory if the design was given an excellent rating the finished product should also have an excellent rating although this was not the case in reality. Several buildings dropped one to two ratings from the design to the actual completion proving that the energy gap was real and making BREEAM a more robust and credible system.

Mandatory credits also became part of every assessment and spread across a number of categories namely, management, health & wellbeing, energy, water, waste, and land use and ecology. These had to be achieved and different rating levels for example, a management credit on commissioning (Man1) must be achieved regardless of whether a pass or excellent rating is being sought.

Exemplar and innovation credits were introduced to address the issues around rigidity. Many Architects and Contractors felt that design intentions were stifled, particularly on larger buildings, and there was no recognition for embracing new technologies. There were now three ways in which Innovation credits (IC) could be achieved. 'The first is by meeting exemplary performance criteria for an existing BREEAM issue. The second is by appointing an Approved Person or suitably qualified BREEAM assessor as an integral part of the design team. The third and final way of achieving an IC is by an application to BREGlobal via the assessor in recognition of a new innovation not covered elsewhere in the scheme documentation' Li et al., (2013).

An outstanding rating was also introduced as BREEAM wanted to recognise the very best performing buildings. This would now require a score of 85% or above in addition to a large

number of mandatory credits and a further ‘In Use’ BREEAM assessment be carried out on the development further down the line. O'Rorke (2009).

2.6 Changes to BREEAM (2008)

By 2008 BREEAM had nine schemes in existence in the UK: Courts, Education, Industrial, Healthcare, Offices, Retail, Prisons, Multi residential, and Bespoke. Previous assessment types were also consolidated in the 2008 manuals and the schemes could now assess: new buildings, major refurbishments, mixed use and fit outs to existing buildings. BREGlobal previously owned Ecohomes, but this was taken over by the Code for Sustainable Homes which was a government initiative. However, BREGlobal were one of the main consultants basing the Code on their BREEAM layout and weighting system. Between 2008 and 2011 numerous schemes were emerging such as, BREEAM communities which took existing categories for single buildings and applied them on site wide basis. BREEAM European Commercial also emerged allowing office, retail, and industrial type buildings to be assessed under one document. This scheme was eligible to; ‘any member state of the European Union, Republic of Ireland, EFTA Member States i.e. Iceland, Norway and Switzerland, Current EU candidates: Turkey, Croatia and Macedonia. Plus other Countries such as: Albania, Belarus, Bosnia & Herzegovina, Moldovia, Montenegro, Serbia and Ukraine’ BREGlobal, (2009). Many of these Countries are affiliated National Scheme Operators, however, to assist with their presence internationally, BREGlobal developed BREEAM international for use in Countries where no affiliated National Scheme Operator exists.

In 2009 BREGlobal also introduced their BREEAM In-Use (BIU) scheme, a completely new scheme relevant only to commercial buildings in occupation. ‘The scheme is essentially self-assessment, carried out by the building/facilities manager who must sit and pass an exam before they embark on the online assessment. The scheme consists of three major parts; asset, management, and organisation efficiency and uses licensed BREEAM Auditors, as oppose to Assessors’ Turner & Arif, (2012)

Following the major changes in 2008, a reasonable amount of time was required for issues with the system to be identified. In 2010 the UK Green Building Council (UKGBC) produced a consultation document with over 60 influential contributors of the built environment. One

of the main findings of the report included a call for clarification between the schemes. Further feedback also suggested that BREEAM should focus on; aligning more with practice, better customer service, developing a scheme for use on smaller buildings, aligning more with European and international standards, development of a specific refurbishment/fit-out scheme, and address the 'wide discrepancies in energy between design stage energy use calculations and actual energy use during occupation measured after completion' (UK Green Building Council, 2010). It's entirely reasonable to suggest that BREEAM had gone through a number of transformations since its inception in 1990. Again, there were criticisms in this area suggesting that BREEAM should not undergo any further major changes due to the time it takes for re-training and fully understanding the impact of those changes in reality. Any further changes should be done gradually.

Further changes were made to BREEAM in 2011 and some of the issues raised in the 2010 consultation document were addressed. Previously BREEAM tried to accommodate different building types individually, therefore, a manual was available for education, one for offices, one for healthcare and so on. The problem was that as the system grew more building types were being encompassed into the assessment. This resulted in numerous manuals, essentially one for each building type, compounded by the fact that they were also trying to accommodate new build, refurbishment and fit-out. This made for a complex training and licencing regime and was costly for both the assessor and the client due to all the associated administration. Now under BREEAM 2011, building types fall within four broad sector categories; commercial, public sector, multi-residential and 'other buildings', each sector containing a sub-group of buildings which can be assessed. For example, commercial sector includes offices, retail and industrial types. The 2011 changes bring all these schemes together into one assessment methodology for New Construction. The credits have also been rationalised with a common framework of 49 issues spread across the nine environmental categories, each with its own criteria defining a relevant standard of performance. These issues will still have specific criteria related to the different building types and functions. BREGlobal also developed a separate refurbishment and fit-out scheme to run alongside the newly constructed scheme.

The most recent update to BREEAM is 2014 only minor changes have been made at this point and, other than a few technical credit changes, perhaps the biggest is a change in

weighting across some of the categories, further minor changes were carried out in 2016 with the next major overhaul expected in 2018.

Table 2.3 Evolution of BREEAM Schemes

2006		2008		2014	
Category	**Weighting**	**Category**	**Weighting**	**Category**	**Weighting**
Management	15	Management	12	Management	15
Health and Wellbeing	15	Health and Wellbeing	15	Health and Wellbeing	15
Energy and Transport	25	Energy	19	Energy	15
		Transport	8	Transport	9
Water	5	Water	6	Water	7
Materials and Waste	10	Materials	12.5	Materials	13.5
Land Use and Ecology	15	Waste	7.5	Waste	8.5
Pollution	15	Land Use and Ecology	10	Land Use and Ecology	10
		Pollution	10	Pollution	10

An initial inspection of the above table indicates how the weightings have changed over time to reflect a greater onus on a particular category.

Overall (Aspinal, Sertyesilisik, Sourani, & Tunstall, 2012; Goode & Xiao, 2012; Holmes & Hudson, 2012) generally agree that BREEAM is a necessary tool that can add value and contributes to the wider sustainable built environment agenda. This is on a general level in the sense that a BREEAM assessment is far better than no assessment. According to the BRE website, there have been in excess of 9000 buildings in the UK that have gained BREEAM certification since 2008 (as of 2018). However, can a blanket assessment really address all the complex needs of different building users in commercial buildings? And do BREEAM assessments help or hinder occupant's meaningful interaction with the building?

Table 2.4 Summary of BREEAM credits

BREEAM Summary (UK only)				
Schemes				
BREEAM UK New Construction	BREEAM UK Communities	BREEAM In-Use	BREEAM UK EcoHomes	BREEAM UK Refurbishment

Category	Credits available	Category weighting
Management	**21**	**12%**
Man 01 Project brief and design	MVG 4	0.57%
Man 02 Life cycle cost and service life planning	MP 4	0.57%
Man 03 Responsible construction practices	ME 6	0.57%
Man 04 Commissioning and handover	4	0.57%
Man 05 Aftercare	ME 3	0.57%
-	-	-
Health & Wellbeing	**8**	**15%**
Hea 01 Daylighting	2	0.68%
Hea 02 View out	1	0.68%
Hea 03 Glare control	1	0.68%
Hea 04 High frequency lighting	1	0.68%
Hea 05 Internal and external lighting levels	1	0.68%
Hea 06 Lighting zones and controls	1	0.68%
Hea 7 Potential for natural ventilation	1	0.68%
Hea 8 Indoor air quality	1	0.68%
Energy	**31**	**15%**
Ene 01 Reduction of energy use and carbon emissions	ME 12	0.48%
Ene 02 Energy monitoring	MVG 2*	0.48%

Category	Credits available	Category weighting
Materials	**14**	**13.5%**
Mat 01 Life cycle impacts	MO 6*	0.96%
Mat 02 Hard landscaping and boundary protection	1	0.96%
Mat 03 Responsible sourcing of materials	ME 4	0.96%
Mat 04 Insulation	1	0.96%
Mat 05 Designing for durability and resilience	1	0.96%
Mat 06 Material efficiency	1	0.96%
Waste	**9**	**8.5%**
Wst 01 Construction waste management	4	0.94%
Wst 02 Recycled aggregates	1	0.94%
Wst 03 Operational waste	1	0.94%
Wst 04 Speculative floor and ceiling finishes	1	0.94%
Wst 05 Adaptation to climate change	1	0.94%
Wst 06 Functional adaptability	1	0.94%
Land & Ecology	**10**	**10%**
LE 01 Site selection	2	1.0%
LE 02 Ecological value of site and protection of ecological features	2	1.0%

Ene 03 External lighting	1	0.48%	LE 03 Minimising impact on existing site ecology	MVG 2	1.0%
Ene 04 Low carbon design	3	0.48%	LE 04 Enhancing site ecology	2*	1.0%
Ene 05 Energy efficient cold storage	2	0.48%	LE 05 Long term impact on biodiversity	2	1.0%
Ene 06 Energy efficient transportation systems	3	0.48%	-	-	-
Ene 07 Energy efficient laboratory systems	5*	0.48%	-	-	-
Ene 08 Energy efficient equipment	2	0.48%	-	-	-
Ene 09 Drying space	1	0.48%	-	-	-
Transport	**13**	**9%**	**Pollution**	**13**	**10%**
Tra 01 Public transport accessibility	5*	0.69%	Pol 01 Impact of refrigerants	3	0.76%
Tra 02 Proximity to amenities	2*	0.69%	Pol 02 NOx emissions	3*	0.76%
Tra 03 Cyclist facilities	3*	0.69%	Pol 03 Surface water run-off	5	0.76%
Tra 04 Maximum car parking capacity	2*	0.69%	Pol 04 Reduction of night time light pollution	1	0.76%
Tra 05 Travel plan	1	0.69%	Pol 05 Reduction of noise pollution	1	0.76%
Water	**9**	**7%**	-	-	-
Wat 01 Water consumption	MG 5	0.77%	-	-	-
Wat 02 Water monitoring	MG 1	0.77%	-	-	-
Wat 03 Water leak detection	2	0.77%	-	-	-
Wat 04 Water efficient equipment	1	0.77%	-	-	-

Notes to table:
The above figures are based on the 2014 BREEAM UK New Construction Manual for non-domestic buildings. The weightings for each category are based on the building being fully fitted.
*Number of credits dependant on building type
Credit required as a minimum standard at the following levels:
MP = pass, MG = good, MVG = very good, ME = excellent, MO = outstanding.

Additional BREEAM (innovation) Credits	Available	Weighting
Man 03 Responsible construction practices	1	1.0%
Man 05 Aftercare	1	1.0%
Hea 01 Visual comfort	1	1.0%
Hea 02 Indoor air quality	1	1.0%

Ene 01 Reduction of energy use and carbon emissions	1	1.0%
Wat 01 Water consumption	1	1.0%
Mat 01 Life cycle impacts	1	1.0%
Mat 03 Responsible sourcing of materials	1	1.0%
Wst 01 Construction site waste management	1	1.0%
Wst 02 Recycled aggregates	1	1.0%
Wst 05 Adaptation to climate change	1	1.0%
Note: Only a maximum of 10 credits can be awarded, from the above list, per assessment.		

Summary

BREEAM comprises 9 categories each of them dealing with a specific part of the construction process. Under each category is a series of credits related to issues within that category. Each of these categories has different environmental weightings for example under a fully fitted building assessment Energy has a weighting of 15% while Water only has a weighting of 7%. In addition to this each category has a different number of credits available for example; under Energy 31 credits are available whereas under Water only 9 credits are available. When the category weighting is divided by the number of credits available in that category an individual credit weighting can be found. For example; Energy has a total of 31 credits with a weighting of 15%, therefore 15/31 = 0.48%, Water has a total of 9 credits with a category weighting of 7%, therefore 7/9 = 0.77%. It can be seen, from the above calculation that Energy has a higher category weighting than Water but the individual credit value is less.

Throughout the assessment minimum credits must be achieved for the assessment to be completed. In addition to this there are also innovation credits that are awarded for either going above and beyond a credit requirement, or by submitting an application for your own innovative solution. There are a possible 10 further innovation credits available in addition to the standard assessment.

Once the number of credits achieved for each category has been established the weightings can be applied giving an overall category score.

A worked example of the credit rating is given below:

Table 2.5 Worked example of credit rating

Category	Credits available	Credits achieved	% achieved	Category weighting	Category score
Energy	31	20	64.5%	0.15	9.67%
Water	9	6	66.6%	0.07	4.66%
Innovation	10	1	10%	0.10	1%

At the end of the assessment each of the category scores are added together giving an overall score for the building. This is applied to a rating scale to establish a rating for the building:

BREEAM Rating	% score
OUTSTANDING	≥ 85
EXCELLENT	≥ 70
VERY GOOD	≥ 55
GOOD	≥ 45
PASS	≥ 30
UNCLASSIFIED	< 30

Information in the above table as of October 2015

BREEAM has evolved alongside other major climate change legislation as demonstrated in table 2.6 below with table 2.7 showing the UK's current position in relation to climate change.

Table 2.6 Connection with other environmental legislation

1997	Kyoto Protocol adopted	The first documentation to be published in 1990 was BREEAM 1/90 for offices
	First UK climate change targets announced	An industrial version of BREEAM was launched in 1991 Retail version published in 1993.
2006	UK Climate Change Programme published	Further updates
	Stern Review	
2008	UK Climate Change Act	Major BREEAM update
	Reduction targets and carbon budgets announced Launch of Renewable Transport Fuels Obligation Launch of Department of Energy and Climate Change Formation of the Climate Change Committee (CCC)	Mandatory Post Construction Review (PCR) Minimum standards introduced from VG onwards. Innovation credits introduced.

		International versions launched.
2009	Low Carbon Transition Plan published including Department for Transport's Low Carbon Transport strategy to 'decarbonise' road and rail by 2050	BREEAM-In-Use introduced
	Defra voluntary guidelines for greenhouse gas recording and reporting published	
2010	CRC Energy Efficiency Scheme started	Minor changes
	DfT Transport Carbon Reduction Delivery Plan published Defra's review of the value of greenhouse gas emissions recording and reporting published Specific voluntary guidelines for freight on recording and reporting greenhouse gas emissions launched	
2011	Changes made to the CRC Energy Efficiency Scheme	Major overhaul
	Government consults on mandatory greenhouse gas reporting obligations Government adopts CCC's Fourth Carbon Budget (2023–2027) Coalition Government publishes Carbon Plan with targets for all governmental departments	All schemes brought together under two documents; New Construction & Extensions and Refurbishments.
2012	Aviation included in EU Emissions Trading System	
	Mandatory greenhouse gas reporting obligations could be introduced DfT to review freight's contribution to reducing carbon emissions from transport End of First Carbon Budget CCC recommends that UK incorporates international aviation and shipping into reduction targets EU consults on introducing a tax or carbon scheme to curb shipping emissions Government to review CRC Energy Efficiency Scheme	Further revisions.

	UK bioenergy strategy published Green Deal starts	
2016	Paris Accord came in to force 2016	New version
	Keep global temperature rise this century well below 2 degrees Celsius above pre-industrial levels.	New version of the New Construction manual with more stringent requirements. *Proposed change for 2018 includes a new stage between design and post construction to address the performance gap.

*Adapted from the FTA briefing note on UK climate change policy and legislation (Freight Transport Association, 2012)

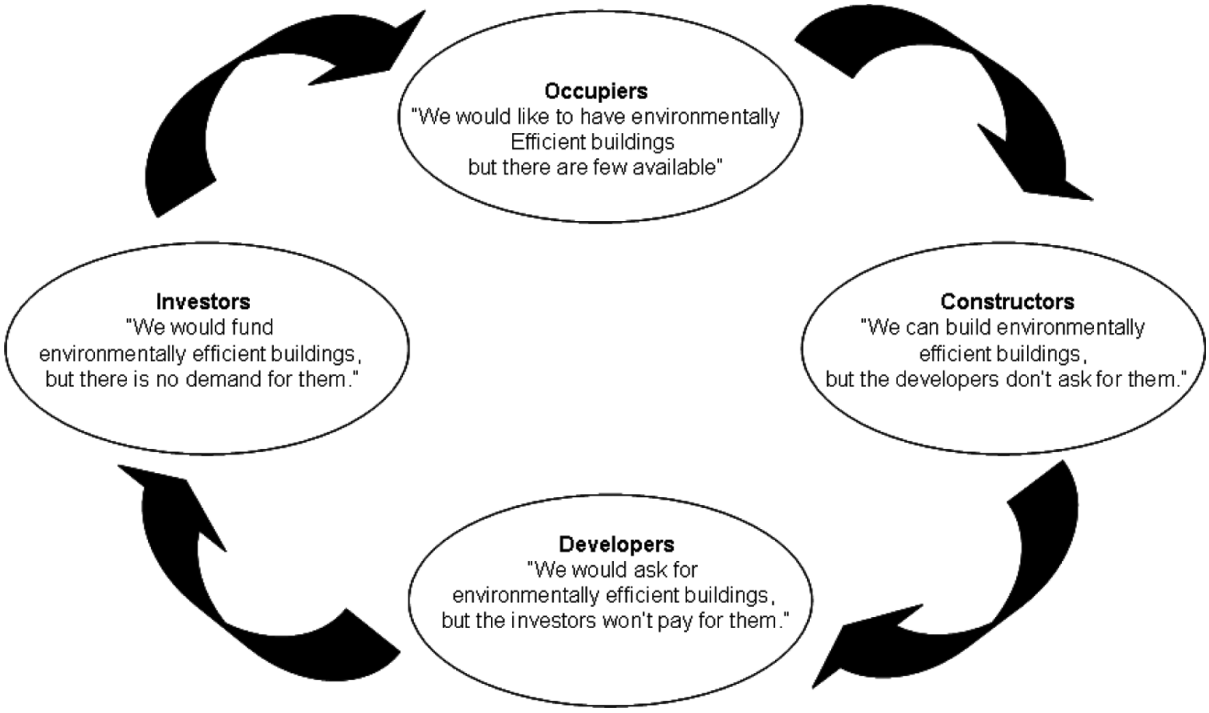
Table 2.6 above demonstrates the gradual changes of BREEAM over time, however, some 20 years later and only now is the 'performance gap' attempting to be addressed. This is against the backdrop of a UK Government consumed by Brexit and failing to meet their climate change targets through weak policies Harrabin, (2017). One could suggest that BREEAM is merely following the pattern of the UK Government with resistance to fully embracing those measures needed to avoid a crisis in the future. Occupation of buildings is arguably a substantial element of the future sustainability conundrum. The fact that the UK is set to miss 2020 targets of reducing greenhouse gas emissions along with a host of other environmental targets Carbonbrief.org (2019), demonstrates that 20 years of BREEAM still is not having the desired effect. Section 2.8 will explore some of these barriers that appear to impede the benefits of BREEAM.

Table 2.7 UK's current position on climate change

Regulation	Target	Current UK position
Climate Change Act 2019	At least 100% reduction in greenhouse gas emissions by 2050 based on 1990 levels 5 yearly carbon budgets	UK emissions were 44% below 1990 levels in 2018. The first (2008-12) and the second carbon budget (2013-17) have been met and the UK is on track to meet the third (2018-22) carbon budget, but is not on track to meet the fourth, which covers the period 2023-27 and not on track to meet the Fifth Carbon Budget (2028-32) (CCC, 2019)

2.8 Barriers to BREEAM

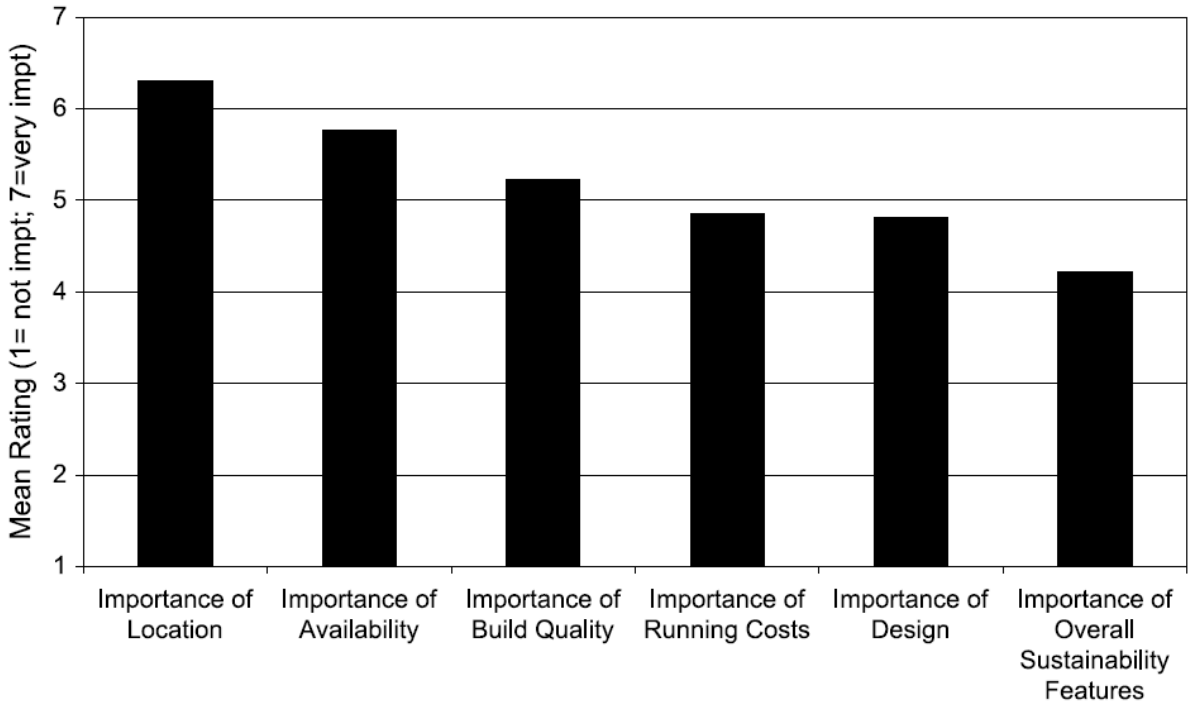
According to Dixon et al (2009) early criticisms from occupiers hinged around a lack of sustainable properties available in the market, thereby suggesting that occupiers could not rent, or purchase sustainable buildings and drive the initiative forward. Therefore, the barrier to sustainable buildings lies with the contractor. Dixon et al (2009) have cited Cadman's circle of blame which highlights the views put forward by the four main stakeholders, from the built environment, as a potential barrier to improving sustainable building stock shown in fig 2.2. As time goes on more and more sustainable buildings are entering the market, however, this research suggests that the real issue is that a myriad of occupiers does not know how to use them properly to get the optimum benefit expected with a sustainable building.



(Adapted from Cadman and cited in Dixon, Ennis-Reynolds, Roberts, and Sims (2009))

Fig 2.2 Circle of Blame

Holmes and Hudson (2001) suggest that Tenants taking on new buildings seldom consider BREEAM ratings during their decision-making process and do not connect BREEAM with the internal environment, even though internal environment is a high priority. Fig 2.3 taken from Dixons study, demonstrates that buildings with sustainability features score fairly low amongst occupiers, however the irony is that the categories scoring high are part of a buildings overall environment credentials. Goode and Xiao (2012) found in their study that BREEAM is not widely used in SME projects mainly due to cost and complexities of implementing BREEAM on small projects and discourages clients from embracing the assessment process.



Taken from Dixon et al. (2009)

Fig 2.3 Measure on Importance when considering new Commercial Premises

The complexities can range from the different schemes such as office, retail and bespoke; the number of categories; the number of credits, and in addition the detailed level of compliance required for each credit. As highlighted in the introduction to this chapter sustainability is complex enough at a meta-level with terminology used interchangeably. Negotiating a complex bureaucratic process can be cumbersome for the assessor, design team and most of all the client. Aspinal et al., (2012) also found that manuals were thought to be too subjective and ambiguous which led to inconsistent judgments by BREEAM assessors. The manuals attempt to standardise a complex system as much as possible with the majority of credits applying across the schemes. However, not all building is the same and they cannot be standardised to such a level as some buildings can demonstrate a sustainable attribute that is not accounted for. To overcome this obstacle BREEAM introduced innovation credits, but Aspinal et al., (2012) found in their study that some BRE assessors do not have the experience to recognise true sustainable innovation and that the whole process has become too much of a box ticking exercise.

A further criticism of BREEAM, and wider assessment frameworks, is the box ticking or point-chasing mentality. This is widely documented and argued by Aspinal et al. (2012),

Schweber (2013) and Seghier, Wah, Ahmad, and Samuel (2017) to name a few. The issue with this mentality is twofold, firstly consideration towards those areas that can help end users change their behaviour are often overlooked because a particular credit costs too much or involves too much work. Secondly, a credit by credit assessment limits designers to view the building holistically as an entity instead of a collection of credits that are sought after to get to a required rating. In reality some of the credits sought during the assessment serve no practical purpose to the users. Haroglu, (2012) also picked up on this by suggesting BREEAM might limit the design team, by drawing their attention to achieving BREEAM credits rather than assessing the building in its entirety. Most assessment frameworks have 'quick wins' which are essentially those credits that are easier to achieve both in practical and economic terms where decisions are made on behalf of the users, however, it is the users who have to live with the ramifications.

The overall custodian of BREEAM assessments seems to be vacant with each gear focusing on their point but nobody looking at the wheel. Several stakeholders are required to procure a building with the addition of a BREEAM rating. All of them have a role to play and the decision makers of those areas can be classified as; the client; the design team; the contractor; the occupier and the BREEAM assessor. Clients, in many cases generally have a project manager to oversee the works. Some clients will want to achieve a certain rating and do not really understand or want to know about the detail. Generally, project managers will see this target through on behalf of their client. The design team, along with the BREEAM assessor, will identify which credits are achievable usually in a hierarchical fashion with the least expensive and most workable usually identified first. The contractor will then try to execute the works incorporating all the credit requirements to achieve compliance. It has been suggested by Diamond, (2011) and Schweber, (2013) that the system is inflexible and making it more flexible and user-friendly could encourage more buildings, particularly those of SME status, to go through the process voluntarily.

2.9 Drivers of BREEAM assessments

In 2012 James Parker (a BREEAM assessor), in association with Schnieder Electronic and BISRA, published a report into the value of BREEAM. The study comprised 49 face to face and telephone interviews with a range of client organisations from both public and

commercial sectors. Of the 49 mixed phone and face to face interviews only 8 of them were conducted with owner occupiers. Of the 49 interviews, 21 of the interviewees were responding in relation to the offices scheme. The purpose of the report was to garner views and opinion from a range of construction industry stakeholders and sectors. 'Most of those interviewed had experience of multi BREEAM assessments' Parker, (2012). The report concluded on four main areas; namely **value**, where most of recipients agreed that BREEAM is a good thing, BREEAM has been very useful as an industry driver for **sustainability**, the **in-use benefits** of comfort and satisfaction for building occupants, and finally the importance of starting the process **early**. According to the report, the benefits of BREEAM include a good PR tool, the minimisation of construction waste and the environmental benefits of the land use and ecology credits. However, the report suggests that the strongest aspect of BREEAM is the social benefits. Of the respondents, around 27% said that there was improved employer retention; around 37% said that there was improved employee production, and around 60% said that there was improved occupant satisfaction and comfort respectively. Apart from the eight owner occupiers, it is unclear how many of the respondents were tenants of the properties, who are the direct recipients of specific in-use credits.

The report also identifies some negatives point in relation to credit chasing and badging as already highlighted. The report also concludes that as the BREEAM rating increases, so do the number of credits achieved in the health and wellbeing categories. This is a fairly standard conclusion as you need to obtain at least 62 credits to achieve the higher rating, therefore, the HEA credits would have to be targeted anyway. However, if these buildings had not been BREEAM rated and instead employed good design principles, suitable lighting, appropriate air-conditioning and a reasonable level of control over one's workspace, would the occupiers be just as happy? The report also asks what the drivers were for achieving higher ratings. Some of the responses included '*to raise the bar*', *a landlord strategy and it is good for marketing the building*', '*rental values will increase*', and '*to improve and build on what we have*' Parker, (2012). There is no doubt that some stakeholders will seek a BREEAM assessment for the above reasons, however, by far the main drivers identified through this literature review appear to be Planning, funding and corporate social responsibility (CSR). Parker (2012) does allude to these and Barlow (2011) also cites these as the main drivers of BREEAM. Each of these drivers can adversely influence the BREEAM assessment process and in turn become a barrier. This is explained in much detail below.

2.9.1 Planning

Previous Governments have been active in rewriting Planning guidance to incorporate sustainability at a strategic level but little in the way of building level. Most Governments, particularly conservative, will be inclined to leave this to market forces Holmes & Hudson, (2001). The difficulty with this is that it relies on voluntary participation, which is taking too long. The push for sustainable buildings comes from the European Council, Article 5 of the EU directive 2001/42/EC states that:

> *"The adoption of environmental assessment procedures at the planning and programming level should benefit undertakings by providing a more consistent framework in which to operate by the inclusion of the relevant environmental information into decision making. The inclusion of a wider set of factors in decision making should contribute to more sustainable and effective solutions".*
>
> European Parliament and Council of the European Union (2001)

This is incorporated into the National Policy Framework NPF (2019) and is left up to Local Councils, through their Local Plans, to incorporate this at a practical level. Most Councils in England and Wales have done this via CfSH for domestic and BREEAM for commercial. The minimum standards may differ from Council to Council with some requiring a Very Good rating while others require Excellent. A further requirement is gathering of evidence and many Local Authorities have taken this to mean a copy of the BREEAM design stage certificate. A typical condition taken from an anonymous Planning Approval is given below:

> *04. APPROVAL CONDITION -BREEAM Standards (Commercial) Unless otherwise agreed in writing by the Local Planning Authority (LPA), before the development of each building hereby approved commences written documentary evidence demonstrating that the development will achieve a minimum rating of 'Excellent' against the BREEAM (2011) standard shall be submitted to the LPA for its approval. The submission shall take the form of a design stage assessment.*

At this stage it is important to point out two issues with this firstly a design stage certificate does not reflect the product. The design stage certificate could have a rating of 'excellent',

however, the post construction certificate could have a rating of 'good' as some credits have been too difficult to achieve and therefore dropped during construction. This probably does not give an accurate reflection of the sustainability status of buildings in each Borough. Secondly BREEAM can be a condition of most Planning Applications, L. Schweber. (2013) highlights that these are generally publicly funded projects and suggests large segments of the construction industry can and do ignore BREEAM. Schweber goes on to identify 'sustainably minded professionals' who reject the adequacy of BREEAM as a way of genuinely achieving sustainability. This could give some reasoning behind why some developments put more emphasis on the rating rather than the process and what is genuinely the best credits for the building in use. With a lack of faith in the system itself the primary goal becomes the target set by Planning regardless of how it is achieved. This importance of this, however, is that this is a crucial stage where decisions are made that can affect occupiers for years after the development is completed.

2.9.2 Funding

BREEAM in the commercial arena can prove to be a costly addition. In 2014 BRE and the Sweet group carried out a joint exercise on the potential percentage uplift on ratings from pass to very good based on an office building.

Table 2.8 Approximate costs of BREEAM

BREEAM Rating	BREEAM version used in capital cost study		
	2004	2008	2011
Pass	0.0.	-	0.0
Good	0.0	-	0.05 – 0.15
Very Good	0.2	0.7	0.13 – 0.34
Excellent	0.1 – 5.7	0.77	0.87 – 1.71

(BRE:*Delivering Sustainable Building 2014*)

For example, a £2m build cost can increase by £34,200 if an excellent rating is sought after, therefore, funding streams for BREEAM are necessary if more clients are to voluntarily take it up. Various bodies offer funding such as: Skills Funding Agency who require excellent for new build and very good for refurbishment; the same with Department of Education in Northern Ireland; and the Scottish Funding Council who require excellent Parker, (2012). There are many others and, in the main, they hinge around public sector organisations.

However, there are some funding streams available to the private sector such as the European Regional Development Agency (ERDA). Minimum BREEAM ratings are still required, but this is usually dependant on the area and sector as oppose to a blanket rating for everything.

Funding as a driver may encourage clients to utilise BREEAM who previously may not have. However, the unintended consequence of this is similar to Planning in the sense that all the focus and attention is now of getting a specific rating to secure the funding. Again, this can result in a blinkered approach to the whole building and encourage credit chasing.

2.9.3 Corporate Social Responsibility

Having a good CSR image in today's market is essential and many large corporations will have a CSR policy, for example M&S have their 'Plan A'. The principles behind a CSR policy can companies to focus on environmental and social issues alongside economic profit. This was identified earlier in section 2.3 as the triple bottom line, or the 3Ps Planet, People, and Profit, therefore, the motivation behind a CSR is genuine. However, the badge becomes more important than the purpose. This was highlighted by Holmes and Hudson (2001) where a BREEAM rating is incorporated into their buildings in the hope that this 'badge of honour' will differentiate their buildings in the marketplace. However, the assessment is then in danger of focusing too much on the higher rating that this becomes a credit chasing exercise. Success is placed on the rating of the building and not the wellbeing of the occupants in use.

Table 2.9 Drivers and Barriers of BREEAM

The following table is the researchers endeavour to consolidation of the issues identified above, as drivers can very quickly become barriers if initiated for the wrong reason.

Driver	Reason	Barrier	Reason
Planning	Most Local Authorities require commercial developments to acquire an excellent rating, therefore, many of these developments would probably not pursue a BREEAM excellent rating. This has helped create a	Planning	Because Planning request commercial developments to acquire an excellent rating, most developers see this as something they just need to get as part of the process. This can lead to limited consideration on credit choice with the design team

Driver	Reason	Barrier	Reason
	market and push the agenda forward.		targeting ‘low hanging fruit’. These are credits that are not necessarily the best for the development, but the easiest and cheapest to achieve.
Funding	The prospect of additional funding when undertaking developments is an advantage. Therefore, most development will add sustainable building into the mix. The development will now have to achieve a BREEAM rating, which previously may not have considered, therefore, as with Planning, this can help drive the agenda forward.	Funding	As with Planning funding can also be a barrier as developers with will apply for funding in return for a rated building. Again, the consideration of that rating will focus getting what’s required and not what might be best for the development or wider stakeholders.
CSR	A company’s corporate social responsibility can play a big role in raising profile. Companies that want to be seen as’ leading the way’, or doing the right thing will have a strong CSR that will be prominent	Tick-box	The tick-box mentality of any assessment or benchmark often results in targeting the easy wins first. This issue with this type of assessment is that the wider picture is overlooked. While the design team are busy achieving a particular rating the long-term impact of their decision often is not realised until late in the occupation and tenants are invariably stuck with it at that point.
Badge	A badge can be a driver where companies, especially blue-chip companies, always want to be the ‘best in class’ so this will inevitably drive the BREEAM agenda forward.	Badge	As with funding and tick-boxing, the need to obtain a badge can lead to achieving and endpoint without considering the journey, or the long-term impact. The badge becomes more important than the cause.
		Inflexible framework	This does not necessarily act as a barrier to engaging a BREEAM assessment, however, it does appear to have an effect on how a design team will engage with the process. If something is perceived as too difficult to

Driver	Reason	Barrier	Reason
			achieve and not worth the payback then it will usually be disregarded. Also, the 'payback' is generally measured in in economic terms rather than possible benefits to the tenant.
		Credit chasing	Again, this is similar to tick-box as easy credits are targeted without much thought on their future impact on the tenant.

2.10 In-use Issues with BREEAM

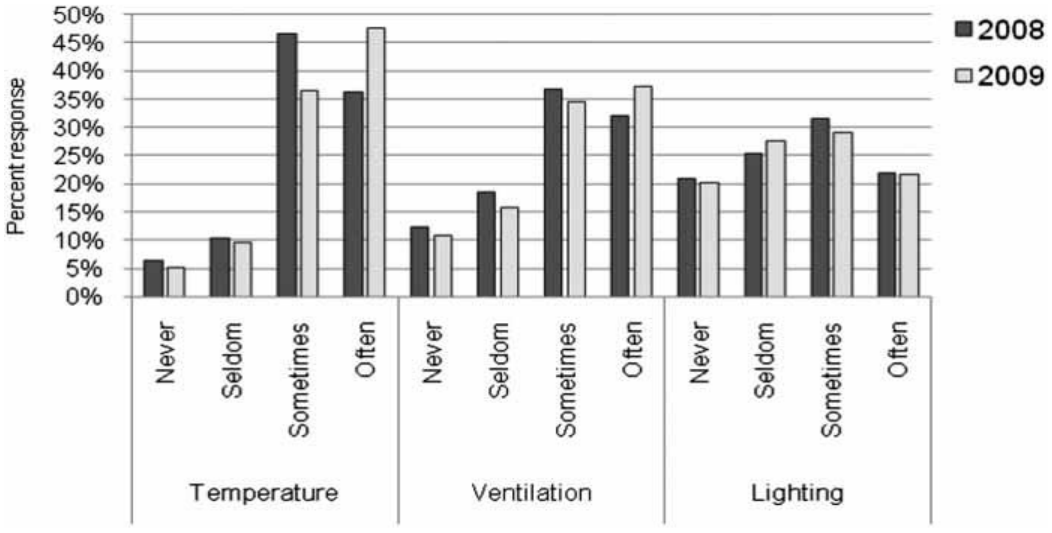
The areas identified above can be classified as either a driver and/or a barrier to fully embracing the benefits of BREEAM. However, when BREEAM is scrutinised on a credit level further recurring issues appear, some of which are a direct result of the areas identified above. The issues that appear to be causing the most discomfort amongst users are discussed below.

During 2005 to 2007 George Baird carried out an international study of 31 buildings to gauge occupant satisfaction against several indicators such as operational, environmental, and personal control. Some of these buildings were assessed using an environmental system such as BREEAM, LEED and CASBEE. However, this research is only interested in the buildings reviewed in the UK where the climate is classed as moderate. Six well-known buildings were reviewed including City Hall in London, the Eden Project in Cornwall, and the University of East Anglia. Of the six UK buildings two of them had undergone a BREEAM assessment. The study used BUS (Building Use Studies) methodology as a benchmark, from 2004 and 2006, then measured each building against those criteria. The results of the study show that by and large there was an improvement from the benchmark, however, several categories scored worse. For example, City Hall in London and ZICER Building in Norwich scored worse on control factors and lighting. Renewable Energy Systems (RES) Building in Kings Langley also scored poorly on control. All these buildings were built with sustainability in mind, and ironically many of these designs won several sustainability awards. However,

there is still a significant level of user dissatisfaction, in particular the inability to personally control heating, cooling, ventilation, lighting, and noise.

According to Holmes & Hudson (2001) Ventilation and Heating are one of the biggest areas of dissatisfaction with occupants regularly complaining about internal environment. By far the biggest area of concern that appears to be the catalyst for some of these in-use issues is a mix between complex controls and a lack of control over an individual's environment. This links in with the findings in Baird's study of 2007. Frustration is borne out of an unhappy environment without the ability to change the parameters and improve the situation. This is illustrated in fig 2.4 below and taken from the Monfared study. Occupants were asked over a 12-month period 'is the fact that you do not have any direct control over temperature, ventilation, and lighting, an issue for you'. They were asked using a lickert scale of never, seldom, sometimes, and often. The graph in fig 2.4 demonstrates that the lack of control gets worse over time, from 2008 to 2009, with users possibly becoming more frustrated with their lack of control. This is particularly prevalent with the heating and cooling possibly down to the environment being uncomfortable and users not being able to change the situation.

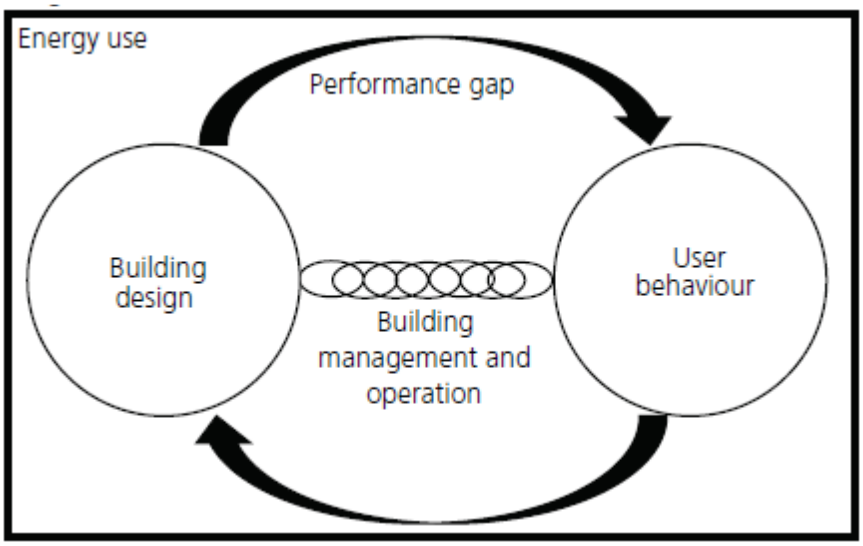
Fig 2.4 Lack of Control



Monfared, (2011).

BREEAM credits are selected during the design stage of any building and the rating required will depend on how many credits are selected. A rating of excellent, i.e., above 70 will require a substantial number of credits from each category. It is highly likely that the majority of credit under the Health & Wellbeing category will have to be achieved as part of

the rating. These credits include the potential for natural ventilation, thermal comfort, thermal zoning, visual comfort, and lighting zones. This means that the building allows adequate natural ventilation, modelling of the building to demonstrate that comfort levels are achieved, and zoning banks of tables to allow overall (not individual) occupant control over a large floor area. All these features have an element of automation. However, the results of the Monfared study show that occupants are not content with the limited level of control over their workspace. Moreover, the level of dissatisfaction with the lack of personal control gets worse over time, using 12 months as a timeline for the study. As highlighted earlier in section 2.6 this can fall under a phenomenon called the performance gap, this is further demonstrated in fig 2.5 below.



The devised non-domestic energy efficiency performance gap (nDeep) model

Fig 2.5 Graphical Representation of the Performance Gap

The organisational structure and culture influence how occupants and a building interact. An appraisal of the organisation undertaken at the design stage, including their current practices and how the building will be managed, is one element that will aid a more realistic prediction of energy use Robinson, Taylor, & Foxon, (2016). On the other hand, the highly technical character of the credit definitions, the aggregation of radically different types of elements and associated measures into a single score, and the bureaucratic complexity of the method precludes a clear message Schweber, (2013). The researcher highlighted earlier the complexities with sustainability, environment, and energy efficiency just from a lay

perspective and this is before you include the complexities of BREEAM. Generally, a design team comprising a contractor, quantity surveyors, project manager, BREEAM assessor and engineer will negotiate the various credits. To bring these credits to fruition can be a lengthy process resulting in several approval processes and numerous changes to the design and, in some cases, the construction. Design teams do this work daily, however, Tenants and some Landlords do not which can be a technically challenging for them just to negotiate the process. This often results in impulsive decisions that can result in consequences for building users that often require modification further down the line. Holmes and Hudson (2012), noticed in their study that the day to day running of these buildings is often in the hands of non-technical managers, they are interested in the buildings and quality of environment provided for their occupants but lack the technical expertise to make the most of the features of the building. In some cases, the day to day running of the building can be outsourced wholesale.

The 'simple building user guide' has a real role in these instances and has the potential, if well written, to be a vehicle for continuous environmental enhancement, particularly in the use of energy, water metering & recycling. This is already a feature of BREEAM but does not appear to cut through with users. This indicates that management have a clear role to play in embedding the guide and ensuring that all occupants know where to find it and understand its contents, and more importantly can add to this as a working document. This needs to become the ownership of the users and not something that sits in the top drawer of a facilities manager.

2.11 Impact of BREEAM on Occupants

The sustainability of buildings should be addressed once they are occupied by either the building owner or occupier. More needs to be done to ensure that once constructed buildings are being operated in the most sustainable manner as much of the energy consumed by buildings are related to the occupation and operation stage. Aspinal et al., (2012). Post Occupancy Evaluations are a useful tool to identify issues during occupation, however, a plethora of issues relating to heating, cooling, lighting and loss of control seems to be prevalent with occupants of buildings that have been graded against an environmental

system. The areas discussed below are a combination of issues taken from the pilot study and credits directly measured under BREEAM.

Visual Comfort

Visual comfort is not just about having a view out of a window, as many buildings that's not practical given their size, shape and location. Visual comfort also links with glare and solar gains resulting in an uncomfortable environment. In practical terms, these issued should not exist in a BREEAM building that can achieve most of the health and wellbeing credits as these points are specifically addressed in the assessment. However, some of these issues were raised in the literature, in particular Holmes & Hudson, (2001), Tetlow, (2012), and Faser & Sewell (2019) therefore, is it logical to assume that a BREEAM assessment alone does not guarantee good environmental conditions?

Noise penetration

Noisy environments are not conducive to a person's health and wellbeing, particularly in an office environment where concentration is required, and clients frequently visit. This is an issue gaining traction and is a major cause of disruption and dissatisfaction to the working day. This issue was also identified by Holmes & Hudson, (2001) in their study where the issue if noise was raised frequently. Noise penetration is not measured by BREEAM for offices; however, this is something that designers, contractors and facilities managers should include as part of any new building, adaptation or refurbishment. However, one of the flaws of BREEAM and the wider construction process is that facilities managers, or occupiers seldom get involved at design stage and therefore cannot affect change until it is too late. The researcher believes that noise penetration should form part of BREEAM and will be included in the framework of this study.

Air-conditioning

Air-conditioning can be in many different forms encompassing either heating, or comfort cooling, or both. True air-conditioning, or more commonly known as HVAC (Heating Ventilation and Air Conditioning), controls the whole internal environment even allowing a fresh air intake to be distributed around the building without opening the windows. However, many buildings just have a combination of this, and it is usually distributed via cassettes positioned flush with the ceiling and have four outlets know as fan coil units and were present in both the pilot and the case study buildings. Both of these studies initially identified issue

with the air-conditioning. In the study conducted by Holmes & Hudson, (2012) a number of key stakeholders were asked for their opinions on the air-conditioning from developers to occupiers and responses included, from the occupants "*ventilation one of the biggest areas for dissatisfaction*", however, the developer believed that a "*BREEAM assessments create a good working environment*". Again, this is an example of the disconnect between the design team's perspective of BREEAM and the occupiers lived experience. The design did also mention that there is an "*element of tokenism*" and BREEAM.

Thermal comfort

Under BREEAM credits are achieved for undertaking a thermal model of the building in accordance with CIBSE AM11 Building Energy and Environmental Modelling. This is based on pre-set data and carried out during the design stage, therefore, actual seating plans for the building can be used but these can change during the design process after the assessment has been carried out. If modelling is carried out at the start of the project several variations can take, please rendering the model out of date. As long as the model has been done and the evidence passed to BREEAM that the temperature parameters meet that in the guide then very little further information is required. Again, this was picked up by Holmes & Hudson, (2012) in their study where most of the buildings they had visited had problems with thermal comfort, this was also a feature in the Faser & Sewell (2019) study. The thermal modelling credit had been achieved under BREEAM in many of the buildings but did not identify any problems the researchers has encountered in practice by asking the occupants. They did identify one building where the model requested solar binds, but these had been omitted in practice due to the cost. The researcher also found this issue with the pilot study whereby credits were traded or just omitted due to cost and replaced with inappropriate credits that were not a benefit to the building. This situation becomes more problematic with SME's (Small and Medium Enterprises) also highlighted by Goode & Xiao, (2012) in their study where they concluded that BREEAM assessments can be expensive and time consuming for smaller projects.

Thermal Zoning

Under BREEAM credits can be awarded for zoning either lighting or heating and cooling. In the case heating and cooling, banks of desks are arranged into zones of 4, 6, 8 and so on allowing those zones to be separately controlled. The same set up happens with lighting where they are arranged in banks. Over large floor plates these credits enable individual

areas to have separate controls to the rest of the floor plate, therefore, in theory this should compensate for areas that require different temperatures or lighting. However, in practice this has not been the case as seating arrangements seldom mirror the heating, cooling or lighting layouts. This must be considered alongside glare, openable windows, daylight levels and lighting levels as all of these can impact on an individual's workspace experience. This literature review has already identified a general negativity towards green building features but add to this the increasing level of complex controls. A study by Cohen et al. (2001) has shown that the actual performance of buildings is compromised by the complexity of the systems built into them and that the environmental success of a building depends on matching technological and management sophistication.

Loss of control

BREEAM has a very strong emphasis on automation for lighting and services. On a basic level the intention behind this is to ensure that lighting and the like are not unnecessarily left on during the day or overnight, therefore, the purpose behind this is laudable. However, little research had been carried out, at the time of the literature review, on how building users interact with the building. A building user's lack of control over their own workspace is now emerging aa a real issue. A study carried out by Sergio Altomonte, (2017) measured two buildings over time, one BREEAM and one non-BREEAM. Users who spent over 24 months in their BREEAM-certified building and workspace expressed statistically significant and practically relevant lower satisfaction with their workspace and with several IEQ categories than occupants of non-BREEAM buildings. This suggests the longer you spend in the building the more unsatisfied (12 months for this building users still relatively happy but issues starting to show). Sergio Altomonte, (2017) also identified that no statistically significant differences in satisfaction between BREEAM and non-BREEAM offices were detected for users who had only recently (0–6 months) moved to their workspace. Pairing of occupants' responses with physical measurements led to infer that lower satisfaction in BREEAM buildings, particularly in open workspaces, might be associated with a perceived lack of control over the luminous, aural and thermal environments.

This study is also in line with a study carried out by Lindsey, J et al, (2012) which identified, across 15 buildings, significantly more negative impressions of their office building as the number of green attributes increased. The pilot study also identified some initial issues with

loss of control over ana individual's workspace. This mainly hinged around blinds and glare with occupants unable to control glare with blinds or open windows.

2.11.1 Occupant perception of BREEAM Buildings

What level of understanding, or awareness of BREEAM do occupants really have? Research carried out by Monfared (2011) and Bordass, (2004), suggests that the perception users have of BREEAM is a better environment, more energy efficient and that they are more forgiving. However, both Sergio (2017) and Lindsey (2012) have both identified that users have negative impressions of green buildings and that this seems to get worse with more green features and over time. A BREEAM assessment alone does not guarantee good environmental conditions Holmes & Hudson, (2012). Clearly there is a disconnect between perception versus expectation, as the consensus of BREEAM buildings is positive. However, as research has demonstrated, in particular Monfared (2011), users who occupy BREEAM building are less than satisfied. Holmes & Hudson, (2012) suggest that BREEAM needs to have more involvement on performance in use.

2.11.2 User behaviour theories

If the perceptions of the building can be influenced, then the behaviour can equally be influenced. An analysis of user behaviour is beyond the scope of this research. However, the following theories do tie in with this study such as habit forming and nudge theory:

- **Habit** – According to Atomic Habits James Clear (2018) there are 4 stages to forming a habit; cue, craving, response & reward, this is termed the habit loop.

Habit could work with recycling as follows:

- Cue – send out email from manager.
- Craving – you want to learn the contents of the email.
- Response – you learn who has recycled the most in your department.

- Reward – you satisfy your craving by finding out who, not you; craving satisfied until next time; craving satisfied by winning and having your name circulated around head office.

Through reward good behaviours can be created, however this is only one part of the conundrum.

1. there must be enough credence & energy given to such a system by high level management. Building users must find that this is important to their peers and not simply lip service.
2. of course, such systems need to be designed properly and with assistance of a psychologist. This is really an illustration of how this could work.

Rewards must be achievable.

Nudge Theory – was put together by Cass Sustain & Richard Thaler. The premise of nudge is that we make decisions daily through heretics and if we are nudged into a different way of thinking, we could make better choices.

An example of how nudge could work is by putting information outside a lift on lower floors saying how many calories you could burn by taking the stairs instead of the lift. This can nudge someone into taking the stairs because it is healthier, when in fact taking the stairs save energy by nit using the lift. Although that message alone probably is not strong enough, this could link with habit forming by creating a cue initially.

Table 2.10 Issues highlighted in the literature review

In-use issues	Barriers and Drivers
Visual comfort	Planning
Air-conditioning	Funding
Noise penetration	CSR
Lack of control	Tick-box
Recycling habits	Credit chasing
Poor internal layout	Badge
	Inflexible framework

The table above consolidates some of the issues identified in the literature review thus far. These range from in-use experience of BREEAM to issues around initial inception and the design team 'management' and 'decision making' of the BREEAM process.

2.12 Chapter Synopsis

This chapter is set out to demystify the confusion around the Environment, Green & Sustainability agenda. In doing so the researcher has sought to present the wider issues whilst filtering down & focusing on BREEAM exclusively. Issues surrounding, the practical implementation have been discussed and collated as these will form the basis of research design, discussed in the following chapter.

This chapter has highlighted some of the issues around BREEAM that will form the bases of the case study and the foundation of the framework. The chapter also set out to answer the first two objectives of the study:

1. Establish the purpose of BREEAM, in relation to commercial building refurbishments, within the wider sphere of the sustainability agenda.

This has been demonstrated throughout the literature by discussing the nexus between climate change, environment, and sustainability. The literature review has identified the wider climate concerns on a global level through the Kyoto Protocol and how the European Union have dealt with this through a series of EU directives. This has in turn been embedded into the UK, as a member state, through the Climate Change Act. As BREEAM is voluntary this has sat alongside the evolving climate change legislation and entrenched key parts of the legislation into their assessments. One criticism highlighted in the literature is the length of time that BREEAM has been in existence without demonstrable reduction in the UK's climate change targets.

2. Identify a range of factors affecting users in BREEAM certified buildings.

The literature review has also emphasised several factors that have the potential to affect the implementation of BREEAM. This includes issues around the drivers for BREEAM such as

funding and planning which are essentially a good thing as more building now have environmental credentials than previous. However, this is also a negative and can result in credit chasing and badging. The literature review also identified a range of in-use factors such as loss of personal control, noise, air-conditioning, and automation. This will feed into the methodology discussed in the following chapter.

Chapter 3: Research Methodology

3.0 Introduction

> *'Research methodology is the theory of how research should be undertaken, including the theoretical and philosophical assumptions upon which research is based and the implications of these for the method or methods adopted'*
>
> (Saunders, et al, 2009, p. 595).

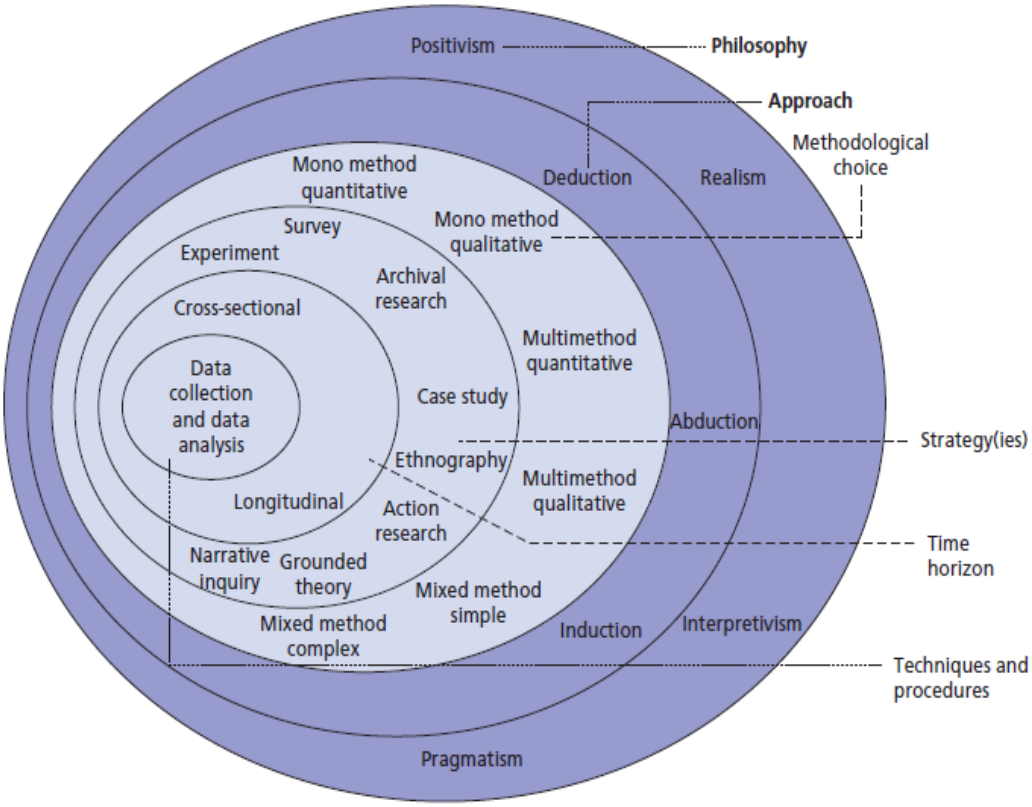
The following chapter will discuss the methodology adopted for this piece of research. This will begin by presenting the philosophical assumptions underpinning the methodology, before setting out the research process including the data collection methods adopted for both the pilot study and the case study.

3.1 Research Philosophy

The research philosophy adopted is important as this will underpin and shape the focus and direction of the research being undertaken. The terminology for describing philosophical positions is interchangeable, for example Creswell, (2014), terms philosophy as '*worldviews'*, (Crotty, 1998) '*ontologies* and *epistemologies'*, Dawson, (2011) refers to '*paradigms'*, and (Kumar, 2011) uses '*methodologies'*. The use of interchangeable terminology can be confusing, particularly when trying to assess where research sits on the continuum. However, all research is based on assumptions or common beliefs about how the world is perceived. The researcher understands this to be the meaning of paradigm, which is essentially a way of explaining a basic set of beliefs. Guba, (1990) suggests that research paradigms can be categorised by their ontological or epistemological stance:

- Ontology – what is reality?
- Epistemology – how do you know something?
- Methodology – how are you going to find out about it?

The impact that an ontological and epistemological approach has on the overall research strategy is shown below in fig 3.1 and more widely known as the research onion.



(Taken from Sauders et al 2019)

Fig 3.1 Research Onion

Ontology is the theory of being or how the world is built and has two basic views; firstly, there is a real world that is independent of social actors, this aspect is called objectivism, or secondly, the world is constructed from the perceptions and actions of those social actors, this aspect is called subjectivism. An objective ontology has developed from the natural sciences and takes the view that '*social entities exist in reality external to social actors concerned with their existence*' Saunders et al (2009). If an objective ontology views the world as independent of social actors, then, at the other end of the spectrum, a subjective ontology takes the view '*that social phenomena are created from the perceptions and consequent actions of those social actors concerned with their existence*' Saunders et al (2009).

3.2 Ontological considerations

A researcher with an objective ontology would probably adopt a positivist paradigm. Positivism is concerned with developing and testing hypothesis that try to produce causal

explanations or scientific laws. Positivists usually adopt a quantitative methodology to test the hypothesis, which usually results in numbers that are then analysed for a result. Typical methods include data collection, and analysis techniques comprise experiments, highly structured large surveys, measurement, and statistical analysis. Researchers with a subjective ontology are likely to adopt an interpretivist paradigm. Interpretivists are concerned with theoretical knowledge and theory building rather than hypothesis testing and generally adopt a qualitative methodology. Typical data collection comprises interviews, focus groups, and questionnaires.

3.3 Epistemological considerations

Epistemology is derived from the Greek words episteme (knowledge) and logos (reason) Grix (2001). It is the theory of knowledge and what is acceptable knowledge in a particular field of study Saunders et al (2009). A central concern for the social sciences is whether the same principles and practices used for the natural sciences should apply to the social sciences Bryman, (2016). Again, there are two aspects on how research is being conducted they are positivism and social constructionism. Positivism is akin to an objective ontology in the sense that the researcher is independent of what is being observed and, therefore, maintaining objectivity of the data. The other opposing stance to positivism is Social Constructionism whereby the researcher explores the subjective meanings motivating the actions of social actors in order to better understand these actions and follows an interpretivist philosophy. According to Saunders, (2009) there are four dominant paradigms namely: Positivism, Realism, Interpretivism, and Pragmatism summarised in Table below and discussed later.

Table 3.1 Ontological and Epistemological views on all four Paradigms

	Ontology	Epistemology	Date collection technique
Positivism	Researcher is external and independent to what is being observed. Only observed **data** is credible.	Only **phenomena** which is observed can provide credible data. Focuses more on causality.	Highly structured, mainly quantitative using large samples.

	Ontology	Epistemology	Date collection technique
Realism	Still objective and independent of thought or belief but interpreted through social conditioning.	Observable phenomena are insufficient by itself. Focus is on explaining within its context.	Can be quantitative or qualitative depending on the subject.
Interpretivism	Socially constructed.	Subjective, focus is on the situation and the reality behind the details, what motivates actors.	Small samples with in-depth investigations.
Pragmatism	Focuses on the research question and how best to answer it.	Can deal with both observable phenomena and subjective meaning. Highly practical integrating different perspectives.	Can be quantitative or qualitative. Mixed or multiple methods.

Table based on (Saunders, 2009)

Positivism: This is an "epistemological position that advocates the application of the methods of the natural sciences" Bryman, (2016). Only phenomena that can be observed can lead to credible data allowing law like generalisations to be made Saunders, (2009). Due to the law like approach of positivism a limitation is in inflexibility to deal with complexities of social phenomenon.

Realism: This is a belief that reality exists outside of the human mind. Realism has similar features to positivism in the sense that both natural and social sciences should approach data collection and explanation in the same way Bryman, (2016). There are two types of realism, firstly '*empirical*' Bryman (2016), or '*direct*' Saunders (2009) which suggests that what you are seeing is reality through our experience. However, it does not recognise underlining structures or mechanisms producing observable phenomena and is, therefore, superficial Bryman, (2016). The second type of realism is critical realism, usually associated with philosopher Roy Baskar. This view argues that our experience of viewing reality can be skewed and our knowledge of reality is a result of social conditioning Saunders, (2009).

Interpretivism: This differs from realism in the sense that the process of interaction between individuals becomes the main focus of the researcher Creswell, (2014). It is often proposed that interpretivism is a direct contrast to positivism Bryman, (2016). Creswell (2014) suggests that rather than starting with a theory, as would be the case with positivism, researchers

generate or inductively develop a theory or pattern of meaning. There are two branches of interpretivism, namely phenomenology and symbolic interactionism. Phenomenology refers to the way in which humans make sense of the world Saunders, (2009). It is primarily concerned with a person's lived experience and an important feature of phenomenology is 'bracketing' where the researcher must put a bracket around their thoughts and feelings. The primary job of the researcher is not to interpret the experiences but just to receive them and be faithful to the original Denscombe, (2008). However, a limitation of interpretivism is the room for bias given the innate role of the researcher. A further limitation is that results cannot be generalised, as research is more informal and seldom carried out with large numbers.

Pragmatism: Pragmatisms, on the other hand, do not see the opposite ends of positivism and interpretivism but rather a continuum. 'Pragmatism argues that the most important determinant of epistemology and ontology that you adopt is the research question and either a positivist or interpretivist philosophy is adopted depending on what question is being asked Saunders (2009). Strategies such as grounded theory are rooted in pragmatism Denscombe, (2008) as the theory is generated from the data. Therefore, a degree of flexibility is required where the practical rather than the abstract is the focus. A limitation of this approach is often that it focuses on practical results and ignores philosophy and theory McCready (2010).

3.4 Approach to research

3.4.1 How does a paradigm shape the approach taken to research?

This research seeks to understand how occupants are interacting with sustainable buildings and seeks to answer the question 'how does a BREEAM rated building influence the user's behaviour'. The question begins with 'how', which would suggest a more posivitist stance as if the author is trying to find something objective. However, the question ends with behaviour and is more concerned with the thoughts, feelings, and actions of the building user which, initially, is seen as more subjective. Again, as the question focuses on a building, a physical asset, one could also assume that this aligns with positivism. However, the physical entity of the building is not the primary focus. For example, if this study just focused on energy consumption the data collection would certainly include an element of gathering hard

data such as electricity and gas consumption, lighting patterns, bin collection and so on. While this provides substantial accurate data, it does not offer any explanation for anomalies in the data such as high usage points. The focus of this research is to explore the influence a sustainable (BREEAM rated) building has on the user by gathering insights into their understanding and interactions with the building. Therefore, in the author's opinion, this research does not align with a positivist paradigm.

In the case of realism, the underlining assumption is that the world exists independently of our knowledge of it however critical realism takes a slightly different view. Easton (2010) discusses the use of critical realism in case study research from an ontological position. This goes beyond social constructionism where he suggests, on occasions, the real-world breaks through and interrupts our explanation for understanding the situations we research. Put simply the world is capable of being observed through scientific means, but there is a social element, that which is not readily observable. Essentially hidden underling structures or patterns to the social world is not always seen but can impact on it. Critical realism is concerned with causal explanations, essentially '*what caused the events associated with the phenomenon to occur'* Easton, (2010). Therefore, the primary focus is on social structures and systems, social entities, such as organisations, relationships, attitudes and so on, Easton, (2010) have real causal powers that affect change. Social structures and systems tend to be on a Meta level and comprise rules, institutions and practices such as Government, the class system, markets and so on. Initially the author contemplated the idea of critical realism as a philosophical stance to underpin this research, but on further consideration there are two main reasons why this is not suitable. Firstly, the application of BREEAM is not mandatory and is nuanced from organisation to organisation therefore this is not regarded as a social structure or system. Secondly BREEAM is made up of several smaller issues each one dealing with a discrete area of the building, its fabric, its services, the construction process, management, end users and the like. Given the complex nature of BREEAM the researcher should have some knowledge of and be a pivotal part of the research to interpret and explain the findings. This is not the case with critical realism as the researcher is essentially emancipated from the research Bryman, (2016).

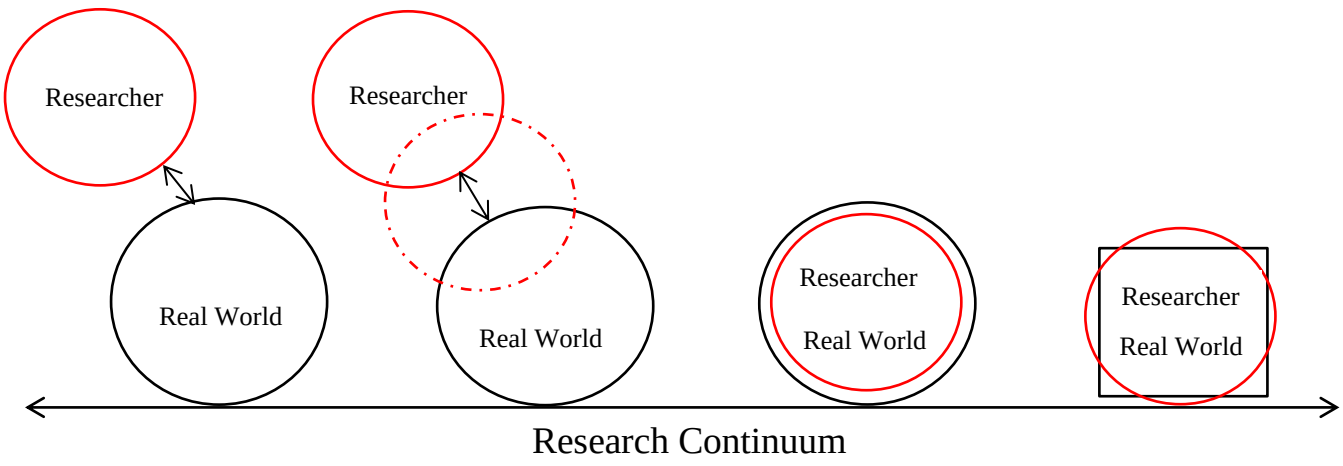
The researcher considered interpretivism and pragmatism together as there are several similarities between the two paradigms however from an ontological stance there are differences. Pragmatism is an approach to specifically deal with practical problems and

BREEAM, in part, is a practical problem. The focus is on the problem at hand whether that requires a qualitative or quantitative solution. However, the essence of a pragmatist's ontology is action and change therefore a pragmatist will go further to identify and change the phenomena.
Interpretivism, on the other hand, relies on a socially constructed world that the researcher observes and tries to make sense of the interaction between social actors.

> *'The core idea of interpretivism is to work with these subjective meanings already there in the social world; i.e. to acknowledge their existence, to reconstruct them, to understand them, to avoid distorting them, to use them as building blocks in theorizing'.*
>
> (Goldkuhl, 2012) P5

BREEAM is a complex framework of credits that cut across nine categories all of which deal with a specific area of sustainability and with their own unique issues. Add to this the attitude, level of knowledge and understanding of individual building users and the layers of complexity increase. It is vital that the phenomena are recognised and understood in the first instance as a pragmatist would look to change the situation in reality. This is a difficult proposal until the far-reaching agenda of BREEAM has been realised, then a pragmatic approach could seek to change the parameters in the way BREEAM is applied.

This research is not looking to change the application of BREEAM at this point, just to understand the issues surrounding its implementation and the affect this has on user behaviour. Also change is not possible particularly with BREEAM as this application is owned by a third party which is where change should be affected. Therefore, this research does not seek to change the application of BREEAM in the real world but to explore and understand the current adoption of the system and the barriers it faces in reality that prevent it from having the desired effect that was originally contemplated. Therefore, this research sits within an interpretivist paradigm with social constructionist ontology. The researchers' own conceptual view of how the four main paradigms interact with the real world in given in fig 7.



Positivism	**Realism**	**Interpretivism**	**Pragmatism**
Researcher is external and independent to what is being observed. Only observed data is credible.	Capable of scientific enquiry. What the researcher observes through their senses is reality. Critical realism appreciates that hidden social structures can be the cause of the phenomena being observed.	Researcher fully immersed in the real world to understand interaction between social actors to make sense of the phenomena.	Researcher seeks to change the phenomena through action.

This is the researcher's visual representation of the four main paradigms this is unpublished and, therefore, there is no reference.

Fig 3.2 Conceptual View of Paradigms

3.5 Research approach

According to Saunders et al (2009) there are two approaches to research either deductive or inductive and the choice of which can largely depend on the research question.

3.5.1 Deductive approach

A deductive approach is more akin to the natural sciences and involves the development of a theory that is subject to rigorous testing. As a result, a highly structured methodology is adopted to facilitate replication and ensure reliability of the data. Data sets are generally large to ensure the necessary level of scientific rigour. A further key characteristic of deductive research is that concepts need to be operationalised to allow the facts to be measured quantitively. Deductive research dictates that the researcher is independent of what is being observed and has no input other than analysing the data in order to identify patterns and generalisations Saunders, (2019). A limitation of deductive approach for this research is the highly logical testing based on a theory with little room to explore other issues should they arise. Social phenomenon is not linear it is messy and takes twists and turns.

3.5.2 Inductive approach

An alternative approach to deductive is inductive research and is more concerned with theory building as opposed to theory testing. The researcher is not strictly independent of what is being observed but more of an instrument who seeks to identify patterns, themes, relationships, sequences, and differences within the data. Researchers in this tradition are more likely to work with qualitative data and use a variety of methods to collect these data in order to establish different views of phenomena Easterby-Smith et al (2008). Generally small data sets are used as the researcher is analysing the quality (i.e. thoughts, opinions, feelings etc) of the data as opposed to the quantity and because of this reason it is difficult to apply generalisations. There can be some criticisms over the reliability and level of interaction the researcher has had with the data.

If deductive and inductive approaches are attached to research philosophies, deductive would align more with positivism and inductive would align more with interpretivism. This research will propose a framework for use with EAMs through semi-structured interviews and case study. Due to the nature of EAMs it is not the intention of the researcher to produce a 'one size fits all' solution but rather a framework with built in flexibility, therefore, this research with take an inductive approach to the problem.

3.6 Research strategy

Saunders (2009) describes methodology as the theory of how research should be undertaken, including the theoretical and philosophical assumptions upon which research is based and the implications of these for the method or methods adopted.

Bryman (2016) suggests that research strategy is characterised by Quantitative and Qualitative approaches. Quantitative is essentially objective in nature, and inquiry in to a social or human problem Naoum, (2013). Quantitative studies tend to be experimental, or survey type from an objective standpoint and generally involve testing of a hypothesis. Qualitative on the other hand tends to have strategies aligned with thoughts feelings, and attitudes, particularly in a real-world setting. Starting out with a theory for testing is not the general procedure with this approach. The main focus with this type of approach is exploration and investigation which leads to theory generation.

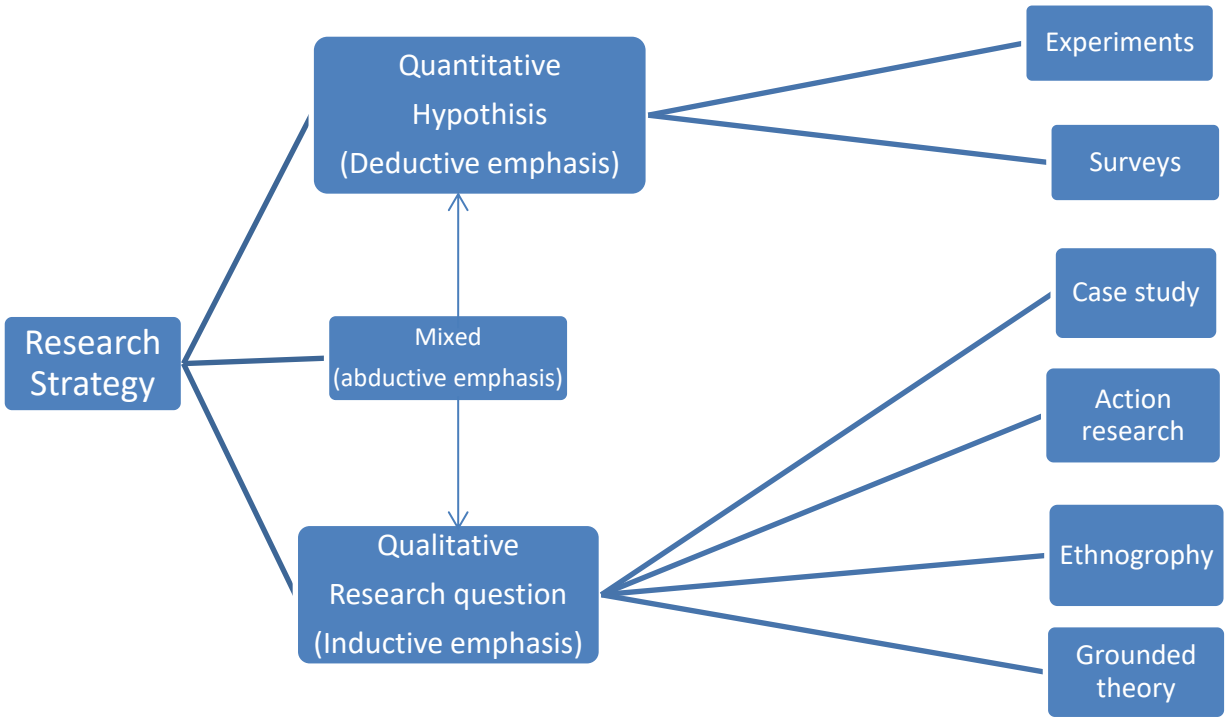


Fig 3.3 provides an organogram of the different research approaches.

3.6.1 Action research

Both Dawson (2011) and Denscombe (2008) describe action research as a methodology/strategy rather than a method. This differs somewhat to other strategies in the sense that the researcher acts as a facilitator generally working with a small group in an organisation who want to change something Dawson, (2011). Denscombe (2008) identifies four defining characteristics of action research as;

- Practical – real world practical problems – generally in an organisational setting.
- Change – emphasis is on changing the practical problem.
- Cyclical process – the research must involve a feedback loop to initiate change from the initial findings. This acts as a precursor to future research.
- Participation – essentially practitioners form an active part of the research.

3.6.2 Grounded Theory

Grounded theory essentially works in the opposite way to many other theories in the sense that the researcher doesn't start with a theory. This strategy is generally referred to as 'theory building' Saunders, (2009). The main distinction here is that the researcher usually partners with an organisation to identify and change a specific issue, therefore, the theory is developed from ground up. This strategy does not have an initial comprehensive literature review, the first steps are gathering data and constantly reviewing, refining, and analysing it until it reaches saturation point where the same results are presenting themselves.

3.6.3 Phenomenology, Ethnography, and Case Study

These strategies have been considered together as they have a number of similarities and all of which have roots in anthropology. Each of the strategies use observations and/or interviews as a data collection technique, however in the case of phenomenology the purpose of the interview is not to understand analyse and theorise but to gain an understanding of the lived experience of the participant. An example of this would be trying to understand how a cancer patient deals with everyday life. The researchers purpose is to present a 'description of how things are experienced first-hand by those involved' Denscombe (2008). The account must be authentic and not merely the researcher's interpretation. To do this the researcher must suspend their own thoughts, beliefs and common sense to allow them to see things from the participants point of view Denscombe, (2008). This is done by 'bracketing off' Denscombe, (2008) cites Schutz, (1962) as a way of doing this is to act like a stranger, 'a stranger is someone naïve about how things work and needs to figure them out from first principles' Denscombe (2008). This should allow the researcher to see things for what they are and not cluttered with assumptions.

Ethnography, on the other hand, is the polar opposite to bracketing as the researcher's beliefs and values become part of the equation, a built-in element that cannot be eliminated Denscombe, (2008). For these reasons' ethnography can attract criticism for its lack of objectivity. Originally ethnographic studies focused on tribal cultures on remote islands where the researcher would immerse themselves in to that culture Dawson, (2011) and live like them to gain an understanding of the natives' point of view. These are the

anthropological roots of ethnography, however, nowadays things have evolved and an ethnographic study is more likely to concentrate on 'life in a classroom', or 'life on a building site' Denscombe (2008). Therefore, observation tends to be the main data collection method which can take months, sometimes years depending on the subject.

3.6.4 Case Study

Robson (2002) defines a case study as 'strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within a real life context'. Yin (2014) adds to this by suggesting that the case study is suitable where the boundaries between those phenomena being studied are not clearly evident. Yin (2014), amongst others, identifies three main types of case study:

> **Descriptive** – A case study whose purpose is to describe a phenomenon ('the case') in its real-world context.
> **Explanatory** – A case study whose purpose is to explain how or why some condition came to be (e.g., how or why some sequence of events occurred or did not occur).
> **Exploratory** – A case study whose purpose is to identify the research questions or procedures to be used in a subsequent research study, which might or might not be a case study.
>
> Yin (2014) p238

Case study shares with ethnography an understanding of local conditions Hammond (2013). Context is important, particularly in a case study given the layers of information collected during a study. It has the ability to focus on the issue and the setting this is termed the '*unit of analysis*' Yin (2014) which helps to define and bound the issue. The researcher is a crucial cog in the case study process, unlike phenomenology where the researcher produces an authentic account of the participant's experience, in case study the researcher becomes part of the process as they will interpret the findings and create a narrative Zainal, (2007). For these reasons case study research often attract criticism for the researcher being biased and unable to objectively report their findings as they are too involved. Refer to section 3.5 on interpretivism where the researcher immerses themselves and becomes a pivotal part of the research as they interpret the findings. A further criticism is generalisability of the findings as the samples are so small, in many situations being only one case. However, an important distinction should be made here between statistical and analytical generalisability. Statistical

generalisation is taken from a 'unit of measurement' generally quantitative in nature with enough statistical information to make an assumption about the population. A case study strategy uses a much smaller sample to a much greater depth, therefore extrapolating any form of statistical generalisation would be an error. Instead, a technique called analytical generalisation is used where data taken from the 'unit of analysis' (the case) and assumptions can be made about other similar situations. For example if the researcher identifies a particular behaviour within in group they may generalise that this behaviour may be present in other groups, but it's not a representation of groups. Yin, (2014)

To overcome some of these issues of bias with case study research Yin (2014) identifies fours tactics for testing research design, as shown below:

Table 3.2 Tactics for Testing Research

Construct validity	This highlights the importance of systematic steps and correct operational measures to the concepts being studied.
Internal validity	Not suitable for descriptive or exploratory studies, as the researcher is not simply describing or exploring contemporary phenomena. This test is used for explanatory studies that seeks to find a causal relationship so A causes B.
External validity	This is a way of testing whether the findings are generalizable, but on an analytical and not statistical basis.
Reliability	Can the data be replicated with the same results? Could a later researcher follow your procedures? This is closely aligned with construct validity in ensuring that correct steps and procedures are taken initially.

3.6.5 Review of strategies

How does a research strategy shape the approach taken to research?

Action research was considered by using a focus groups to identify and change the issues. However, it was felt that this would not work particularly well, as the BREEAM methodology is a third-party certification system that cannot be altered, and we have to work

within the bounds of that. Also, this research phenomenon is not unique to this specific company, the intention is to produce a framework that SMEs will find useful. Action research is about working with a company to change something that can be specific to them. Therefore, the net needed to be cast wider to catch those companies who were not knowledgeable about the application of BREEAM and did not have an inherit appreciation for the built environment.

Ethnography was also considered as there is a place for observation in this type of study, however, most people at work do not live and breathe sustainability moreover, the specific criteria of BREEAM. Therefore, observation would not pick up reasons why employees did or did not cycle to work or use public transport. However, observation could have been used for example, to record the number of times somebody used a recycling bin. Therefore, a pure ethnographic study would not have identified all the hidden issues at play.

The concept behind grounded theory is that the researcher has an open mind in relation to the numbers being interviewed, or ultimately where this will take them. By not specifying anything at the outset the intention is to collect data until saturation point is reached and no new information is being provided Dawson, (2011). When considering whether grounded theory was a suitable approach, the researcher looked again at the areas of BREEAM i.e. waste, transport, energy, management. All of these are possibly capable of data collection until they reach saturation point, however, all these issues are being researched together. In addition to this, as already alluded to, this company were knowledgeable in this area. It is logical to assume from this that companies outside the built environment in different industries may add additional layers of complexity thereby forming a much larger project, than originally anticipated, to reach the necessary saturation point of data.

In the case of phenomenology, this is not a suitable strategy. Even though the researcher is trying to gain insights from building users of BREEAM rated buildings this is not something that they have 'lived' experiences of most occupants may not even be aware that there building is BREEAM rated. Also, given the complexities of BREEAM, its important that the researcher has some knowledge and appreciation for the system and processes, as some components of BREEAM can be quite technical. Ethnography on the other hand would allow that level of involvement but involves a large amount of observation and for practical reasons it was not viable to spend a large amount of time within the organisation, therefore,

this approach was not suitable. Table 3.3 below provides the researchers comparison of the different methodologies.

Table 3.3 Comparison of Qualitative Methodologies

Characteristics		
Phenomenology	**Ethnography**	**Case study**
Focuses on individual	Focuses on group/culture (can be an individual depending on the case)	Can focus on either
Lived experience of the individual	Attitudes, beliefs from being part of that group	Attitudes, beliefs from analysing a situation
Inward looking	Inward looking	Outward looking
Mainly qualitative	Mainly qualitative	Can be qualitative and, or quantitative
Main data collection technique is interviews	Mainly observations, but also interviews, documents and artefacts	Can be interviews, questionnaires, observations, documents, recorded data (units of analysis)
Limitations		
Often criticised for lack of rigor as the researcher focuses on generally once case to a very detailed level.	Often criticised for lack of objectivity as the researcher generally considers one group or culture at any one time.	Often criticised for bias as interpretation of the research is generally down to the researcher's opinions and views as they are a fundamental tool in the research process.
In reality all the above limitations feature in each of the above methodologies in one form of the other.		

The table above illustrates the versatility of a case study approach and how this can accommodate a range of phenomena. When considering a suitable methodology, it is not just the research question that leads the choice if approach, but also what is practically possible within the constraints of the company and your day-to-day job for the immersive nature phenomenology & ethnography. The most appropriate approach to this research is case study. Table 3.4 below highlights the five components of case study.

Table 3.4 Yin (2014) sets out five components for research design when using case study:

Components	Interpretation
A case study question	This is the starting point, framing the question who, where, why, what and how?
Its propositions, if any	Focus on what is being studied, what do you intend to do? The logical steps.
Its unit(s) of analysis	Defining and bounding the case. Is this a single case or multiple cases?
The logic linking the data to the proposition	Pattern matching, explanation building and time-series analysis. The case study should practically reflect the proposition.
The criteria for interpreting the findings	Addressing rival explanations to strengthen own study findings.

The above list set out by Yin provides the building block for case study design by following each component and ensuring there is an element of 'self-check' along the process.
This research will take on three distinct phases, namely: Planning, Development, and Validation. The activities around the Planning stage have included studying the literature and establishing the current body of knowledge around BREEAM and its wider agenda.

Planning – Development – Reliability

Planning – This is an exploratory study to gain a deeper understanding of whether a BREEAM rated building has any impact on user behaviour; therefore, a case study approach will be adopted using a semi-structured interview technique. Based on the literature review, and the findings from the pilot study several factors would be identified, questions would be framed to aid interviews with experts in the field. The information collected during this stage would be qualitatively analysed and form the bases of the initial framework. The framework would then feed into the next phase of Research Development.

Development - The activities in the research development phase would include data collection through a questionnaire survey, quantitative analysis of the data and refining the data to feed into the framework proposed in the first phase.

Reliability –The final phase of the process is to ensure credibility of the findings. There are three ways in which to do this; the first is by validation, this is generally used for studies that

take on a more deductive approach, reliability is generally used for studies that take on a more inductive approach. Where mixed data collection techniques have been employed, triangulation can be the most valuable way of ensuring validity, to ensure that the data are telling you what you think they are telling you Saunders et al (2009). Denzin (1978) defines triangulation as 'the combination of methodologies in the study of the same phenomena'. This study will employ qualitative methods of data collection, therefore, the approach for this study is more akin to reliability, as the study in its entirety encompasses a pilot and a main study. Reliability will be achieved through protocols of the study and other supporting documentation such as BREEAM trackers used during the assessment Brennen (2005).

3.7 Sampling

There are two main sampling techniques available: probability and non-probability. The type of technique will depend on the study, for example probability sampling such as random, systematic, and cluster are all generally associated with quantitative research with large numbers being involved. Whereas non-probability sampling is generally associated with smaller quantitative studies where the subject can be more accurately targeted and their individual experience is different to somebody else. Types of non-probability sampling include snowball, purposive, and self-selection Saunders, (2009), Bryman, (2016).

As this is a case study methodology non-probability techniques were considered, the first one being snowball sampling. Atkinson and Flint (2001) quoted Vogt (1999) in their publication as:

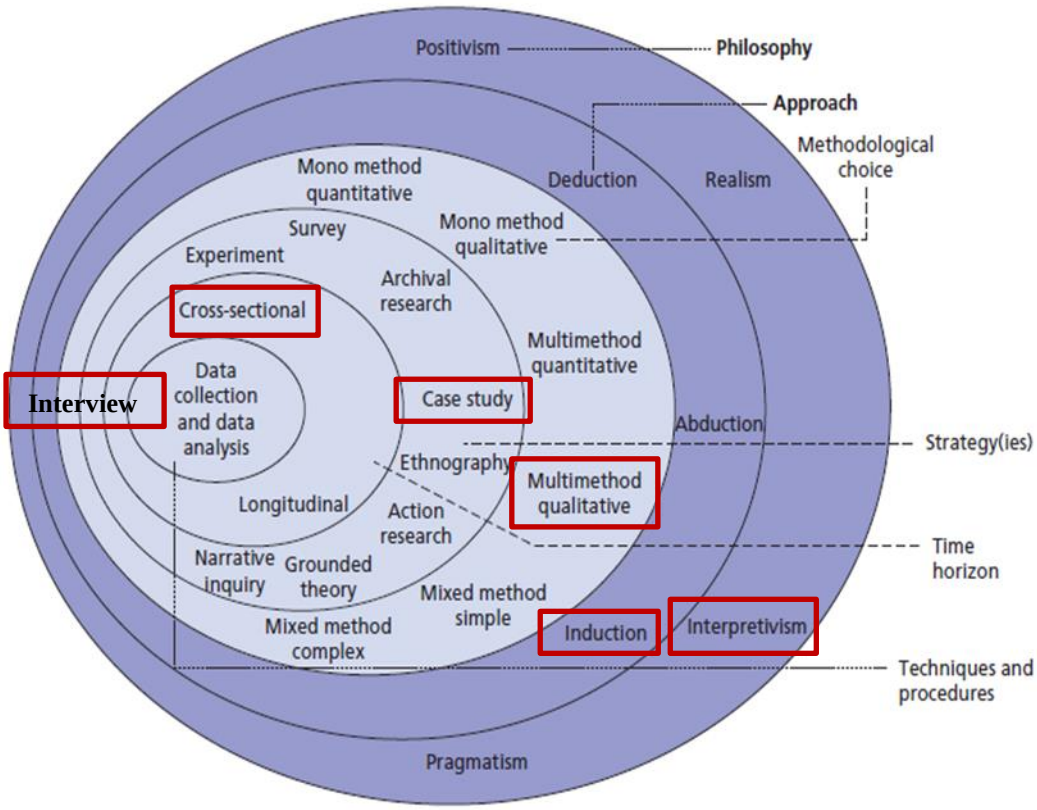
> *A technique for finding research subjects. One subject gives the researcher the name of another subject, who in turn provides the name of a third, and so on.*
>
> Atkinson and Flint (2001)

Usually, this technique is used where the researcher cannot easily identify participants which relies on the first person being interviewed recommending the next person. Purposive is also a non-probability sampling technique which allows the researcher to purposively select the case. However, in order to do this the researcher must have some knowledge of the participants. As the case study and pilot study were small cases, elements of both techniques were involved in selecting a suitable sample. In both cases the researcher had some

knowledge of the building but was not familiar with individual staff members. In the case of first the pilot study, as all building users were on the same level with similar conditions, the participant recommended the following participant and the researcher ensure a good mix of age, gender and the like. Therefore, the technique mainly employed for the pilot study was snowballing. However, the case study was more complex as there was two levels with different departments with varying skill and knowledge, and some staff members were involved in the refurbishment. Having studied the building, in the context of the research, it was crucial that participants were selected from the ground floor, first floor, HR (for policy), building managers, and involvement in the refurbishment. This was the purposive strategy adopted for selecting the sample, as individual staff members were not known a snowball strategy was adopted allowing participants to select the best person based on the study information and purposive strategy. Again, the researcher ensured a mix of age, gender, and management level.

Table 3.5 Case Study sample selection

Participant	Location	Department	Management level	Gender	Age
1	Ground	Customer S	Middle	F	44
2	First	Projects	Senior	M	48
3	First	HR	Senior	F	29
4	Ground	Technical	Non-management	M	27
5	First	HR/L&D	Junior	F	30
6	Ground	FM	Middle	F	42



(Adapted from Saunders et al 2019 with research strategy overlaid)

Fig 3.4 Research onion with Researcher's choice

3.8 Review of Data Collection Methods

Fig 3.4 above, reintroduces the research onion highlighting the researchers' methodology and strategy. The underpinning philosophy is interpretivism as this is a study trying to understand social phenomena in a real-world setting. The approach to this study is inductive as the researcher is not starting out with a theory to test but rather explore and answer research questions. The methodology adopted for this study is a multi-method qualitative approach due to the different types of data being used. The strategy is a case study with the main data collection technique being interviews, however, further data was collected in the form of; the BREEAM report, the BREEAM tracker, and minor observations on PC and monitor shutdown behaviour.

Alongside the initial literature review, a pilot study was conducted with a view to garner thoughts & opinions from building users of the BREEAM rated building. The researcher believed that this would in turn feed into & help frame the questions to use for the case study.

3.8.1 Pilot study

The building used for the pilot study (Yin case study) was originally built circa 1920 comprising six storeys with a total floor area of 37,703 sq ft (3,503 m^2) situated in Glasgow. The basic services comprised 4-pipe Fan Coil Units for both heating and cooling with a central concierge serving all floors. The shell and core of the building had recently achieved a 'good' BREEAM rating. The focus of the study concerns one of those tenanted floors that previously underwent a fit-out with the dual purpose of upgrading to BREEAM excellent. The rationale of this paper considers whether there is any change in occupant behaviour when decanting from a typical 1970's office building to a BREEAM 2006 fit-out excellent rated building and whether the benefits of BREEAM are relayed to the building users effectively. Under the 2006 version approximately 50 credits encompass the fit-out process of an office building, apportioned between the nine major categories. Each credit possesses different numerical values and the number of credits achieved depends on the level of commitment required by the client. The credit value in total is 97, although a score of 70 and beyond equates to a rating of excellent.

Table 3.6 reintroduces the credit categories under BREEAM

Table 3.6 BREEAM Credit evolution

2006		2008		2014	
Category	**Weighting**	**Category**	**Weighting**	**Category**	**Weighting**
Management	15	Management	12	Management	15
Health and Wellbeing	15	Health and Wellbeing	15	Health and Wellbeing	15
Energy and Transport	25	Energy	19	Energy	15
		Transport	8	Transport	9
Water	5	Water	6	Water	7
Materials and Waste	10	Materials	12.5	Materials	13.5

2006		2008		2014	
Land Use and Ecology	15	Waste	7.5	Waste	8.5
Pollution	15	Land Use and Ecology	10	Land Use and Ecology	10
		Pollution	10	Pollution	10

Prior to conducting interviews, the researcher reviewed the BREEAM 2006 credit table, consisting of 51 credits along with the original BREEAM fit-out report for the building to help focus and formulate the questions. This was carried out over three phases. The first phase resulted in the removal of credits that did not directly interact with the users of the building. These generally comprised credits relating to construction management activities surrounding the fit-out works, for example considerate constructors, site waste management, construction site impacts and the like all of which had no bearing on the user. The second phase entailed the removal of credits that did not contain user interaction, feedback systems, or did not seek to condition the internal environment. These generally comprised external lighting, major leak detection on the incoming mains supply and the like. The residual credits from phase two were refined again this time focusing and removing those credits that had the potential to result in a 'placebo effect', for example NOx emissions from boilers, refrigerants etc.

3.8.2 Approach to Interviews

Interviews range from structures, at one end of the spectrum, to unstructured at the other. In the case of a structured interview, the interviewer retains control of the interview and will likely offer fixed questions with a set of fixed answers. Unstructured approaches on the other hand essentially pass control to the interviewee, allowing them free reign of the topic. This allows for a more in-depth interview; however, focus can be harder to control. This type of interview would be suited to phenomenology, discussed earlier, where the interviewer immerses themselves in the world of the interviewee and lets them fully express themselves.

Much like questionnaires, approaches to interviews can make the form of structured, semi-structured or unstructured. The choice of which will depend on how much control sits with the interviewer or interviewee. Interviews with a specific purpose would benefit more from a

structured approach, as to keep the interviewee on track and not veer off on a tangent. Whereas unstructured would allow the interviewee to just talk, possibly relating to an experience, where interruption by the interviewer would upset the flow and perhaps stop the interviewee from expressing themselves. This type of approach would suit a phenomenological strategy, discussed earlier. However, in this study, again the main stay of control should sit with the interviewer, and on the other hand the interviewee must be accommodated to discuss other areas relating to the wider study & their experience of using a BREEAM building.

The pilot study, and to a similar extent, the case study is exploratory. Therefore, thoughts & feelings are an important part of the process to capture. However, this should not be at the risk of losing focus on the interview parameters & direction. Therefore, a semi-structured interview technique was chosen.

Questions were then framed around the remaining credits that had the potential to affect the user's behaviour either directly or indirectly. Of the remaining credits, six themes were developed loosely fitting the BREEAM categories: namely services, building fabric, travel, metering, water, and recycling. Some sub-questions were built-in to explore whether their behaviour in the office was emulated within their home life. The intention of these themes was to explore whether the building they occupied had an impact on their behaviour and if this continued through to their home-life. A total of fifteen questions were devised in terms of the building fabric, travel, transport the services installed throughout the floorplate. This encompassed questions around lighting, sub- metering, water saving features, waste recycling, general services such as heating/cooling, thermostats, and the like, as shown below in table 3.7

Table 3.7 Questionnaire Design

Cluster	Category	Questions	Themes
1	Building services and control	Q1,2,3,4,5, and 6	How did users interact with them?
2	Building fabric	Q7	Windows / Light / Glare
3	Metering information	Q8 and 9	Were users prepared to investigate particularly high readings (water/gas/electric)
4	Travel strategy	Q10,11, and 12	How did users travel to work / or would consider other means of transport
5	Water technologies	Q13 and14	Attitudes towards water consideration
6	Recycling	Q15	Are they encouraged to recycle

3.8.3 Question Design

When designing the question approach, both open & closed questions were considered. According to Intro to Research Methods, C. Davison, open questions tend to be slower, more difficult to record & code responses. Whereas closed questions tend to be quicker, easier to record & code. This led the researcher to think about what they were trying to achieve, what information did we expect to get from this exercise? The purpose was to unearth true feelings about the way a user interacts with the building. How they felt about its sustainable credentials and above all how they interact with it. Some of the participants thoughts and feelings had to be captured, therefore, to a lesser extent they needed to be able to raise issues

specifically relating to their workplace, that us researchers would not be aware of. In light of these points, the decision was taken to use open-ended questions within a semi-structured interview environment. This also allowed the researcher to adapt the questions to foster & harness a number of variations. However, the question of interview couldn't be too open as to make it difficult to time manage or succinctly capture responses.

3.8.4 Interviews

Semi-structured interviews were chosen and conducted with six members of staff to explore the experience and attitudes towards the building. All of the staff members who took part in this study had experienced occupation in the original 1970's building for more than 12 months and occupation in the new BREEAM excellent building for more than 24 months. Four of the occupants were male and came from a professional surveying background ranging from Building Surveying to Valuation, one of which was a graduate. The remaining two occupants were female one of which was an administrator and the other a senior secretary. The six-occupant ranged in age from early 20s to late 40s with an average length of employment of around four years. All occupants had experienced working in a non-BREEAM building prior to moving to this building.

Initial issues noted with pilot study was that the questions were too prescriptive, and they needed to be looser and understand the user's perceptions of BREEAM. One of the criticisms of the pilot study was that the majority of the users already had prior knowledge of BREEAM through their work and an understanding of the working of the system. We needed to encompass users who did not have a great deal of prior knowledge of BREEAM, as this highlights the awareness they have gleaned since occupying a BREEAM building. This is one of the major criticisms of BREEAM, whereby tenants move into a building with very little knowledge of how that building works or the features in it. The larger and more complex the building this issue is exacerbated. As a result of this weakness in the pilot we chose and insurance company who still work within the construction sector but are significantly remote from the inner workings.

Table 3.8 Changes to questions

Cluster	Category	Question	Refinements
1	Comparison with previous building and home life	Q1, Q26, Q27	Drilling down more in to changes between home life and work life.
2	Awareness of BREEAM	Q2, Q3, Q7	A better understanding of the user's awareness and perceptions of the building they inhabit.
3	Services/training	Q4, Q5, Q6, Q8, Q11, Q12	More emphasis on training around building features and services.
4	Control	Q9, Q10	More emphasis on controls and how they affect behaviour.
5	User behaviour	Q13, Q14, Q15, Q28	How users interact with their surroundings.
6	Travel	Q16, Q17, Q18, Q19, Q20	Behaviour around travel.
7	Water	Q21, Q22	Behaviour around water.
8	Recycling	Q23, Q24, Q25	Behaviour around recycling.

Refinement of the questions from the pilot study allowed us to focus more on the individual building and the user's interaction with it. This was an aim of the original pilot study, however, with the users having a good prior knowledge of BREEAM and inhabiting a multiple-occupied building this did limit the responses. Whereas, in the main study we were able to focus on those two points and choose a building solely inhabited by the occupants with very little prior knowledge of BREEAM.

3.9 Chapter Synopsis

This chapter set out to identify the path this research would take. It started by identifying the wider research philosophy that guides the direction of research and where this research sat

within that continuum. The researcher felt that this study sat within the interpretivism paradigm using a case study methodology. The initial exploratory case study was also introduced in this chapter along with the questionnaire & interview strategy.

Chapter 4: Analysis

4.1 Introduction

The following chapter will analyse the results from the both the pilot study and the main study. The first part of this chapter concentrates on the analysis of the pilot study where all the responses from the interviews were put through Nvivo and word frequencies gathered to identify emerging themes from the study. These were loosely categorised in to four pillars and tested further in the main study. The chapter will then analyse the main study using the same techniques of word frequencies before coding in to three categories namely, negative, positive, and change. The negative cluster identified all relevant words spoken with a negative connotation, the relevant words spoken with a positive connotation, and relevant words that resulted in a change in behaviour when compared to a benchmark building, or their behaviour at home. The results were further categorised in to the four pillars to feed into the framework.

4.2 Pilot study

As this was an exploratory study, responses from the interviews were analysed purely on a qualitative basis to identify emerging themes for analysis. Following the interviews an initial observation to emerge hinged around users feeling a sense of resentment predominately aimed at the building. Many of the users could not identify the benefits of occupying a BREEAM 2006 excellent building, as many of the features of BREEAM were not being successfully relayed to the building users. Therefore, the first part of this analysis was to look at the in-use features of BREEAM by comparing between work and home

This was important at this stage as the wider study was concerned with how a BREEAM building impacts on user behaviour. Therefore, some level of reference point would help to distinguish whether the change in their behaviour was because of an office or home environment. Analysis was carried out using Nvivo by firstly undertaking a search of word frequency. This was done several times over refining each search by removing spelling errors, small words initially of three letters then four and so on, splitting out any double-barrelled words until we were left with essentially pure data. This is shown in Table 4.1.

Once the data was collected the responses were analysed using concept mapping techniques to identify emerging themes. The process initially started with training, feedback, awareness, tangibility, benefits, management, and information. Initially a broad brush was applied to establishing themes by allowing any area that might be relevant. The process was refined several times with themes being wrapped up into others until this process was saturated. This left four themes, things that were tangible to the users of the building along with benefits that building users could physically use that were remotely connected to sustainability. Clearly training and feedback were substantial enough to be separated into their own areas, respectively, therefore, four pillars were identified as major categories namely training, tangibility, usable benefits, and feedback.

Table 4.1 Frequent Word Table

Word	Count	Weighted Percentage (%)	Similar Words
Aware	46	4.69	Aware
Lights	29	2.96	light, lights
building	21	2.14	building
behaviour	18	1.83	behaviour
centrally	14	1.43	central, centrally
impact	14	1.43	impact, impacted
breakdown	13	1.33	breakdown
energy	13	1.33	energy
manual	13	1.33	manual, manually
services	11	1.12	services
Cycle	10	1.02	cycle, cycled, cycling
moved	10	1.02	moved, moving
automated	10	1.02	automated
investigate	10	1.02	investigate, investigating
Office	10	1.02	office
control	9	0.92	control, controlled, controls
outside	9	0.92	outside
transport	9	0.92	transport
colours	8	0.82	colour, colours
conscious	8	0.82	conscious
influence	8	0.82	influence, influenced
redecorating	8	0.82	redecorate, redecorated, redecorating
switching	8	0.82	switch, switching
Effect	7	0.71	effect
Meter	7	0.71	meter

changed	7	0.71	change, changed, changing
information	6	0.61	information
posters	6	0.61	posters
Public	6	0.61	public
regional	6	0.61	regional

Phase two of the analysis then began by grouping the most frequent words loosely in to the four pillars. For example: awareness, consciousness, user manual, posters etc… all hinge around the pillar for training and education. Cycling and transport relate to a person's individual experience of getting to and from work, this could be influenced by providing a travel pass, or showers, therefore, these were categorised under the pillar for useable benefits. This process continues several times with the content being moved around until a blueprint had emerged. This was now a basic framework to apply to the main study.

Question Analysis

The first cluster of questions hinged around the services of the building and how familiar the occupants were with their usability. Occupants were asked whether they were aware of the services in the building and if they were trained or made aware of how to use them. All the respondents had some level of awareness on the services and that they were controlled centrally by a concierge. Any changes to the services, such as increased heating and cool, were subject to a request or application via the concierge. Of the six respondents only one suggested that the system of a central concierge works well. While the other five respondents suggested that either '*it takes too long for the request to feed through*' and/or '*I would like to have more control over the services'.* Generally, there was no ill feeling towards the use of a central concierge, just that occupants had lost control over their own workspace conditions. This contrasts with (Monfared, 2011) study, which highlighted issues with the facilities management (FM) due to poorly defined roles and responsibilities. However, the study also found that the lack of personal control over an individual's workspace caused dissatisfaction. This is in line with the (Menzes, 2012) study that also found that a lack of control over an individual's workspace leads to dissatisfaction, whereas the more control an individual has over their surrounding the less energy they consume. The findings in (Brown & Cole, 2009) study add to this by suggests that the less comfortable occupants are the more likely they are to use personal controls available to them. Personal modifications of a workspace contradict

the fundamental philosophy of BREEAM as it leads to a disconnect between the user and the building and ultimately result in higher energy use.

There is a dichotomy here between a comfortable background environment and personal control over their environment, which links to an influence over energy. The issue with standard cassette air-conditioning units is that they expel air to specific points around a floor plate. Occasionally the seating plan will align with this or not, therefore, people underneath generally feel adverse heat or cool air, whilst those further away from the cassette outlet experience more of an ambient background temperature. These conditions tend to lead to users modifying their personal environments either through controls or by apparatus such as heaters or fans. However, if a user does not have that level of control there is a feeling of loss of control as they cannot change their perceived uncomfortable environment. There is a need for air-conditioning systems to be more sophisticated with a simple control interface to allow individuals some level of control. This gives users a stake in their own environment with a sense of responsibility making them more likely to contribute to the energy efficiency of the building. (B. Bordass, Bromley, K. and Leaman, A., 1993) suggests that controls can deliver high levels of comfort but are usually too complex for the average user to understand. There needs to be a balance between user control and sophisticated automation.

A further question in relation to services was whether the occupants were aware of the location and contents of the building user guide. A 'building user guide' is a feature of BREEAM that awards an addition credit during the design stage if a non-technical document is made available to the users of the building. The guide contains the following information: Building Services Information, Emergency Information, Energy & Environmental Strategy, Water Use, Transport Facilities, Materials & Waste Policy, Re-fit/Re-arrangement Considerations, Reporting Provision, Training, Links & References (BREEAM, 2006). The guide goes further, however and demonstrates the benefits and savings associated with energy saving and efficient fittings throughout the building. Many of the users expressed a nonchalant attitude when answering this cluster of questions and had little regard towards the importance or purpose of the building user guide. Perhaps the explanation for this behaviour could be associated with some of the services being automated and the remaining services being controlled centrally through a concierge. This could leave users feeling like they did not need to read or understand the contents of a user guide, as they have no responsibility in their operation. This is in line with Bichard's (2011) observations whereby individuals do not

see it as their responsibility to reverse trends. Therefore, the general trend among occupants was the lack of importance given to the user guide. By the same token the employer did not make any ongoing attempt to engage the occupants. This was further confirmed during the interviews where the researchers where shown a monthly report on energy consumption distributed to all staff members, however many of them did not understand the information it contained. Concerns with this line of thought are that users overlook a document that contains very useful information that could have a positive impact on their behaviour.
The literature is suggesting that there are a number of consequences to occupants losing control over their workspace, for example Monfared, (2011) made the link with dissatisfaction. Menzes, (2012) made the link with a lost opportunity for energy reduction. Brown & Cole, (2009) made the link between knowledge and quality of those controls often leads to frustration and decreased comfort. During the interview's respondents did show some signs of frustration. However, when this is compared to respondent's attitudes towards the building user guide none of them appeared to want to ask about it, look for it, read it, or take any time to understand its contents. This is in contrast to Brown & Cole, (2009) study which suggests that occupants willingly sought to find further information on controls for the building.

A possible reason for this could also be dissatisfaction with the business or management leading to a disengagement with the building. For example; in Brown & Cole, (2009) study there was an element of personal control for all occupants, whereas in the pilot study building everything was automated apart from the blinds. Therefore, it is possible that occupants would view the act of gaining knowledge on a building's services as counterproductive because they are powerless to change anything as it is controlled centrally. This could lead to disengagement with the building and is a possible explanation for the nonchalant attitude of the occupants.

This is further confirmed by Veitch & Gifford (1996) who state that *the pervasive view is that when personal control is lacking feelings of powerlessness and unhappiness and decreased task performance will follow*. This is contrary to BREEAM requirements. For example, credit HEA 01 of the Health and Wellbeing category aims to give occupants a degree of control by introducing automated lighting to areas such as atria, and near windows. BREEAM then goes further to suggest limiting a bank of desks by no more than four or 40m^2 i.e. one desk per 10m^2 where the occupancy figures are not known. BREEAM allows this

figure to be increased for larger developments where the floor layout and occupancy figures are much greater, therefore, resulting in areas of automation and a lack of individual control. The interviewees were asked whether they felt that automation prevents them from remembering to switch off the lights at home, as this is not something, they do regularly at work due to automation. Most of the respondents took a minute to think about this as they had not considered it until being prompted. The most common responses were '*yes I suppose it does*' and '*somebody else turns the lights off at home'*. This does indicate that there could be a connection with behaviour between home and work life and possibly the adoption of bad habits moving from one environment to the other.

Baird's study looked at various international buildings and the in-use credential of each building. Baird, (2010) User controls scored low on BREEAM excellent buildings

Tangibility

The results also indicated that users react positively where they can see the impact of their actions. The best example of this was in recycling where each of the users interviewed said that this had a positive impact on their behaviour and now actively recycle both in the office and at home. Occupants were asked if information from, for example the sub-meter, was presented electronically where peaks and troughs in the data were clearly identifiable would they investigate this further. All responses suggested that this would make them investigate further. One particular response stated "*If we were given a breakdown of the meter readings then it would probably make me investigate it more and may have an impact on my behaviour at home if I could see the savings and benefits*". However, a report is already issued on a regular basis, albeit not presented in its simplest form and many of the occupants do not read it. There is a dichotomy here firstly the way in which data is presented as previously highlighted if something is too complex people will disengage with it. Secondly there is a 'disconnect' between words and actions, as highlighted in Bickman's (1972) study.

This is important as it does indicate that the way in which a message is portrayed is just as important as the message itself. Tetlow, (2012) suggests that displaying information, in this case energy, in a positive way along with signage can have a positive impact. Signage was also provided in Goldstein, Cialdini, & Griskevicius, (2008) study suggesting that the position and viewpoint of signage all helps to convey the message. This is an example of

nudge theory whereby constant reminders are set up to nudge a person in to making a particular choice.

Useable Benefits

The results also indicated that useable benefits could impact on behaviour. While most of the users were vaguely aware of the company's transport plan and the issues between using private v public transport, their decision for using public transport was solely down to the company subsidising the cost of an annual ticket. One respondent in particular suggested "*without the company offering to pay up front for an annual train pass I couldn't afford to take the train, that's why I use public transport not to be sustainable*". This was in contrast to the number of occupants who actually cycled to work as a result of installing cycle stores and showers as part of the BREEAM requirements. This measure should impact on behaviour or at least persuade occupants to cycle more, however the useable benefit of a bus pass appeared to have more impact on travel behaviour than the provisions allowed for in the design stage of BREEAM. It is possible that during the design stage the decision taken to include cycle storage and showers could have been to simply to gain extra credits. This highlights the possibility of using benefits 'indirectly' to influence behaviour. For example, benefits offered to occupants where the rationale is unconnected to the wider sustainability agenda could result in a positive impact on behaviour.

Feedback

The results highlighted that, in general, feedback systems were not in place and information was not disseminated to a usable level. Many of the energy and water saving features installed in the building, as part of the fit-out works did not have any meaningful results collated and fed back to the building users. Zabel (2005) and Kua (2008) both identify the importance of feedback loops as an integral element for influencing behaviour. In the main case study more focus was placed on awareness as this is a key component of feedback, even if meaningful information were disseminated would the users necessarily understand it? This emphasis on awareness and training provides the necessary feedback loop that appeared to be missing.

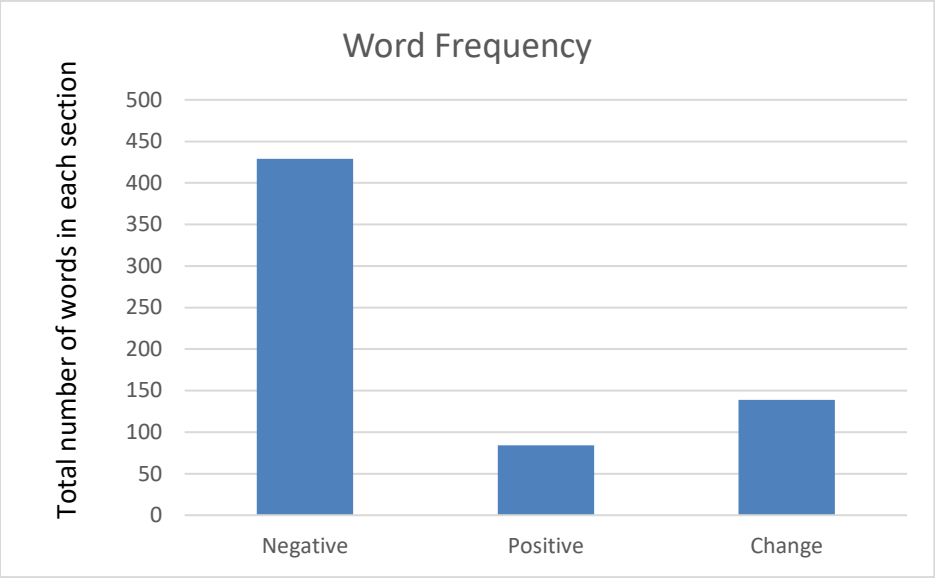
In summary to the pilot study has highlighted a number of issues for further exploration in the main study. The pilot study has also provided and initial framework around four pillars of emerging themes for further analysis and to form the basis of the thesis framework.

4.3 Initial Analysis of case study 1

Interviews were semi-structured with a mixture of open and closed questions. All the results were fed in to Nvivo where it became apparent that many of the answers were nuanced and linked with other answers. When coding the initial responses from the case study the researcher considered setting up nodes in line with the question themes, however, it was felt that this could be restrictive due to the crossover of several areas of information. Therefore, initial data sorting involved a broad-brush approach across all the responses and separating the relevant responses in to three main sections, namely negative comments, positive comments and those comments that appeared to have changed the user's behaviour. Applying this strategy allowed the researcher to focus on the individual comments to allow the bigger picture to emerge, especially as one goal of the research s to identify whether a BREEAM building influences the user's behaviour. Once the meta-level coding was completed word frequency exercises were carried out for each section. This began with a word frequency search, using Nvivo, for each section capturing 100 of the most frequent words. This was refined over several stages by introducing 'stop words' at each refinement and reducing the overall count. The final word frequency count was refined down to 30 as this was the point where all residual and connecting words were significant to the study.

Initial observations show the negative comments to be much higher than the other categories which indicates that generally the building is discussed in a negative context rather than a positive context as shown in the chart below.

Chart 4.1 Word Frequency



The total number of words used in a negative context was 429, with words relating to a change in behaviour being 139, and words used in a positive context was just 84, as expressed below:

	Negative	Positive	Change	Total
Total No. of comments	429	84	139	652
%	66%	21%	13%	100%

As outlined in the methodology chapter, the three sections were coded into a series of categories which followed a similar vein to those for the interview questions. The categories are as follows:

Negative – this section collated comments where the responses had either a negative impact on behaviour or users demonstrated a negative attitude towards the building.
Positive – this section collated comments where the respondents had either a positive impact on behaviour or users demonstrated a positive attitude towards the building.
Change – this section collated comments where the responses indicated that they had modified their behaviour, either positively or negatively, within the building.

The table below shows the frequency of words used in either a negative or positive way, or where they have forced a change in behaviour.

Table 4.2 Word Frequency for Negative Comments

Word	Count	Weighted Percentage (%)
bins	39	2.76
lights	34	2.41
building	26	1.84
recycling	26	1.84
cups	24	1.70
showers	19	1.35
cost	16	1.13
air	15	1.06
control	15	1.06
drinks	14	0.99
windows	14	0.99
space	13	0.92
water	13	0.92
cars	12	0.85
cycle	12	0.85
home	12	0.85
machine	12	0.85
parking	12	0.85
waste	11	0.78
aware	10	0.71
Gary	10	0.71
PIR	10	0.71
taps	9	0.64
temperature	9	0.64
fans	8	0.57
communication	7	0.50
conditioning	7	0.50
encouraged	7	0.50
facilities	7	0.50
bike	6	0.42

Table 4.3 Word frequency for positive comments

Word	Count	Weighted Percentage (%)
car	8	3.96
home	8	3.96
lights	8	3.96

Word	Count	Weighted Percentage (%)
space	7	3.47
building	5	2.45
parking	4	1.98
share	4	1.98
better	3	1.49
jackie	3	1.49
bills	2	0.99
bin	2	0.99
cups	2	0.99
cycle	2	0.99
dual	2	0.99
facilities	2	0.99
flush	2	0.99
recycling	2	0.99
remember	2	0.99
tap	2	0.99
together	2	0.99
train	2	0.99
water	2	0.99
1000sq	1	0.50
5000sq	1	0.50
5pm	1	0.50
9am	1	0.50
aesthetically	1	0.50
architecturally	1	0.50
automated	1	0.50
Aware	1	0.50

Table 4.4 Word frequency for change comments

Word	Count	Weighted Percentage (%)
bin	12	3.65
showers	12	3.65
cycle	10	3.04
building	9	2.69
park	7	2.13
car	7	2.13
cups	6	1.82
aware	5	1.52
home	5	1.52
money	5	1.52
waste	5	1.52
facilities	4	1.22
habits	4	1.22

Word	Count	Weighted Percentage (%)
public	4	1.22
transport	4	1.22
behaviour	3	0.91
drink	3	0.91
encourage	3	0.91
jog	3	0.91
lights	3	0.91
personal	3	0.91
recycling	3	0.91
reminded	3	0.91
running	3	0.91
scheme	3	0.91
attitude	2	0.61
bikes	2	0.61
coffee	2	0.61
cost	2	0.61
desk	2	0.61

Once a general arrangement had been established of the most frequent words and their context, the process to sort them into categories could begin. For this the researcher went back to the questionnaire and the objectives of the research. In the pilot study and the case study, one of the parameters was that building users had to have occupied a non-BREEAM building prior to occupying a BREEAM building. The reason behind this was to explore whether the building users noticed any differences between the buildings in a physical nature and whether this had impacted on their behaviour. In addition to this question were also a sheet about their home life & whether habits at home or work have impacted their behaviour. All these issues were considered under the category of benchmark.

A further objective of the research was to explore the level of awareness building users had around BREEAM. This was significant as the pilot study used occupants whose careers were in the building & property industry. Whereas the case study used occupants from the insurance industry who did not necessarily appreciate BREEAM and the worker sustainability agenda around buildings. Therefore, the next category was ‘awareness’.

There is a body of knowledge around the level of control a building user has over their own space and how this affects behaviour, this was identified in the literature review by Monfarad (2019), and Altomonte, (2017). Contrary to this there is a further body of evidence around the level of complexity of building services for a standard user to adequately understand &

appreciate. These could be some of the factors affecting or influencing behaviour choices. The researcher is keen to analyse this area further, therefore, the next category was services & control.

Travel was an important issue as the pilot study had already alluded to improved travel behaviour purely through sensible management policies subsidising the costly expense of travel to and from work. This is also a major component of BREEAM, therefore, analysis of the practical implications of BREEAM travel credits and how they are implemented on a daily basis certainly required further analysis. Therefore, travel became one of the categories.

The final category was recycling, as again there is a body of evidence suggesting that recycling can be positive when it is tangible, obvious & easy to do. Again, this is a major category in BREEAM and the researcher was keen to explore and analyse the building users comments.

The raw data could now be coded at a meta level into the headings identified below. Further sub-headings of positive, negative and change were set up under each of the main headings. Using Nvivo raw data was then moved into each heading and sorted under the respective sub-heading. Initially this was carried out with a broad-brush approach then refined and the process repeated. This was starting to indicate where the main positive and negative issues were. The five mean heading chosen to initially sort the data were:

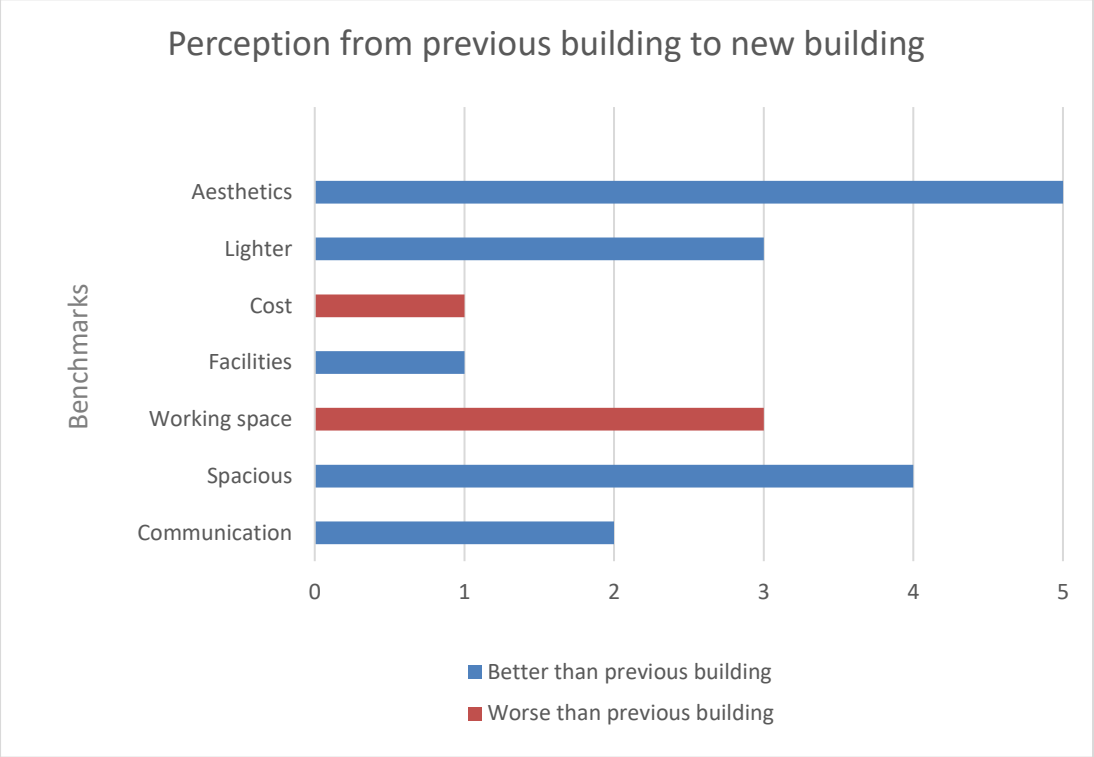
- Benchmark
- Awareness
- Services
- Control
- Recycling

4.4 Category: Benchmark

The purpose of this category was to garner the user's perception and thoughts on the new building when being asked to compare it with the previous one as this was the benchmark they had experienced. Users had occupied the new building for at least 12months and were

starting to get a feel for all its nuances, therefore the researcher was keen to explore whether their current experience is better or worse. Most of the parameters were set by the users themselves, for example, when they were asked what to do think is different in this building from the previous one, all of them identified space without being prompted. Space is not a specific requirement of BREEAM, however, a user's space greatly impacts on their behaviour Tetlow, (2012). Initial responses were collated and expressed graphically in the chat below:

Chart 4.2 Perception from old building to new building



At first glance the above chart appears to show an improvement from the benchmark, however, on closer inspection there are some interesting results being displayed. Spaciousness scores very highly with most users as the building has a much larger footprint than the previous one. However, users felt that their actual 'working space' had diminished considerably. This was an issue that appeared in numerous answers and was generally split between those working on the first floor of the mezzanine having a more positive experience and those working under the mezzanine having a more negative experience. Most of the respondents were more impressed by the building design and size, as this was a disused tram

station that had been converted. Therefore, expectations hinged around the size and grandeur of the building not its BREEAM rating or built-in features. As highlighted in the awareness category many of the tenants had not really heard of BREEAM either before they moved in or while in occupation. This contrasts with Monfared (2011) who, in her study, found that a BREEAM excellent rated building raised the occupant's level of expectation, however, most of those tenants had been involved and were engaged in the development stage of the refurbishment which had not happened in this case. Some of the verbatim comments from users working under the mezzanine are given below:

> *"The negatives is the way it is set out. There is a lot of wasted space, the way that all the operational areas are packed in like sardines is not great".*

> *"Because there is so much space in the centre, its open plan and then we are all penned into one side".*

Again, half of the respondents thought the building was airier and lighter than the previous building, however, as the questions materialised it became clear that, while the building was brighter, lighting and glare were issues.

Table… below categorises the most frequent negative and positive words, along with those that signify a change in behaviour, relating to the benchmark category. This is almost a reversal from some of the other tables where negative comments have dominated. Again, as with the chart above, it shows that both aesthetics and communication was largely positive as most respondents liked the look and the feel of the building, and the fact that everything is on one level as opposed to being spread over several floors as the previous building. The categories have been analysed further below.

Table 4.5 Positive, negative & change % with comments on Benchmark

Word	Length	Count	Weighted Percentage (%)	Verbatim Comments
Negative				
building	8	26	1.84	Even if the department had some kind of bin and all the cups went in there and then recycled. That would have a huge impact as they go through thousands of cups a

Word	Length	Count	Weighted Percentage (%)	Verbatim Comments
				month! Especially when we have come from a building where we used a regular cup! In terms of the whole building it's quite noisy in certain areas. The roof was supposed to keep the noise in, but it's obviously not worked because we can hear babies screaming etc. During a conference call it is so loud and I think if you have got people in a meeting and you need to discuss things you don't want to hear everything else and I think sound carries too much. That's the only thing I can say from a personal perspective I don't like about this building. In the last building I was near the window and it's not only the air that you are getting it's also the smells, the grass, everything else that you would associate with a summer's day outside. You don't get that in here, none of the senses, plus people can regulate themselves a bit more, which they can't do at the moment We could open windows in the last building.
home	4	12	0.85	I don't bother recycling here because I know they just throw everything in one bin bag anyway, even if you put them in recycle bags. I do at home, just not here. Probably because I know what I'm doing at. I know all the information I need, and because I know that it's easy, but here it keeps changing and there doesn't seem to be any "do this, do that", so no-body really knows what's going on. It would be a lot more simple [sic] if people were to say this is what we would like you to do. If someone said to me put plastic bottles in this bin I would put plastic bottles in that bin.
facilities	10	7	0.50	The negatives is the way it is set out. There is a lot of wasted space, the way that all the operational areas are packed in like sardines is not great, especially as the reason why we moved was because of space. I know we don't pay rent on it, but even so they are pretty jammed in there. Aesthetically it is lovely, to work in I think it's getting more and more cramped and I don't think that is a great atmosphere to work in to be honest with you.
Sub-total		**45**	**1.35**	
				Positive
home	4	8	3.96	At home if you could have automated taps and lights I think that would be great. I think personally, it's more to do with the green bin at home, so it's implanted at home with the secondary bin,

Word	Length	Count	Weighted Percentage (%)	Verbatim Comments
				separating waste, so I have just brought the same concept here to work.
building	8	5	2.45	It is a lovely environment to work in because it is unique, I have never worked in a building like this before. I enjoy the look of the building and the feel of the building, I like it that we are working closer together, we have got more teams together than in the other building, the other building was two separate floors so people didn't really know who people were before unless you were management and then you would get to know people.
better	6	3	1.49	Obviously architecturally it looks a lot better, it's aesthetically pleasing and much bigger and it's a nicer environment to work in to be honest.
together	8	2	0.99	
1000sq	6	1	0.50	In terms of space it has gone from 1000sq m to just over 5000sq m so it's much more open and light.
5000sq	6	1	0.50	
5pm	3	1	0.50	Because of the limited number of spaces, one thing the car park has done is remove the 9am-5pm culture because people have to fight for car parking spaces, so I have noticed it has changed working behaviours because people are coming into work early to ensure they get a space.
9am	3	1	0.50	
aesthetically	13	1	0.50	
architecturally	15	1	0.50	
Sub-total		**24**	**11.89**	
			Change in Behaviour	
building	8	9	2.69	My habits haven't changed it's just things that have been introduced since coming into this building, such as the drinks machine, that gets on my nerves and makes me realise how much waste there is with the cups. In the last building someone did a survey and between 50 and 60 people said they came to work in their car and that's what they would continue to do, but within the first week of moving, I can probably name half a dozen people who didn't drive before started to drive and come in early to get a parking space. So even in the first week of being in the new building it was causing issues for everyone.
home	4	5	1.52	At home it's very different from here. I am probably an 8 or 9 at home but it here it's completely different here. Yes it is important. It is more important to me at home, put it that way, and habits that I have got at home I am trying to bring in here and it does affect my attitude.

Word	Length	Count	Weighted Percentage (%)	Verbatim Comments
attitude	8	2	0.61	Mind you my attitude hasn't changed but my actions have. In the old building I used a mug, now I use coffee cups that are thrown away after each drink. So yes I suppose I am worse now.
Sub-total		**16**	**4.82**	

The total number of words used in a negative context was 45, with words relating to a change in behaviour being 16, and words used in a positive context was just 24, as expressed below. This indicates that users talk about the new building in a negative manner and, to a greater extent, without realising. When users were asked what they think of the building all of them were in awe of the size and history, however, when they were left to discuss the building with nobody listening, they had plenty to say about it. Moreover, there was the feeling that users could not express these views to management.

Table 4.6 Percentage of total comments on Benchmark

	Negative	Positive	Change	Total
Total No. of comments	45	24	16	85
%	53%	28%	19%	100%

4.4.1 Benchmark Analysis

Analysing some of the words further, for example 'Building', this was mentioned far more in a negative context than positive. One of the main reasons for this as due to noise, this is not something that is not measured under BREEAM for offices. However, this particular issue arose during the design stage where all of the ceilings to the meeting rooms & training rooms were removed as part of a cost cutting exercise. Tendencies were also detected for users of non-BREEAM buildings to be more satisfied with sound, privacy, and amount of space, this is in line with S Altmontes (2017). This was a stark difference from the previous building which had lots of openable windows at the occupant's disposal. Again, this is in line with S Altmontes 2017 study suggesting that occupants of non-BREEAM-rated buildings showed trends for significant and substantive higher satisfaction with air quality and visual privacy

than users of BREEAM-certified offices. The lack of openable windows was also a source of complaint as this diminished option of cooling down the building when it over heated and there was little view out of the building.

In relation to the positive comments many of these hinged around the aesthetics & grandeur of the building, and the space. Most of the users commented positively on the building environment, however, this is not the same as building comfort. Likewise, the large floor area of the building did not translate into usable floor space for the occupants.

In relation to the negative and change categories there were some stark comments mainly around recycling and the change in their behaviour between home and work. This also highlighted in the negative category a lack of management & policy around how the building should be used, for example with recycling. This is discussed further in the recycling category, but it has been included here too as there is a distinct change in expectation from the previous building and the occupants home life. A text word search was carried out using only the negative and change nodes, as these were closely related, this is expresses in the word tree below; the researcher has underlined the full statement in the same colour to illustrate how differently occupants view their behaviour in the building when compared to their behaviour at home. The comments to the left of the tree are the user's attitude to recycling in the home compared with their attitude on the right to recycling at work.

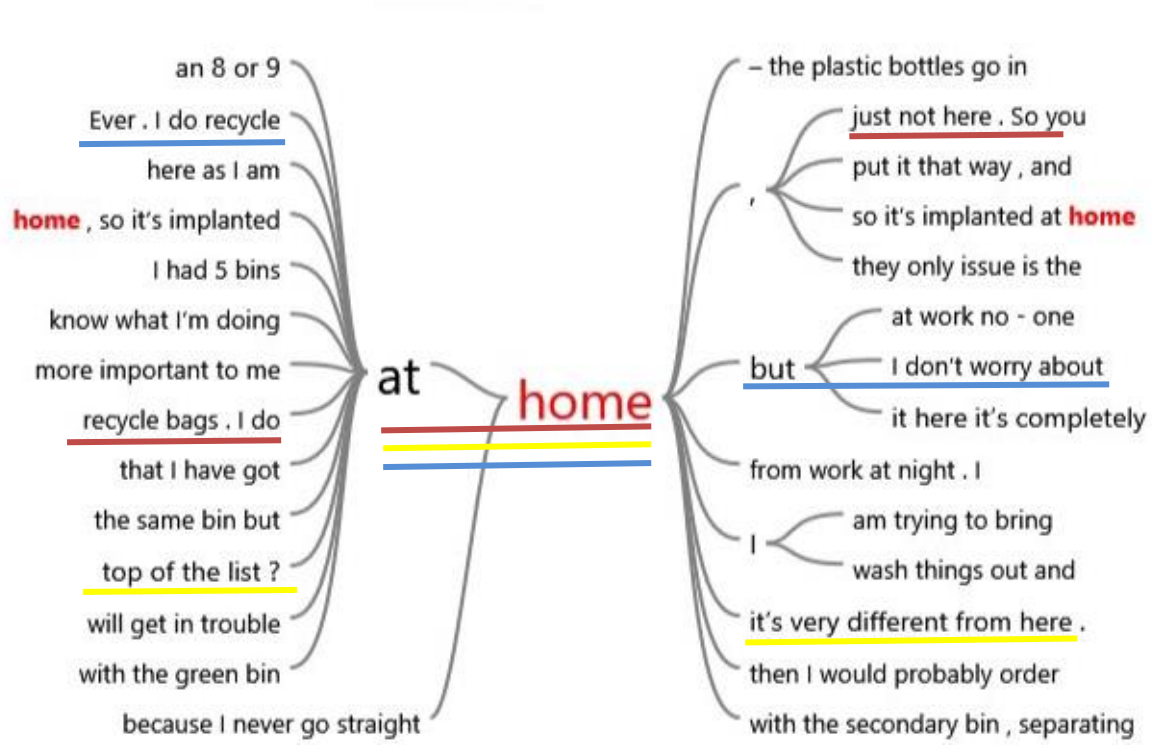


Fig 4.1 Attitudes towards recycling

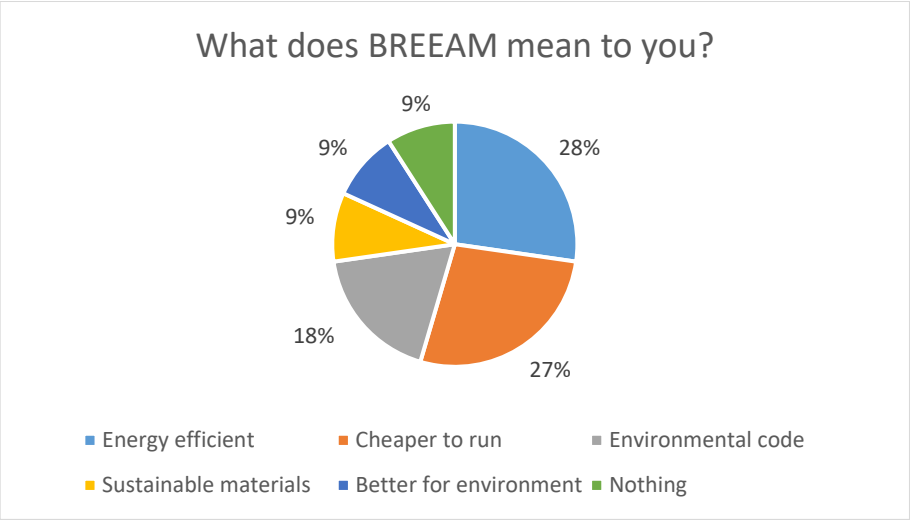
The word tree identifies a stark difference in attitude, essentially the left side of the tree indicates the positive while the right side indicates the negative. The catalyst that changes their behaviour is the difference between home & work. The interesting conclusion that can be drawn from this when considering some of the valuable comments is the lack of management setting policies and the lack of respect for the building from the users, possibly an extension of building users being unhappy with their surroundings.

4.5 Category: Awareness

The purpose of this category was to gain an insight about the general level of awareness and understanding building users had of BREEAM categories and credits. This was important as participants in the pilot study all worked for a building consultancy firm who had a reasonable understanding of BREEAM. Whereas the case study participants, while the end brand was construction, the business at head office was mainly insurance and administration.

Occupants were initially asked what BREEAM meant to them if they had to describe it in a few of lines, the results are shown below:

Chart 4.3 Users understanding of BREEAM



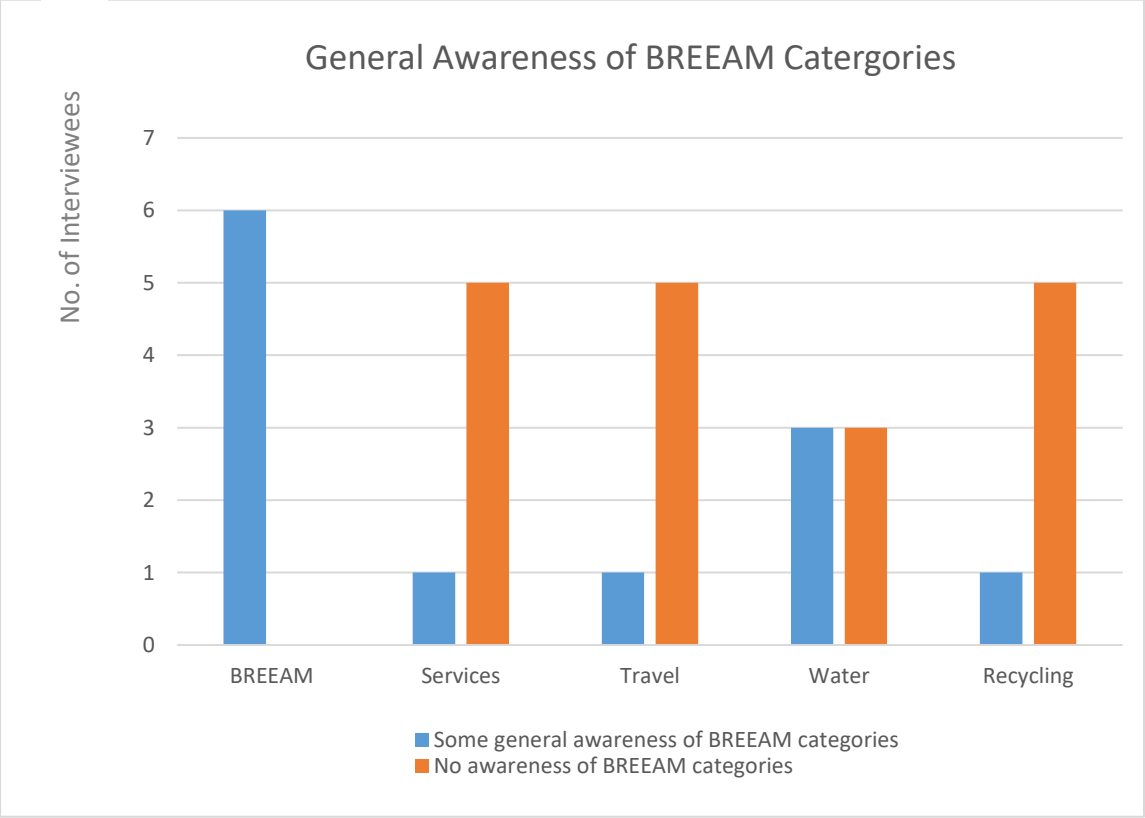
Most of the respondents associated BREEAM with being cheaper to run, this is also an expectation highlighted by (Holmes & Hudson, 2001). Although one respondent who had access to cost data highlighted, in the previous question, that the new building was far more costly that the previous one suggesting:

> *"We were very surprised that the lights within the centre of the building are rated at 3KW each, but I know there is a huge void to fill with light when it's dark but I think there is about 30 odd lights, which from a running cost perspective it is a sizeable amount of cost that is generated from keeping those lights on. We did a very basic calculation of about £100 - £120 per day if the lights were on 12 hours a day".*

This is a view given in Aspinal et al., (2012) study where respondents were asked whether the upfront cost of BREEAM is offset by lower operation costs. This was a mix with half suggesting it was, but with no real evidence, and the other half believed that there is not enough evidence to support the concept. Therefore, it is reasonable to assume that lower running costs appear to be a perception rather than actual experience for some occupiers. Moreover, this was a Landlord's decision that the Tenants had no choice over. Half of the respondents also associated BREEAM with energy efficiency and lower running costs. As

highlighted by Reason and Mashford (2014) Portcullis House, built in 2001, was one of the first office buildings to achieve a BREEAM excellent rating. However, its display energy certificate was a 'G' rating demonstrating poor in-use energy efficiency. This is more commonly known as the 'energy gap', or on a wider level the 'performance gap', according to Robinson *et al* 2016, a factor of the performance gap is user behaviour. This was demonstrated as even though respondents perceived BREEAM to be energy efficient, most of the staff still left lights on and did not turn the PCs off at the end of the day, which indicates that users are not connecting BREEAM with their day-to-day behaviours. Data was also collected about their general awareness of the main BREEAM categories, these are shown below:

Cha 4 General awareness of BREEAM



All respondents had briefly heard of BREEAM but did not really know what it was or what it meant apart from those who were involved with it as part of their job. Most respondents knew a very little about the wider agenda of BREEAM and thought it was mainly to do with green building or materials. Again, most of the respondents had no awareness of travel, water, or recycling being a criterion of BREEAM many of which have caused a number of occupant

issues and were a frequent source of complaints. This is in line with the issues raised in the literature review whereby sustainability, environment, and green building are often used interchangeably and in the wrong context causing confusion. Add to this that, after 20 years of market dominance, building users still have a scarce awareness of the fundamental purpose of BREEAM.

One element of BREEAM to assist with awareness in the non-technical building user guide, for which one credit is available. However, nobody was aware of this apart from the facilities manager who had mistaken it for the operational and maintenance manuals (O&M). It then transpired that this is an outstanding credit on the BREEAM tracker for the design team to complete and in the end, it was not achieved. Although in the pilot study the non-technical guide had been produced in a timely manner, but occupants either did not know where it was, or did not think it was important. These findings are in line with the results of the pilot study, however, they contrast with the (Holmes & Hudson, 2012) study where all those respondents found the user guide useful although the difference here is that those occupants were made aware of the use guide. It is clear here that management have to overlay this with action as the benefit of this is being lost by lack of communication and policy. More is required than just a manual to raise awareness and left in a top drawer.

Again, verbatim comments under this category have been collated and arranged in to negative, positive and change nodes as shown in the table below:

Table 4.7 Positive, negative & change with comments on Awareness

Word	Length	Count	Weighted Percentage (%)	Verbatim Comments
Negative				
aware	5	10	0.71	For me personally, we have not got an awareness but I think the main motivation for something like that is financial, and as we are the ones paying the bills I think there is not as much motivation as we might have at home. More communication. People being made aware of what is expected from people. If no-one gets told they just carry on doing what they have always done.

				More knowledge. Being more aware of what recycling and sustainability means. If you went round the office and asked everyone I'd say 70% of people wouldn't have a clue, probably more.
communication	13	7	0.50	I am sure if this information did get communicated half the workforce will say "really? I didn't know that." So just lack of communication. I am just not sure how that would be done in a building in this size. Communication is also something I would like to see more of. I think people still drive in and they just park on the road. It's not been communicated to be honest but unless individuals are getting a personal gain I don't really think they are bothered if the company gets a higher BREEAM rating. There is a lack of communication there isn't there. There should have been a notice above the taps. Paper cups, cans. That is I suppose an attempt at recycling to make sure that we separate the rubbish appropriately, but to my knowledge people aren't aware of that.
encouraged	10	7	0.50	Showers are a number 1 for me. Maybe also a cycle to work scheme. I go jogging in my free time anyway so I would probably jog to work instead of driving. With regards to public transport I have never really been encouraged to use it since working here. When you bring in a car park that is first come first serve, to be honest with you I think it has encouraged more people to drive.
Sub-total		**24**	**1.71**	
Positive				
Management	6	3	1.49	I'm probably more aware of it because it's such an open plan space and all the lights are on all the time during the day then [management] would be asking "me why are the lights on over there"? They have been on for 3 days! So it makes me more aware because I am being paid to do my job then I think it makes me more aware.
bills	5	2	0.99	Totally. That's partly because of bills though. If I wasn't like that at home and I had the likes of [management] asking why the bills were so high, I think it would make you that way but I am like that anyway.
Sub-total		**5**	**2.48**	
Change in Behaviour				
aware	5	5	1.52	I think certainly from a cost perspective I think it would make people more aware, whether it would change behaviour I don't know. It's always different when that person is paying the bills, but from an awareness

				perspective, something that shows if you left your monitor on this is what the overnight consumption is. That will quickly add up if you multiply it by approximately 260 monitors just in head office alone. We wouldn't do it at home but we do it at work because we don't pay the bills. Basically, just a reminder. Just a note to make sure everyone remembers, because it's just forgotten about and take it for granted that somebody else is looking after it. So if you are being reminded it would you make me more aware.
money	5	5	1.52	I think if you said to people this is the money that we are wasting, and put it in monetary terms, I think that would make a difference. If somebody told me how much it cost a month to run the electricity then I think it would make me start turning the lights off etc. For example people will think that's money that could go on my pay rise or bonus, everyone always links it back to themselves.
habits	6	4	1.22	
behaviour	9	3	0.91	Yes, I think if people were aware of the consumption of the building. Having awareness helps change behaviour and I think it should be 'this is what the building consumes' and I think people are intelligent and they can make their own mind on what that means from cost etc and how somebody might be able to keep that to a minimum.
encourage	9	3	0.91	
reminded	8	3	0.91	Yes I think that would be a good idea because people generally will just forget if they are not being reminded.
cost	4	2	0.61	
Sub-total		**25**	**7.60**	

The total number of words used in a negative context was 24, with words relating to a change in behaviour being 25, and words used in a positive context was just 5, as expressed below. The change category is higher than the negative category indicating that the building users are prepared to explore and possibly change their behaviour if they understood more about the building they frequented. Interestingly, more communication appeared to be a big issue. This could suggest that some Landlords are not that interested in communicating the features of BREEAM. Could this be an outcome of adopting BREEAM for other reasons such as funding where the focus is obtaining enough credits (any credits0 to secure funding.

Table 4.8 Percentage of total comments on awareness

	Negative	Positive	Change	Total
Total No. of comments	24	5	25	54
%	44.5%	9%	46.5%	100%

4.5.1 Analysis Awareness

The table above has collated the most frequent words contained in the Negative, Positive, and Change nodes that relate to awareness. With the exception of the previous table, the negative and change word count is far higher than the positive one. This shows that words, such as aware and communication were often spoken of, by the occupants, in a negative context.

It is clear to see from the above that by far the section with the least comments was positive. Most building users connected awareness with something negative that they did not know and conversely if they knew it would impact or change their behaviour. There is a sense of users wanting to know more about the building, however, that does not necessarily transpose into behaviour change. Further interesting points identified under the change category was the need for a note or reminder to do things, for example, the 260 monitors that are left on, what will instruct them to switch them off? There is the tangibility of cost 'cold hard cash', however, this is not coming directly out of the building users' pocket and clearly is not enough to motivate them. Additional strategies are needed to make any meaningful impact. Nudge theory, discussed earlier, has a role to play here for all the everyday tasks that need doing, such as turning off monitors, management need to enforce, keeping up the gentle reminders along with signage until new habits are created, which in turn fosters a change in culture as outlined in Duhigg (2012).

This is further demonstrated in the word tree below that shows some link between lack of communication, understanding, and awareness. The only two words that were prevalent in the positive category were management and bills as these highlighted a level of awareness. In the case of the work environment management asking FM why lights, heating and the like

are on when it's not necessarily raised awareness with FM. This had a positive impact, but only on FM and not the wider workforce.

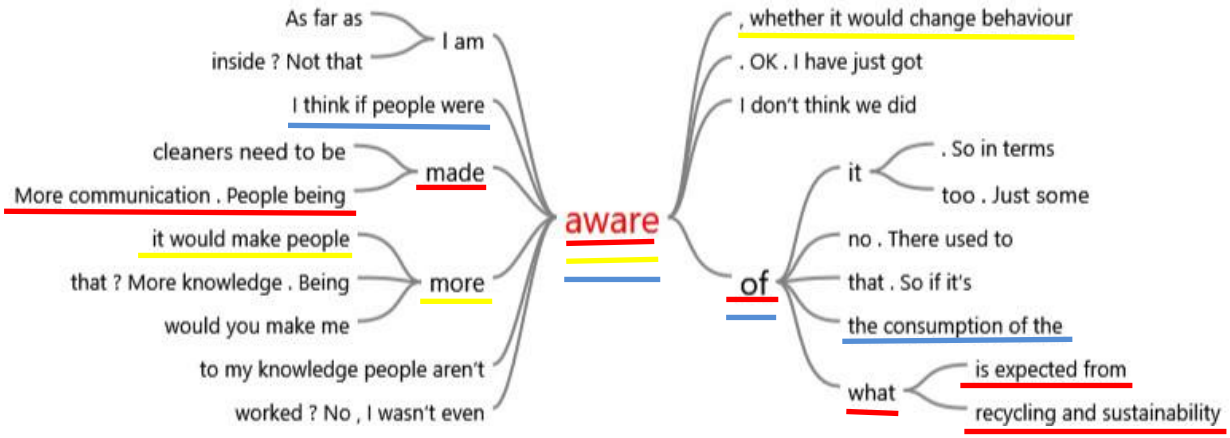


Fig 4.2 General Awareness

The word tree above indicates on the left a more open response from the user's wanting to understand more about the building juxtaposed against the reality of whether these measures would in fact change anything their behaviours. Again, this demonstrates the need for management and policy. The negative influences in this category all hinged around awareness, communication, and encouragement. There is a role here for BREEAM to raise their awareness with regular building users and advertise its purpose and features better. However, the mainstay of responsibility must sit with management in ensuring that the features of BREEAM are embedded into their policies.

4.6 Category: Services and Control

This is by far the largest category as it encompasses all the services including lighting, heating, and sanitary as well as how these services are controlled; therefore, part of this analysis will look at the building user's environment and how control impacts on the users personal space.

Analysis of this category will be in three parts, the first part will look at lighting, the second part will look at heating & cooling and the third will look at sanitary. Analysis has been split

like this as each part had issues raised during the interviews, however, all three parts also have issues with automation and personal control and this cuts through all of this category and will be discussed within the relevant parts.

This category is possibly the largest and the one that attracted the most complaints. Again, the negative category is by far the largest and unlike areas such as glare, the difference between the ground and first floor are stark. Further issues highlighted are the cost of having the lights on, the lack of control over a personal space, lack of fresh air and automated taps in the bathroom. This category also highlighted a general unhappiness and around the rules to modifying a user's personal space. These issues are discussed in turn below.

Table 4.9 Positive, negative & change comments on Services

Word	Length	Count	Weighted Percentage (%)	
Negative				
lights	6	34	2.41	When it is a bright sunny day I am not sure these lights are adding a huge amount of value that above my head, but they are on. I think they are too bright to be honest. They are over my head and I sometimes get headaches.
cost	4	16	1.13	We were very surprised that the lights within the centre of the building are rated at 3KW each, but I know there is a huge void to fill with light when it's dark but I think there is about 30 odd lights, which from a running cost perspective it is a sizeable amount of cost that is generated from keeping those lights on. We did a very basic calculation of about £100 - £120 per day if the lights were on 12 hours a day. We didn't have a say in the design. The lights and the drinks machine must cost a fortune! Well if you put that and the money we waste on lights together, then yes. The lights cost £20K in the first quarter.
air	3	15	1.06	Obviously [management] they have their own controls and they can do what they want, and then you go down where there's loads of people in the corner with one air-con switch for all of them and no windows that open – it's probably a different story down there. I know it's very difficult because it's an open plan office and we are quite lucky where we sit because we can control it from the cupboard just outside, but that's only because we are controlling it for ourselves and marketing so it's very
control	7	15	1.06	

				different but for everyone else it's open plan they have to go with the majority and unfortunately we are getting some people saying they have earache or their eyes are watering because they are sitting right underneath the air-conditioning, and then other people complaining they want to move because they are boiling and sat next to the window. Well for instance the person that was complaining that they were cold because they sit under the air-conditioning unit phoned in sick with a cold because they were so cold. We've got air-conditioning but because of the size of the building, we are not in enclosed offices so it's very difficult for me to manage an optimum temperature that is the main issue here. Obviously it's quite nice now because we have the glass roof that heats up quite nicely during the summer, but can also get very hot because we have very little fresh air, which causes an issue. We do have fresh air coming out of the filters but if someone is sat right under them I have to turn them down which means we haven't got any air circulating around the building. If they had an unlimited budget they should have made it so that you could control your own temperature over each work station. We have just had some contractors in and they have put cardboard filters in two side of the unit to stop the air-flow blowing onto people as that was a huge issue, because obviously it can't be turned off because we haven't got enough controls, so there is a vast amount of people which are being controlled by one unit.
windows	7	14	0.99	Where I am, from a dead selfish point of view, I am fine, I am perfectly comfortable. Other people, I guess would prefer windows that open, that would solve some problems, because air-con is freezing so natural air is just nicer isn't it. That's one of the things I said when I first stat down, can we open the window? People wouldn't know with regards to BREEAM would they? The way I found out that it was BREEAM was because of the issues they have had been faced with in the building i.e. we can't open the windows
water	5	13	0.92	The taps which are on PIR's, the cisterns, the cisterns only fill part way up in the bathrooms to save water, but that's been causing issues because they don't flush as powerful so they don't work because they don't have enough water in them. What it is, they are on a sensor so if someone leaves the bathroom it will stop anyway because there is no-one there, so the sensor will switch so they might not even be to the level that BREEAM states, which means when they next

				person flushes there may only be half the water in there than there should be in order for it to flush. Which generally means you get a backlog of debris
pir	3	10	0.71	I noticed some corridors where the PIR keeps the light on almost permanently or on some stairwells. Even on the mezzanine level they are probably set too higher level, it can take 30-40 minutes to switch the light off if the PIR doesn't recognise any movement.
taps	4	9	0.64	The automatic taps, obviously that's BREEAM, some people have been complaining about that, they can't get the taps on properly.
temperature	11	9	0.64	*see air
fans	4	8	0.57	We are not allowed fans on our desks, but if we had them that would be fine – then the area could be kept at a constant temperature and if it got too hot just turn the fans on. I think there needs to be more units fitted, as there are quite a lot of people and everybody is different so if you turn it up to please some people you've got complaining and you turn it down you've got complaining. There are no fans allowed on desk so people cannot control it themselves. You can only have a fan if you have a medical condition.
conditioning	12	7	0.50	*see air
Sub-total		**150**	**10.63**	
				Positive
lights	6	8	3.96	In terms of space it has gone from 1000sq m to just over 5000sq m so it's much more open and light. At home if you could have automated taps and lights I think that would be great.
dual	4	2	0.99	I think that we have dual flush, so I am aware of that.
facilities	10	2	0.99	It is a lot better than before and there is much more space and facilities like the canteen which has more seats for people to sit and chat over lunch and interact more.
flush	5	2	0.99	
remember	8	2	0.99	
tap	3	2	0.99	At home if you could have automated taps and lights I think that would be great.
water	5	2	0.99	
automated	9	1	0.50	
Aware	5	1	0.50	
Change		**22**	**10.90**	
facilities	10	4	1.22	*see travel
lights	6	3	0.91	I felt quite an emotional attachment to the building as I've seen it go from a derelict shell to a very pleasant office. So I will turn lights off.

				Well we don't want to start drilling holes in the walls but if there is something that could be put up saying "please turn the lights off" then yes.
personal	8	3	0.91	
desk	4	2	0.61	
Sub-total		**12**	**3.65**	

The total number of words used in a negative context was 150, words used in a positive context 22 and words relating to a change in behaviour being just 12. The negative comments were a close to seven times the positive comments indicating that services are a major sticking point. However, perhaps more interesting is the number of comments in the change category at just 12. Users had little to say in this regard, even when signage was recommended to nudge to change behaviour, in fact they expressed concerns over damaging the walls. The results are analysed further below.

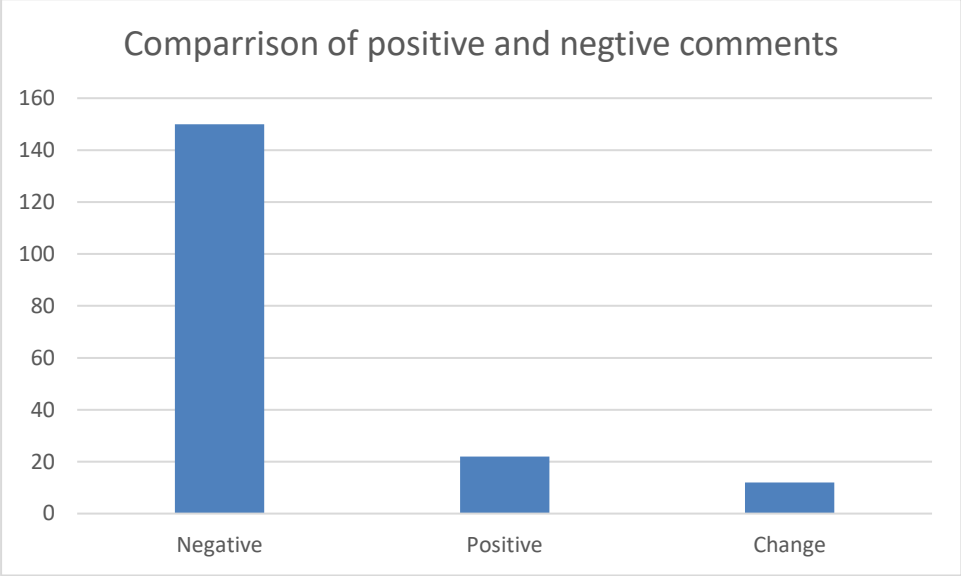
Table 4.10 Percentage of total comments on services and control

	Negative	Positive	Change	Total
Total No. of comments	150	22	12	184
%	81.5%	12%	6.5%	100%

4.6.1 Analysis of services and Controls

By far this category attracted the largest number of negative comments ranging from lighting issues, automation, the temperature of the building and the lack of control. Almost every user had something negative to say about the building mostly around the environment being either too hot or too cold and not having the ability to change their environment. This was coupled strict policies on the use of desk fans and lighting. Chart 4.5 below expresses the stark differences between the positive and negative comments.

Chart 4.5 Comparison of positive and negative comments for services and controls



By far the biggest cluster of negative comments were experienced in the services category with 148 negative comments compared with just 22 negative comments. This means that services were discussed in a negative manner 148 times. Not surprising the change category is small, as generally users cannot adapt their behaviour from an air-conditioned building to a none-air-conditioned building.The three major issues identified in this category namely, lighting, heating & cooling, and sanitary are discussed in further detail below.

Lighting

Lighting was by far the largest source of complaints with the main issues hinged around lighting levels, Passive Infrared Sensors (PIRs), and glare from the lighting. Under BREEAM 2008 there are two credits covering lighting levels and zoning. Essentially these areas should comply with CIBSE lighting guide 7 which gives recommendations for lighting levels and zoning. According to the BREEAM tracker the credit for lighting (Hea 5) and zoning (Hea 6) had been achieved and were both signed off at the pre-completion stage. Therefore, issues around lighting being too bright should not have been experienced. Likewise with zoning, according to BREEAM 2008 lighting should be zoned per ever 4 desks and controlled by a PIR, however complaints around this issue were that lights were unnecessarily left on all day, because they were picking up on movement. Whereas lighting

elsewhere was failing to pick up movement. The same credit also seeks to limit glare from lighting, although it appears this was only experienced under the mezzanine. Some of the verbatim comments around these issues are given below. Again, this is a source of complaint as the ground floor under the mezzanine is too dark and above the mezzanine is glare. Bearing in mind this was checked and passed under BREEAM. Users can also see that lights are on needlessly during the day, but because they are automatic there is nothing they can do, some verbatim comments are given below:

Lighting levels

> "*They are probably needed on much more downstairs under the mezzanine because it's much darker because we have the skylight above us, so we get a lot of light*".

> "*I think they are too bright to be honest. They are over my head and I sometimes get headaches*".

Again, as highlighted earlier PIRs are part of the BREEAM process that awards credits.

PIRs

> *"Some of the PIR's are probably set to stay on too long, I noticed some corridors where the PIR keeps the light on almost permanently or on some stairwells".*

> *"Even on the mezzanine level they are probably set too higher level, it can take 30-40 minutes to switch the light off if the PIR doesn't recognise any movement".*

Lighting glare

> *"I know there has been issues that some people have glare on their screens but I have never had any issues with the lights".*

> *"It took me 7 months to sort out the lights under the mezzanine, to get it right where everybody was happy. Because people had glare from their screens".*

PIRs are an automated system intended to turn lights on and off according to the sensed occupation/vacancy of a space and that occupants will not be inconvenienced. A further benefit often espoused includes the expectation that energy savings will occur, that the

building's market value will be enhanced and that tenants will be retained. However, how inhabitants will actually interact with the energy-saving technologies is difficult to foresee. This is another example of loss of control to a workspace and where policies could enhance the impact of this, they make it worse by not allowing any desk lighting.
The general trend of lighting issues seems to split between the ground and first floor mezzanine with users having different experiences depending on where they sit. As highlighted the credit lighting and zoning was achieved at design stage and fully signed off at Post Construction Review (PCR) because nothing had not changed from the original lighting specification. Nevertheless, several complaints were routinely raised, therefore, it is possible that this lighting was never checked in-situ against areas like the ceiling heights, skylights, wall colours, and seating layouts, as the BREEAM tracker would appear to suggest.

Heating & Cooling

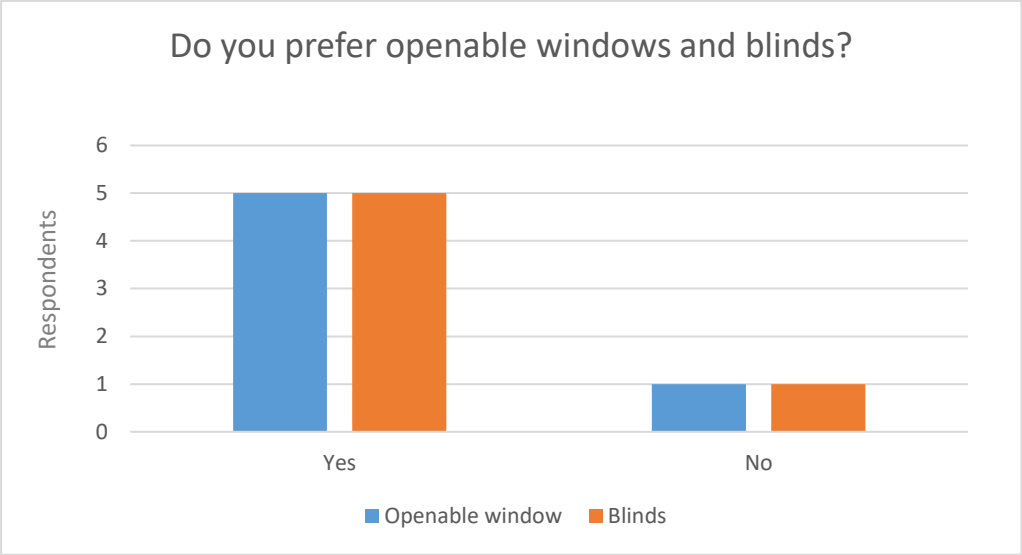
Some of issues highlighted in table 4.9 fall under a single credit within the Health the Wellbeing category, namely thermal comfort. This credit requires evidence to demonstrate that thermal comfort in occupied spaces has been assessed in accordance with relevant CIBSE guidance BRE (2010). The researcher obtained a copy of the post construction tracker, which provides a status on which credits have been achieved. The thermal comfort credit had been achieved at the post construction review stage and the evidence provided stated that "*formal written confirmation was received, from the design team, confirming that no changes had occurred since the design stage thermal comfort assessment was carried out*". There is some discrepancy here as on paper it would seem that thermal comfort is acceptable, however, most of the respondents had something negative to say about the thermal comfort levels they experienced in the building. A study carried out by Holmes and Hudson (2012), looked at the operational value of BREEAM credits to occupiers. Of the five buildings reviewed in the study three of them did not achieve the Thermal Comfort credit (Hea 10) and two of them did when retested in use.

Some of the issues identified behind the reasons for such a negative response hinged around users being sat directly under the air conditioning units meaning they were too hot or too cold most of the day. Whereas those who sat further away experienced very little benefit from either the heating or cooling. Issues arose when users sat at the periphery request a change in temperature which in turn affected those users sat closer to the outlet. A further frustration

was that only one or two users were able, and allowed, to alter the controls removing any personal control over the user's workspace. This was coupled with strict policies restricting the use of personal devices such as fans, heaters, and lights to improve the workspace. This is a catalogue of compounded issues that could have been addressed as far back as the design stage by aligning the design with the seating plan. In addition to this a design decision was taken to remove the walls, enclosing the space, for no apparent reason other than to open up the space. A further intervention could have been made by allowing and training more users to understand the controls. At this point the most tangible intervention would be modifications, however, a brand-new refurbished building should not require modifications to achieve ambient temperatures. Although, at this point allowing modifications may have been the only intervention to quell some of the dissatisfaction. Whichever way this is presented it does not bode well for encouraging users to adapt their behaviour. Either they are allowed modifications that in themselves and not energy efficient, or they are not, which results in perpetual dissatisfaction and not conducive to behaviour change.

Coupled with heating was the issue of cooling the building down. This was an old building with a profiled metal roof that acted like a conductor, therefore, it heated and cooled quickly. During the summer months around mid-morning the building overheated every day for a few hours, however, the perimeter windows were sealed, and no fresh air intake was possible to cool the building down. The results for the interviews revealed a stark difference between the previous building and this building where all the windows were openable. Five of the six users commented on this and said that they preferred the previous building where they could open windows, have fans on desks and pull blinds across when glare was high. This is expressed in the chart below:

Chart 4.6 Preference for openable windows and blinds



Most of the users would prefer to have openable windows and blinds to control their workspace, as they did in the previous building. None of these modifications were allowed in the new building. The researcher is not suggesting that modifications are a good thing, the aim should be to get the design right first time, however, not allowing modifications creates a dissatisfied workforce. These conditions will not be conducive to encouraging engagement from the workforce to collectively reduce the buildings' sustainable footprint. This did set up a vein of resentment that came across in the interviews.

It is also important to mention at this stage that the commissioning credit was achieved at PCR stage. The purpose of this credit is to make sure that services are commissioned by an appropriate project team member and there is a commissioning programme in place for the following 12 months. The building had been occupied for more than 12 months before BREEAM was fully signed off and yet several issues were still being raised and modifications had been already been made to the air-conditioning. This suggests that there is a disjoint between the information that BREEAM requires and the experienced reality of the building users. This is in line with Sergio Altomonte, (2017) regarding BREEAM as a 'tick box' exercise. However, the researcher also believes that this has an element of 'the circle of blame' highlighted in the literature review. Instead, this is more like a circle of responsibility whereby every member goes about their area of responsibility possibly in a blinkered fashion without anybody seeing the bigger picture. For example: the design team would have

appointed a commissioning specialist for the services; this would have been handed over to the occupants; there was no facilities manager at the time and would have been random users standing in with limited knowledge; the BREEAM assessor would have gathered information confirming that commissioning was carried out and there is a commissioning plan for the next 12 months along with specifications. The issue is that this focuses on the process of commissioning and, unless the system is naturally ventilated, user feedback is not accommodated. Therefore, on paper everything complies, but in reality, users are complaining and uncomfortable.

Sanitary

Again, the negative influences were around water & taps, both of which are specific BREEAM credits. Credit Wat 4 requires a sanitary shut off to the water which means that once a person leaves the toilet, the cisterns stop filling, thereby reducing the flush next time round. In addition to this the credit Wat 1 limits water used through urinals, WCs, sinks and showers to less than $1.5m^3$ of water per person per year (p/y) if all three credits are sought and $4.5 – 5.5m^3$ for one credit. The tracker indicated that one credit was achieved. Clearly the purpose of BREEAM is to conserve water, especially portable water, therefore these measures are necessary, but issues arise with the practicalities.

During the interviews, when users were discussing their thoughts around water, they were reminded that these are features of BREEAM. This was not well received and made the users resent BREEAM, however, when the reasons behind the credits were explained they understood and sympathised with the challenges. This was highlighted in the Bordass & Leaman study who concluded that users are more tolerant of green buildings if the understand the fundamentals and are brough into process. The key is to explain the reasoning behind the features of BREEAM so that users have some understanding of what is being achieved. It is crucial to involve building users in the process and aftercare as much as possible to give them a stake in the building. Again policy & management cannot be underestimated, but in addition to this is the appointment of green champion, as highlighted in the Mackenzi-Moore study can help to regularly disseminate information around the different features and why users may need to approach them differently. A green champion should be a building user who experiences the same issues and is given the freedom to shape company policy with the knowledge that management will take this seriously.

4.7 Category: Travel

Again, some very contentious points hinged around travel, in particular the parking. The researcher was informed during the interviews that an agreement had taken place between the Landlord and Tenant to reduce the number of parking spaces available. This was also in line with the BREEAM credit Tra 6 which awards credits for demonstrating that parking spaces have been limited. The philosophy behind this credit is to encourage other forms of travel to commute to and from work, however, this needs to link with the travel plan credit Tra 5. The travel plan should be tailored to the specific needs of the building users this would then identify how many spaces can be relinquished.

Table 4.11 Positive, negative and change comments on travel

Word	Length	Count	Weighted Percentage (%)	
Negative				
showers	7	19	1.35	Yes that was a decision made between the landlord and the architect. I remember when I had a meeting with the architect one morning and we went to have a look at the toilets and I asked where the showers were and it was at that point that he said they had been removed from scope by the landlord. It was then he explained about BREEAM and the decision was a cost deduction one. So it wasn't a decision we were involved in or had any influence over. Yes I think so, but it's the showers, I know if we had showers a lot more people would pick it up. I mean I would in the summer if I could have a shower here. I know it's 20 miles but what is 20 miles on a bike? If you look at most people that work here, they only live local – probably 8 miles maximum, and people in Liverpool could cycle to the train station then jump on the train. We've got places to put the bikes but it's the showers that puts people off. but if there are no showers then I don't think that [sic] may females will cycle to work and not have a shower before work, so that number might increase if we had the right facilities for people to use.
space	5	13	0.92	
cars	4	12	0.85	It was the car parking that was the biggest emotion, how many spaces? Do we get a space? Is it first come first serve? Why is the £40 per month allowance being taken away? It was the biggest emotive element about moving here and it remains to be the case.

cycle	5	12	0.85	
parking	7	12	0.85	
bike	4	6	0.42	
Sub-total		**74**	**5.24**	
Positive				
car	3	8	3.96	One thing the car park has done is remove the 9am-5pm culture because people have to fight for car parking spaces
space	5	7	3.47	I have noticed it has changed working behaviours because people are coming into work early to ensure they get a space.
parking	7	4	1.98	
share	5	4	1.98	
cycle	5	2	0.99	We also promote the car share don't we and we do the cycle to work scheme.
train	5	2	0.99	
Sub-total		**27**	**13.37**	
Change in Behaviour				
showers	7	12	3.65	I think fitness levels aside I think I would need some good showering facilities here to make me think about that. I would probably jog to work or even cycle but I don't want to be sitting at my desk all sweaty and uncomfortable. If the facilities were here to wash before work then I would definitely think about it. If there were facilities where you could get a shower and get changed it would make it easier for people to cycle in. Marie does cycle but she wouldn't now because there are no showers.
cycle	5	10	3.04	
park	4	7	2.13	The car park is a big issues isn't it. If they thought that by limiting so many spaces for that many people would encourage car pooling or public transport, I think they were very naïve. They are still driving to work, they are now moaning because they have to pay for their car parking. So it's not had a positive effect on the environment. I know for a fact that with the previous car park, because you couldn't claim back all of the money back for parking, then some people didn't want to drive and contribute to pay for parking. Now there is a fee car park – people who used to catch the bus to work are now driving and coming in early so they can get a space. I think people still drive in and they just park on the road. It's not been communicated to be honest but unless individuals are getting a personal gain I don't
car	3	7	2.13	

				really think they are bothered if the company gets a higher BREEAM rating.
public	6	4	1.22	
transport	9	4	1.22	Well if you're looking at a travel pass your probably looking at about £800 a year, now that's a hell of a lot of money to pay out in one go for a travel pass. When I worked at Royal Sun Alliance they would pay for the pass for you and then take it out of your wages each month, which was absolutely great.
jog	3	3	0.91	If we had showers I would probably jog to work
running	7	3	0.91	
scheme	6	3	0.91	Before we had the bikes in the office and they were being kept under the stairs and we are not allowed bikes in the office because they could fall into the wall, fall down the stairs that sort of stuff
bikes	5	2	0.61	
Sub-total		**55**	**16.73**	

The total number of words used in a negative context was 74, with words relating to a change in behaviour being 55, and words used in a positive context was just 27, as expressed below. Many of these comments related to parking, not only was this an issue in the new building but it was a lot worse than the parking situation is the last building. This really gave the perception that they had lost out on something that they had previously. This is discussed in more detail below.

Table 4.12 Percentage of total comments travel

	Negative	Positive	Change	Total
Total No. of comments	74	27	55	156
%	47.5%	17.3%	35.2%	100%

4.7.1 Analysis

As identified above, travel was a major source of complaint with the building users. By far the largest issue hinged around parking spaces. In the previous building each user had a £40 allowance each month to pay for parking. Upon moving to the new building parking was available but limited and on a first come first served basis. As outlined above spaces were purposely limited as a result of an agreement with the Landlord and the BREEAM credit Tra

5. Apparently, a questionnaire went round the company to identify who drove, who could car share, and who would cycle to work. This was all part of the BREEAM travel credit Tra 5 and should have identified the maximum number of spaces available. This should, in turn, have matched with other modes of transport so every member of staff was accounted for. Something has broken down here, either the travel plan did not identify everyone, or staff members changed their mode of transport after the travel plan was issued.

A result of the travel plan, a cycle to work scheme was introduced offering money off a bike. The work carried out by the company was laudible in trying to reduce the transport burden. However, this did not appear to follow through with the BREEAM assessment. Almost all the users commented on the fact that there were no showers in the building, this coincided with people not wanting to cycle to work because of the lack of showers and no bike store. It is possible that those staff members who said they would cycle to work changed their minds once they realised that there were no showers or bike store and decided to drive affecting the available number of parking spaces.

From the verbatim comments parking was one of the most contentious issues amongst building users. The decision to limit parking without a comprehensive plan in place actually resulted in negative behaviour change. For example, users are now driving in to work instead of using public transport because it is free if they get there early enough. Users are also arriving earlier to get a space as they are limited now, however, they were staying in the car park until 9am, therefore, the employer is not benefiting from this as one interviewee pointed out. Users will not cycle to work as there are no showers, thereby rendering the bike scheme ineffective.

There is a real disconnect with travel and this appears to run through the whole assessment. Perhaps a reason for this is the initial decision to undertake BREEAM for funding purposes only thereby giving it the status of a ‘means to an end’ approach without considering the content or purpose of the credit. This has resulted in numerous complaints some behaviour change and users not engaged with the building. It is imperative that the users of a BREEAM building see the features as something useable & tangible.

In addition, the cycle credits were dropped from the assessment due to cost and replaced with the ecology credit LE5 which required bat boxes. The location of the building is in the centre

of Birkenhead and during the interview a comment was made that the bat boxes had never been used since they were installed. The researcher is not against bat boxes per se, it is what flows from this decision that is a matter of concern. A bat box gave the necessary credit, but at the expense of a cycle store and showers that building users had already expressed a desire and need for. This had an impact on how many users would cycle to work and make users think 'what was the point in asking'. This can affect attitudes and in the long run behaviour and effectively halt the users from engaging with the building.

This is in line with some of the findings identified in the literature review especially BREEAM being a tick box exercise to get to a desired level of credits and was further echoed by Holmes and Hudson (2001). This has missed the fundamental principle of a travel plan by working together as a company and truly creating a bespoke solution that suits the needs of all staff members as opposed to a generic document that ticks the box. The Department of Transport describes the process as:

> *Communication about your travel plan starts the moment you send out your staff travel survey or set up initial discussions groups. Travel plans are intended to bring about change, calling for skilful communication to ensure that the prospect is received in a positive spirit and that no one feels under threat. (DfT 2008, 22.)*

The travel plan was sent out to staff, but never really followed through as a working document and not consulted following the decision to drop the cycle store and showers.

4.8 Category: Recycling

Recycling did not register as a major source of complaint, however, once building users were given the chance to discuss this in isolation several strong views were aired mainly driven by the drinks machine.

Table 4.13 Positive, negative and change comments on recycling

Word	Length	Count	Weighted Percentage (%)	
Negative				
Bins	4	39	2.76	No because I don't know where it is. I thought you meant the one outside, the cardboard one? Do you mean the different bins? Well everyone just seems to throw it in the same bin and I get involved in that unfortunately. Yes because with regards to the can machine, people buy cans and put them in the bins at the side of their desks. I think cans are meant to be recyclable but everyone just throws disposable waste in there so it doesn't get separated. I saw the cupboards and asked what it was and someone said there is a recycle bin. I can't recall there being any official communication that it was there. I would just put it in the bin. Bottles of water are a prime example, we were putting them in different bins and then the cleaner just put them into one Oh sorry, I thought you was talking about the bin storage area. Well we have got the bins next to the drinks machine, but to be fair you don't generally find anything else in there apart from cups. The kitchen no. We've got the recycling bit in the kitchen and the other one but as I say they tend to throw their rubbish in the nearest bin. Would [management] want bins throughout the office, when we can't even have a cup on our desk? It's not going to happen.
recycling	9	26	1.84	I don't bother recycling here because I know they just throw everything in one bin bag anyway, even if you put them in recycle bags. So I think people are more aware and we have the recycling bins outside, but I have noticed that the recycling bins that were provided as part of the kitchen fit-out have never been used. I think it just then all goes into the general recycling together. We haven't got a recycling policy. We recycle a lot more in here, they don't generally do it in the kitchen although we do have the plastic

				bin liners in separate bins, people just put their rubbish in the nearest bin don't they.
cups	4	24	1.70	Yes because more and more cups are being used all the time. It's not just costing money it's obviously having an impact on the environment as well. Yeah I have heard loads of people mention the coffee cups, that it's really bad for the environment to throw away a cup after every drink. I mean how many cups are being used, there are thousands of cups being used every month.
drinks	6	14	0.99	High energy and high cost. The drinks machine works out at £30 a cabinet rental a week, so there's £90 per week and it's 11 pence per cup of drink. So I think the drinks machine amounts to about £13,000 a year. The drinks machine that gets on my nerves and makes me realise how much waste there is with the cups. The fact they have introduced these things that we didn't have before but no-ones using them. Even if the department had some kind of bin and all the cups went in there and then recycled. That would have a huge impact as they go through thousands of cups a month! Especially when we have come from a building where we used a regular cup! How this is more energy efficient, I don't know? Obviously the coffee machine is really bad for the environment with all the cups,
machine	7	12	0.85	
waste	5	11	0.78	
Sub-total		**126**	**8.92**	
Positive				
bin	3	2	0.99	I try and use the bins in the kitchen.
cups	4	2	0.99	My personal preference is I quite like the drinks machine because it's more hygienic than sharing cups, and whether people making the drinks have washed their hands
recycling	9	2	0.99	
Sub-total		**6**	**2.97**	
Change in Behaviour				
bin	3	12	3.65	If someone said to me put plastic bottles in this bin I would put plastic bottles in that bin.
cups	4	6	1.82	I'd like to see a recycle bin for the paper cups
waste	5	5	1.52	

drink	5	3	0.91	
recycling	9	3	0.91	Awareness. If we tried to separate cans from paper cups from general rubbish, I think that would help. It's like that in Uni, they have the 3 bins, burgundy, black and orange and a picture on each and they are all next to each other so there is no extra effort to put things in the right bin. I think you would have to take everyone's desk bins away for it to work.
coffee	6	2	0.61	
Sub-total		**31**	**9.42**	

The total number of words used in a negative context was 126, with words relating to a change in behaviour being 31, and words used in a positive context was just 6, as expressed below.

Table 4.13 Percentage of total comments on recycling

	Negative	Positive	Change	Total
Total No. of comments	126	6	31	163
%	77.5%	3.5%	19%	100%

The number of comments in the behaviour change category indicates that the building users would like to adapt or change their behaviour as they are unhappy with the level of waste produced by the drink machines. However, if kettles are not allowed this situation cannot change and is invoking unhappiness among building users. One interviewee felt so strongly about it that they refused to drink from the vending machines. This is discussed further below.

4.8.1 Analysis

This category is closely aligned with the awareness category as most of the interviewees were unaware of the dedicated recycling area curtesy of BREEAM. When questions were asked about recycling most thought this was the sensitive document waste bins outside and many were surprised when they realised one was in the canteen, apart from the facilities manager.

Apparently over lunchtime the two main bins in the canteen were filled up with rubbish while the recycling bins hidden in a cupboard were virtually empty.

Clearly the users want to recycle as they have demonstrated that with their attitude towards the drink machines so why was recycling in general not being carried out and had not been practiced for the last 12 months. One interviewee suggested:

> "*It's like that in Uni, they have the 3 bins, burgundy, black and orange and a picture on each and they are all next to each other so there is no extra effort to put things in the right bin. I think you would have to take everyone's desk bins away for it to work*".

It simply is not enough to expect users to know all the features of a BREEAM building and just react accordingly. It is becoming clear that additional measures must be put in place to nudge building users towards the embedded and sustainable behaviour change. This contrasts with a study carried out by Wu et al. (2013) who compared the recycling habits of two buildings on a University campus. One was built with sustainability in mind, Centre for Interactive Research on Sustainability (CIRS), and the other building being the Students Union Building (SUB). Recycling behaviours were monitored over lunchtimes for several weeks and the results show that recycling in the CIRS building was around 25% higher than recycling in the SUB. This led the researchers to conclude that being in a sustainable building encourages the user to correctly choose the right recycling bins to dispose of rubbish. The study does highlight bias in the sense that users of the CIRS building are familiar with that building. However, there are further issues with this study, for example, how familiar were the users of the SUB, were they students and unfamiliar or not particularly connected to the building? The users of the CIRS building already understand sustainability and it is in their consciousness. The researcher found a similar vein with this study, as the pilot study users were familiar with BREEAM through their work and understood a lot of its features. Whereas the case study users had very little or no knowledge of BREEAM and their interaction with the building was more remote than the pilot study.

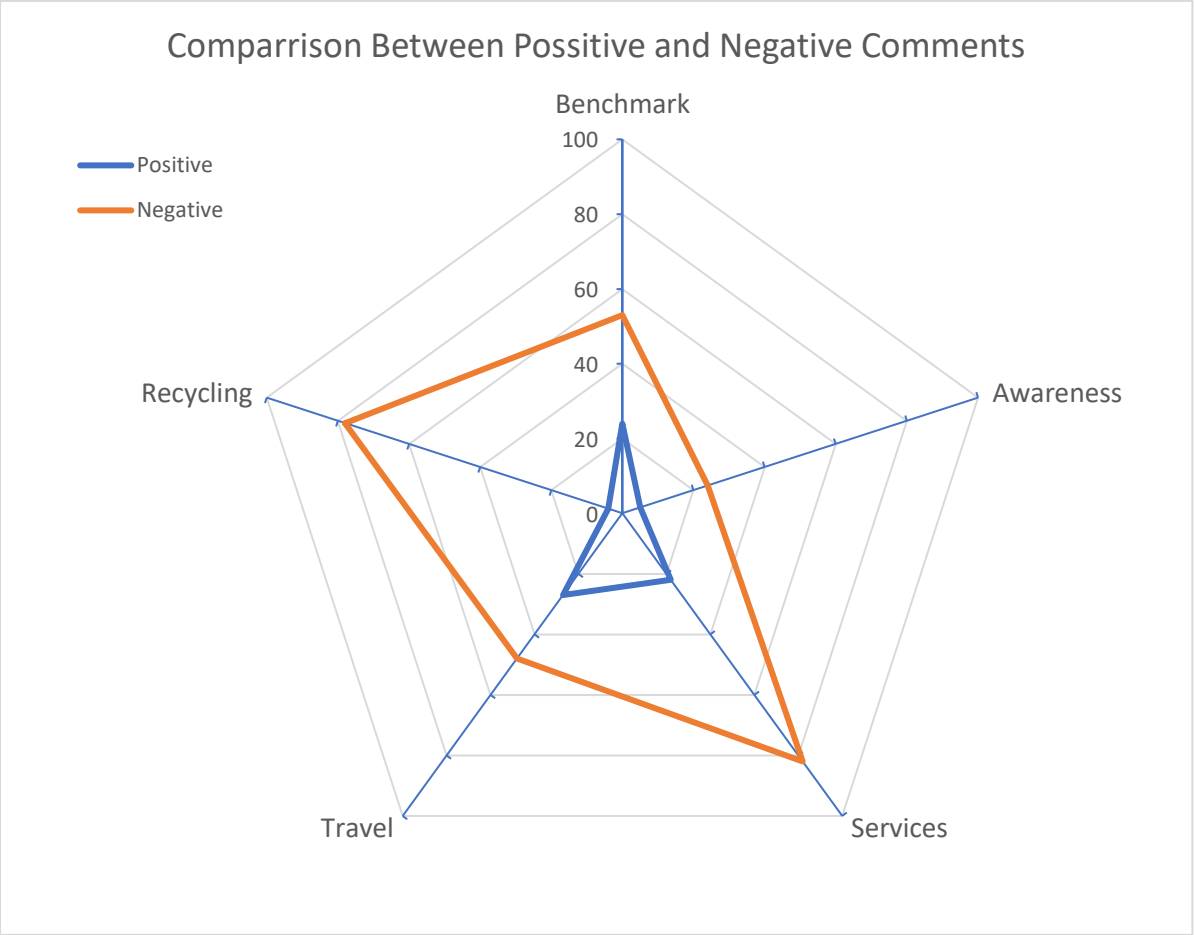
Contrasting the Wu et al. (2013) with the results of this thesis highlights several differences, as this building was built to a sustainable framework, but the building is not used in a sustainable manner. Therefore, the theory that by being a sustainable building encourages

sustainable behaviours does not transfer in this situation. However, there are a number of reasons for this, firstly sustainability is not in the consciousness of these building users. Clearly, they understand sustainable concepts as this has been demonstrated with their behaviours at home, however, these diminish one they are in this building. A further difference is signage on the recycling bins in the study bins were clearly signed, however, in this building recycling was hidden away and not adequately signed. This supports the case for tangibility, building users need to see their efforts. This acted in reverse for the dinks machine as users could see that the cups should be recycled, but there were limited outlets in which to do that fostering dissatisfaction. The researcher believes that all the negativity around the building has affected the user's motivation to engage with the building.

4.9 Review of categories

All five categories analysed above have indicated significant number of complaints negatively that have clearly fostered high levels of negativity. In general users felt disassociated with the building beyond their appreciation for the look and feel of the building. Perhaps the points to glean from this chapter is that many of these issues are solvable. The catalyst for the number of and levels of negativity are, in part, down to the lack of specific policies to integrate the features of BREEAM, or those policies that impinge on the integrating the features of BREEAM. A basic comparison between the positive and negative responses has been expressed below in chart…… from this it is clear that the air-conditioning and the drinks machine cups were the biggest sources of complaint. The positive spike in the benchmark category reflects the aesthetics of the building which all interviewees commented on and was a good starting point. However, this diminished quickly once the focus was turned on to functionality of the building.

Chart 4.7 Percentage comparison between responses



4.10 Chapter Synopsis

This chapter set out to analyse the data gathered in both the pilot study and the case study, initially the pilot study identified a range of issues for the interviews that were sorted into a number of areas. These were eventually refined in to four pillars namely tangibility, useable benefits, training, and feedback and provided a basic framework for analysing the case study. The pilot study also provided the opportunity to identify refinements for the case study questions. The chapter then analysed the results from the main case study using the basic sorting technique of those comments that were discussed in a positive guise, those in a negative, and those where a change had or would occur if a specific parameter were changed. For example, what did they do differently in this building to the previous building and if something were changed how would they respond?

Once the data was sorted in to these three areas the data was refined to identify clusters this tended to be around a high frequency of complaints. Once the data was sorted a deeper analysis of the responses could begin. Initially the level of complaints and negativity towards the buildings was surprising before a pattern started to emerge. Issues identified in the main were not solely down to a BREEAM building, but the lack of training and integration into their everyday work life. Many of the issues identified are solvable if interventions are taken at the right time. The chapter cross references with the literature review and other areas of research in comparison or contrasting with the results.

A further purpose of this chapter was to carry out objective 3 of the aims and objectives:

3. Investigate the impact of BREEAM on user behaviours in a BREEAM certified building with specific reference to Small and Medium Enterprises (SME).

This chapter has successfully done this and demonstrated that a BREEAM building does in fact impact on the users and in this case it in a negative way. However, the chapter also identified that main reasons behind this are largely down to a lack of policies around awareness, training and feedback targeted at the BREEAM features and fostering sustainable behaviour as a whole. This would help integrate BREEAM into the building and 'bed-in' some of the features in conjunction with training and setting up feedback loops. The next chapter will discuss the results in more detail and propose a framework to aid integration of BREEAM in existing buildings occupied by SMEs.

Chapter 5: Framework

5.1 Introduction

The following chapter will discuss the pitfalls of BREEAM at specific stages from inception to completion of an assessment. The chapter then consolidates the issues identified in the literature review and analysis of the data along with complaints that arose during the interview stage. This will present a map of all these issues along with the driver, decision maker and the impact that decision had on the user of the building. Doing this enabled the complaint to be tracked to a potential cause and a reason. The complaints mapping will then feed into a framework that suggests several interventions to address sustainability at different stage of acquiring and occupying building space. The intention of the framework is an aide memoire to run alongside BREEAM and ensure that the right policies are being considered to fully integrate BREEAM into the day to day working life of building users. The versatility of the framework will also assist SMEs who do not wish to undertake a BREEAM assessment but would like to consider implementing a range of sustainable policies.

5.2 Complaints mapping

The first part of this chapter presents a map of complaints that are based on the analysis of the data and from the users themselves during the interviews. There was a lot of negativity around the environment in the building and the researcher was keen to identify the root cause of the complaint. What was the driver behind that complaint, who made that decision and what has been the outcome? Identifying the various stakeholders who make the decisions was challenging as ultimately the reason why a credit is built into the building or process is the choice of a number of stakeholders. This can range from; the design team generally encompasses the architect, project manager, structural engineer and services engineer, the landlord and the tenant. Remote stakeholders can also impact significantly on the decision-making process such as funding bodies, planning, and building control. None of these stakeholders will ultimately preside in the building apart from the tenant who then performs the role of the employer where different sets of decisions are taken.

Mapping the full remit of decision makers throughout the various stages helps to identify when the decision was made and by whom. This is the point where interventions need to be made, if the decision and its ramifications can be understood there is the prospect to change that course of action.

Table 5.1 Complaints Mapping

Pillar	Complaint	Issue	Driver	Decision maker	Result	Impact	Comments
T	Space	Limited useable floor space	Poor design	Design team/Tenant	Cramped	Negative	Seating layout should be discussed with employees/heads of business units during the design stage to ensure optimal layout.
A/F	Communication	General lack of awareness	BREEAM	BREEAM/Tenant	Little understanding or appreciation of BREEAM	Negative	More should be done to educate building users on BREEAM
F	Engagement	General lack of engagement and understanding of the building	Management	Management	Little understanding of building features	Negative	More should be done to educate building users about the building's features
T	Lighting	levels	BREEAM/poor design	Design team	Bright and airy on the 1st floor, dark and poor levels on the ground.	Negative to some employees and not others	This can create a resentful environment. Lighting should be considered at design stage alongside seating/desk layout.
T/F	Lighting	Cost	Money	Landlord	Expensive to run and inefficient	Negative	Tenant can change bulbs at a significant cost with a long-term payback possibly outstripping lease term.
T	Air-conditioning	Too cold/too hot	Poor design	Design team, Landlord, Tenant	Dissatisfied workforce	Negative	Design team (designs are too generic), Landlord (LL's interest is to ensure ongoing maintenance is carried out not the comfort of the tenant), Tenant (should ensure that that the air-con layout matches that of the desk/office layout)
UB/T	Control (workspace)	No fans	Management	Design team/Tenant	Dissatisfied workforce	Negative	Employees should be allowed to modify workspace if design was carried out adequately in the first instance. However, this is not conducive to an energy efficient workplace. The primary

Pillar	Complaint	Issue	Driver	Decision maker	Result	Impact	Comments
							aim should always be to get the design right in the first instance to negate the need for modifications.
T		Lighting	BREEAM	Design team/Tenant	Lights left on when nobody in the room. Lights go off when people working.	Negative	There is a dichotomy between lights that can be turned on but are not due to cost, and lights that should be on that are not due to automation. This demonstrates missed opportunities to have an input from the very early stages
T		Heating	BREEAM	Design team/Tenant	No individual control of heat	Negative	Some staff members are too cold while some overheat altering the air-conditioning controls has the reverse affect particularly during 11am and 2pm during the summer months.
T	Windows	Glare	BREEAM	Design team/Tenant	Uncomfortable environment, interrupted work patterns	Negative	Credit Hea 3 was not achieved which calls for an occupant controlled shading system
T/A	Water	Toilets cut off before flush finished	BREEAM	Management	Dirty pans source of complaints	Negative	This is simply a lack of understanding around the shut-off system. This could have the timer setting changed. This is a further example of tenants being left with a building that has sophisticated features that have not been fully explained.
T/A	Taps	Automated	BRREAM	BREEAM/Design team	Taps do not come on properly	Negative	Again, this is an issue of settings and the sensitivity can be adjusted so the taps pick up movement adequately.
UB	Parking	Limited parking spaces	BREEAM/ Tenant	Landlord/Tenant	Lack of spaces with limited alternative	Negative	BREEAM advocate limited parking space, but this must be in conjunction with other measures i.e., care share, cycling, public transport etc…people would not cycle because there were no showers. Fewer people have a space now than they had before now resulting in additional parking costs for users.

Pillar	Complaint	Issue	Driver	Decision maker	Result	Impact	Comments
UB	Cycling	No cycle storage	Tenant/BREEAM	Design Team/ Landlord/Tenant	No secure area to store bike	Negative	BREEAM requirements were seen as too onerous for the number of credits and therefore, dropped from the assessment in lieu of a simpler credit. This decision has impacted on travel behaviour.
UB	Showers	No showers	Tenant/BREEAM	Landlord	Nowhere to shower and change clothes if you have cycled in to work	Negative	The company had started a 'cycle to work' scheme since the BREEAM assessment, however, take-up was very limited due to the lack of showers and cycle storage.
A/F	Recycling	Recycling area remote	BREEAM	Design Team	Limited recycling taking place	Negative	Dedicated recycling area was in the canteen and very few users were aware of it, therefore, rubbish was frequently thrown in regular bins and not recycled.
T	Drinks machine	Dedicated drinks machines installed, as kettles were not allowed in work areas	Tenant	Tenant	Large stream of recycling and additional energy use	Negative	The installation of dedicated drinks machines was seen as a positive move from management, however, building users were not happy with the number of cups that were wasted and not recycled.
T	Noise	Too loud	Tenant/cost	Tenant	Private phone calls could be heard around	Negative	During the design phase the tenant wanted to save costs and value engineered the removal of internal walls and ceilings. This resulted in a diminished level of sound insulations where calls on speaker phones could be heard throughout the office.

5.3 Discussion

The complaints map above is a synopsis of the issues raised during the interviews where several interviewees spoke candidly. It is clear to see from this that while BREEAM is a driver for many of these decisions, the actual decisions were taken by the design team and the landlord. The tenant may have been informed, however, from the verbatim comments in table 4.9 there are some instances where decisions were made without them being consulted. Furthermore, the tenant only saw the impact of the lighting once the received a bill. A further example was recycling, BREEAM was the driver behind this, however, the design team took the decision regarding location. The criticism here is that the design team will not be occupying the building, their task is to achieve a BREEAM rating, therefore, the position of the recycling bin is less import than the fact that one is there. This is illustrated in fig 5.1 which shows the location of the recycling area in red and ranges from the closest point of the office area at 17m to the furthest point at 68m. This is not a convenient location as identified in the verbatim comments of 4.8.1.

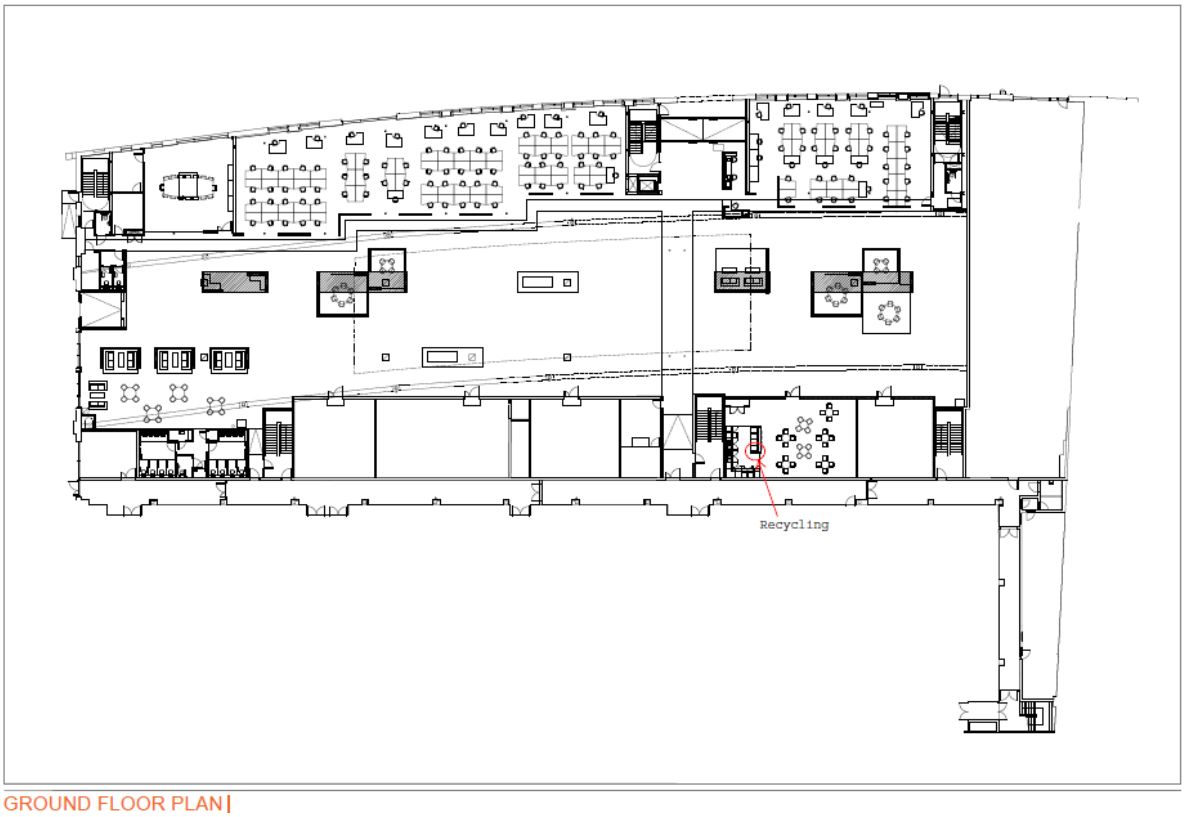


Fig 5.1 Ground floor plan of building showing location of recycling

Cycling and parking were again decisions that were taken during the design stage and resulted in negative attitudes towards the building. Therefore, several of these decisions have been taken without due consideration for their impact on the building users, or how they will respond. One way of potentially reducing this situation is to fully understand the company and workflows. It is not the task of design team their task is to achieve a given rating. The tenant is the only stakeholder who can have an impact on these decisions in relation to future usability. Therefore, the more they know about their business, its layout, workflows, working practices the better they can inform the design process and ensure that meaningful decisions are made by having that information already available to use when decisions are required. A client who knows their business can make up for their lack of knowledge or understanding around the workings of BREEAM.

The complaints mapping exercise has been invaluable as a precursor to the framework in that it simply lays bare the complaint and its impact. However, a further layer is the to the BREEAM conundrum are the stages and the activities at those stages that again result in a negative impact. As outlined in section 2.9 of the literature review there are several pitfalls where BREEAM can result in problematic outcomes. The first one of these encountered is the driver behind having a BREEAM assessment carried out. The driver behind this assessment was funding from the EU and predicated on achieving a 'very good' rating, therefore, from the outset the result was more important than the assessment. This led to decisions based on practical and economical convenience and not their impact in use resulting in a myriad of convenient credits chosen as outlined in table 2.9 of the literature review. The next pitfall of BREEAM is the design stage where several decisions are taken as outlined in the complaints map. Ill thought-out decisions at this stage can involve changing layouts, removing internal walls, or omitting items. These decisions will impact on other areas of the design and, therefore, other credits. The final pitfall is during occupation where all the BREEAM credits have achieved, however, they are not fully integrated or being used to their full effect as outlined in section 4.9 of the analysis chapter. Fig 5.2 below presents a concept of how these stages interconnects and result in issues that that lead to complaints.

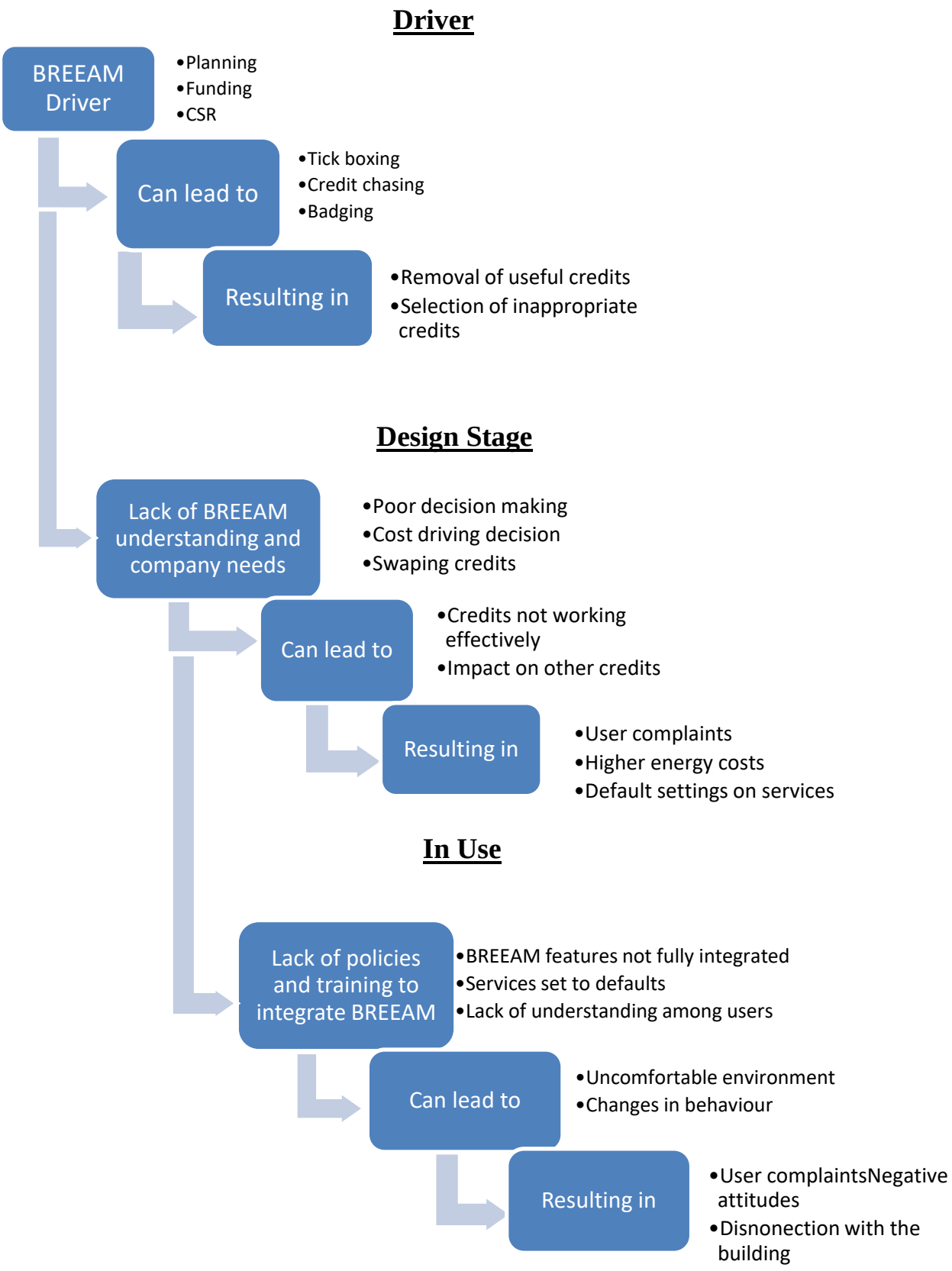


Fig 5.2 Three-stage concept of BREEAM pitfalls

5.4 Framework Introduction

The following framework encapsulates the issues identified during this thesis and presents practical ways in which some of these issues can be addressed and reduced. Table 2.9 of the literature review identified drivers of BREEAM with planning and funding being the main two, which has positively helped BRREAM's coverage in the market. However, there is also an unintended consequence in that is can also drive credit chasing, as much of the onus is put on the rating and the rating, as identified in section 2.9 of the literature review. Therefore, the tenant needs to be aware of those credits that will most benefit them during occupation and make sure they are not replaced with an easier cheaper credit. The optimum way a tenant can do this is to have information to hand from staff surveys, management meeting, CSR policies and the like. This enables set parameters to be established on building requirements, space, and use from the tenant's perspective during the design stage. The tenant is also the employer and having been involved in the design and construction/refurbishment of the building their role is to ensure that BREEAM is now fully integrated into the building. Therefore, the framework provides for intervention of these three key areas; prior to acquiring space, during the design stage, and in-use when the building is occupied.

A further consideration of the framework are the four pillars identified in section 4.2 of the analysis where responses indicated that users are more likely to engage if something is a useable benefit, it is tangible, they have received training in it, or there is a mutual feedback loop. This was demonstrated with a subsidised bus pass in section 2.9 where most interviewees said they would be encouraged to use public transport more if it was cheaper for them. Tangibility was further demonstrated in section 4.8.1 of the analysis where one interviewee explained how more encouraged, they were to recycle in university to the convenience of the bins. Clearly signed recycling bins were also echoed in the Wu et al. (2013) study, therefore, making something easy and tangible is more likely to foster engagement. Therefore, the four pillars in relation to the various interventions are also embedded within the framework.

The philosophy around the framework is two-fold, firstly to overlay BREEAM by complementing their framework and providing guidance beyond the point where BREEAM stops. both the management and staff have further responsibilities to ensure a successful and

sustainable use of the building. This is perhaps where BREEAM falls short, as following the issue of the PCR certificate BREEAM has no further involvement. Therefore, embedding BREEAM into the everyday lives of the building user is left unchecked. Larger companies may well have a raft of policies around CSR and sustainability. However, SMEs will also have staff policies, management, and finance rules to contend with especially those who straggle the 250 employee's threshold from small to medium. This framework will help SMEs to consider policy interventions that they may have previously overlooked whether when acquiring new space, or in-use, whether having a BREEAM assessment carried out or not.

The final purpose of the framework is to provide practical measures to aide understanding of the policies and what they would look like. The framework's effectiveness is enhanced where a BREEAM assessment has been carried out, however, some of the recommendations and measures proposed can be selected, integrated, and built on. For example, the simple user guide is part of BREEAM, however, if the building does not have a BREEAM rating the employer may not be aware of this. There is no reason why a non-BREEAM building cannot have a simple user guide covering the services, emergency information, fire procedure, travel times for public transport, and training needs.

Table 5.2 Framework

Sustainable Policy Intervention Framework										
Reason for BREEAM	EU Funding		International Funding		Planning		CSR		Other	
**Note If the reason for a BREEAM assessment is for funding or planning each credit must be considered for its impact or usefulness on the building users. Selecting credits based on numerical value only to support a pre-determined rating will result in unwanted credits and useful credits being overlooked.*										

Stage	Pillar	Requirement	Recommendation	Responsible	Practical Measures
Prior to acquisition (BREEAM Drivers)	Tangibility	Companywide policy on building and space acquisition	Introduce a pre-requisite checklist that the company should consider when acquiring new buildings or space	Company	• Transport links and frequency (is public transport local and regular and close by) • Parking availability in relation to No. of staff members (e.g., BREEAM recommends 1 space per 3/4 users, general guide should be 1 s/p 2 users in conjunction with other measures.) • Position of existing services in relation to proposed desk layouts • Building orientation and depth • Window positions in relation to glare/view out
	Useable benefit	Companywide policies on purchasing	Introduce policies on purchasing kit, PCs, stationary, and furniture	Company	• A policy stating that only A, AA, A+, or A* equipment is purchased. (having this type of policy enables the tenant to request energy efficient 'kit' is installed in the building rather than the landlord making the decision)

Stage	Pillar	Requirement	Recommendation	Responsible	Practical Measures
	Feedback	Research staff needs	Garner and capture thoughts from staff around sustainability to gain an understating of where staff generally sit on the continuum.	Employer (companies probably know very little about their staff's throughs and feelings around sustainability, this is a good opportunity to understand more about your staff)	Carry out staff surveys using Likert scale for example: • How important is sustainability to you? • List BREEAM categories in order of importance to you • What is the one sustainable thing you do at home? (This at lease gives some understanding of how sustainable staff are and will assist on future decisions around the buildings)
	Feedback	Understand workflows of departments	Map all the departments using 'space adjacency' planning and document workflows	Employee	• Have a written workflow from A to B and express graphically • Overlay with optimum desk layout to ensure smooth workflows • Have a meta plan of which departments should sit next to others (knowledge on what layout works best for the company will enable informed decisions when acquiring new space or refurbishing existing)
	Tangibility/ feedback	Basic design parameters	Set minimum design criteria for any building space regardless of whether BREEAM is sought	Employer	• Somewhere safe, secure, and well-lit to store bikes • Installation of at least one shower • Separate room with radiator/drying facilities

Stage	Pillar	Requirement	Recommendation	Responsible	Practical Measures
Refurbishment (Design and construction stage)	Tangibility/ feedback	Tenant input to HVAC design.	Avoid hot and cold spots around the floor plate and ensure (as practically possible) a comfortable environment for employees.	Tenant (or tenant representative)	• Use the information already gathered on workflows and desk layouts. • HVAC layout and seating plan should align • Taking temperature profiles around the building to identify any hot or cold points near windows (this level of pre-design ensures as far as possible that a comfortable environment has been considered and should be disseminated around staff, so they have an appreciation of the work involved in creating the environment)
	Training / feedback	Policy on commissioning	In addition to BREEAM credit more staff should be involved in commissioning of the building to a basic level.	Employer (too few employees are available for commissioning, employer should set % threshold)	• Ensure a rolling group of staff understand the M&E services, other than the facilities manager, to develop an appreciation of how the building functions, how the controls work. • Set minimum % of staff that receive training and understand how M&E controls works for the building. • This should take account of staff absence
	Training / feedback	Policy on BREEAM user guide	Create a policy to integrate the BREEAM simple user guide into the vocabulary of all building users.	Employer (the simple user guide by BREEAM does not make employees read it, a policy is needed to ensure adequate understanding and dissemination	• Policy should include provision for a critical mass of staff to read the user guide and should form part of the onboarding package for new starters. • Refresher training must be carried out annually

Stage	Pillar	Requirement	Recommendation	Responsible	Practical Measures
				throughout the company)	• Create online quizzes to maximum retention.
In-Use	Training / feedback	Policies around better awareness	Engage users in the wider agenda of climate change. This helps underpin awareness and understanding of BREEAM. This, in turn, could help users develop an appreciation of how the building can impact on the environment and their behaviour within it, particularly if not managed correctly.	BREEAM (should issue basic online training on their credits and features with every BREEAM application) Employer (overlay basic training with targeted training relating to the building)	Bite size training (possibly online) in three stages: • **Stage 1** - Facts and statistics relating to elements of climate change such as recycling plastic, heating etc… • **Stage 2** - General understanding of BREEAM and its credits, what is the purpose of BREEAM • **Stage 3** - How this relates to the building and what features the building has.
	Training / feedback	Knowledge sharing	Send monthly updates on energy use, water, and recycling	Employer	• Provide simple to read charts on energy, water, and recycling • Set soft targets initially and offer users to beat them • Provide information on savings made through hitting targets • Tie this in long term with rewards (this will slowly engage the user with the building and foster an intrinsic connection with the building)
	Tangible / feedback	Policies encouraging pro-	Set up a sustainability action group with green	Employer (must involve employees at head and director	• The Company can; set energy targets for the building, share data regarding gas, electric, lighting etc usage, look at

Stage	Pillar	Requirement	Recommendation	Responsible	Practical Measures
		environmental behaviours	champions. This would be two-fold, Action group – should review all policies to ensure sustainability is considered at every level. Review scope for new CSR/sustainability policies. Green champions disseminate information	level to influence engagement)	the possibility of gamification to engage users, set up a green committee or green champion, motivational signage • Green champions – working alongside colleagues, but encouraging pro environmental behaviours (this is based on the research by Mackenzi-Moore)
	Useable benefits	Policies around travel	Inadvertently encourage staff away from one person/one car travel into work.	Employer	Offer a range of subsidies to encourage the building user to make different choices on travel. • Annual bus pass • Annual train ticket • Car sharing • Employers pool car rota system • Bike scheme offering money off • Offering electrical company and lease cars
	Useable benefit	Remote working	Working from home for a % of the working week	Employer	Less parking need/Co2, less burden on services, possible trend towards smaller more efficient office space.

Stage	Pillar	Requirement	Recommendation	Responsible	Practical Measures
	Tangible / feedback	Suggestion box to capture user's feedback	Users can anonymously submit comments relating to any aspect of the building initially within the first three months of occupation and again at 6 months.	Employer	• Allows Users to be open and honest about the building they inhabit. • A two-stage approach allows Employers to address issues identified at the three-month and six-month stage. (it is important that the employer addresses any issues identified at the 3-month stage for the system to have credibility)
	Feedback	Carry out POE within 12 months of occupation	Requirement with outstanding buildings, however, this should take place for all BREEAM buildings	Employer	This is a continuation of the suggestion box as the first 12 months are crucial to foster engagement in the building.

5.5 Chapter synopsis

This chapter looked at the pitfalls of BREEAM at specific stages from inception to completion of an assessment. The chapter presented a complaints mapping table based on the literature review and analysis of the data along with complaints that arose during the interview stage. The map highlighted the driver, decision maker and the impact that decision had on the user of the building. This then feed into a framework that suggests a number of interventions to address sustainability at different stage of acquiring and occupying building space. The intention of the framework was an aide memoire to run alongside BREEAM and ensure that the right policies are being considered to fully integrate BREEAM into the day to day working life of building users. In this regard the framework has identified and suggested a solution to the issues captured in the complaints mapping table.

A further As a basic test any policy, decision, or change relating to the wider green agenda should demonstrate that it is either; tangible – something that the building user can see the impact of, or a useable benefit – something that the user will gain a tangible benefit from, or training – something that they user will have to be trained to appreciate and understand it, or feedback loops – something that will allow the user to raise issues (good or bad) and not just thrust on them. It is very possible that most decisions will be a combination of all of these pillars, but by running policies and decisions through the process will enable the employee to consider a range of issues that would have otherwise been overlooked.

This research set out to answer three research questions

1. Is there a difference in end user behaviour between a BREEAM and non BREEAM building?

This was addressed in both the pilot study and the case study by asking the interviewees about their experience from one building to next. The results from the case study were stark in this area with many building users feeling like they had lost a benefit such as, an openable window, a parking space, or somewhere to store their bike. These kinds of issues resulted in complaints and fostered a disconnect with the building. Therefore, there is a difference in end

user behaviour between BREEAM and non-BREEAM buildings. However, this is not necessarily the fault of BREEAM, many of the features were not fully integrated. In addition to this and outlined in the Monfared (2011) study sustainable building need sustainable occupants, in fact the new building attracted far more complaints and negativity. This emphasises the need for awareness, training, and feedback, as the building users were sustainable in their own homes.

2. Does BREEAM influence end user behaviour, in the way it was intended, to achieve effective sustainability?

This was addressed in the analysis chapter under travel where it was identified that users were not using public transport despite having parking spaces removed. This was demonstrated again in the analysis chapter under recycling where the users were not recycling despite having a dedicated recycling station required under BREEAM. These are credits that should encourage users to recycle more or use public transport more frequently and yet the do not. It is clear from this research that a BREEAM rated building is not enough to encourage users to behave sustainable. BREEAM is probably the starting point but sustained behaviour change requires intervention from the tenant as a stakeholder and then as the employer to integrate and encourage the building users. However, there is the prospect that tenants will have a BREEAM assessment carried out and think ‘that’s it’ that is a way of demonstrating sustainability. This thesis has demonstrated that this is not the case and BREEAM requires further attention and should be a working endeavour and not just an assessment.

3. How to make systems that achieve sustainability in buildings workable? (is there a better way to optimise the BREEAM framework to positively impact on user behaviour)

This has been addressed in the framework table under section 5.2. The framework addresses those areas where BREEAM can set a different course, such as credit chasing, and reminds the user of the importance of focusing on long term occupation. The framework also addresses anomalies within the assessment such as bikes and showers, this credit should not have been taken out and replaced with birdboxes. By understanding the building users needs this action could have been halted instead this became a source of complaint and bike stores

were retrofitted 3 months after the BREEAM assessment was sign-off. The BREEAM framework is a third-party assessment trying to address several issues which results in a complex set of credits. BREEAM is a blanket that must be shaped and formed to fit particular requirements, the assessment cannot be the start and the end of engaging building users to behave sustainably. It is imperative that the right stages are intervened, and pitfalls averted coupled with an action plan on integrating all the features successfully. In this regard the framework presented in this research will optimise and integrate the BREEAM assessment framework.

6.0 Conclusion

This thesis set out to explore whether BREEAM impacted on occupant behaviour. A comprehensive literature review was carried out and reviewed global climate change targets, followed by European law, followed by the integration into British law and highlighted the evolution of BREEAM alongside these pivotal changes. The study then focused on the drivers and barriers of BREEAM and identified several key points where the assessment can change course. The proceeding chapter reviewed several possible strategies before identifying case study as the most appropriate. A pilot study and case study were carried out and the results were analysed using Nvivo. A number of issues were identified, many of which were a continuation of the literature review. These were draw together in a complaints map to highlight where the issue originated and what was the outcome. This then fed into the framework to provide a practical set of measures to use with a BREEAM assessment to ensure optimal integration. Although many elements of the framework are useable with the need for a BREEAM assessment as a precursor.

The intention of the research was to find a way to optimise the BREEAM framework and in that regard the framework proposed in this research achieves that.

6.1 Limitations on Research

A limitation of this research is further investigation around the four pillars. Given the size and parameters of a Masters in Philosophy much of that was focused on producing a framework to optimise the BREEAM framework. Therefore, exploration and further research in to the four-pillar strategy was beyond the scope of this research.

6.2 Recommendations

The outcome of this piece of research has culminated in a framework to assist SMEs in integrating BREEAM properly into the building and working lives of the building users. However, a recommendation of this framework is also to utilise it when a BREEAM assessment has not been carried out, as there are several useful policy interventions that will assist in creating more of a sustainable environment. The versatility of the framework will

assist SMEs who do wish to undertake a BREEAM assessment but would like to consider implementing a range of sustainable policies.

A further recommendation of this framework is to be used as a working document and not a standalone checklist; it should grow with the company allowing them to add their own policies. The framework provides specific stages of intervention to consider sustainable policies and is versatile enough to form the basis of an SMEs own sustainable policy framework.

6.3 Further research

As highlighted earlier any decisions relating to sustainability should apply the basic test of the four pillars identified in this research. Is the policy or decision tangible, does it result in a useable benefit, does it require a degree of training, and is there a feedback loop built-in? The researcher believes that this is potentially an exciting area of further research. The prospect of using the four pillars as a decision and policy making tool warrants further research into this area. This thesis has demonstrated that the framework is transferable to other SMEs who will be familiar with some of the issues raised and will welcome a path to solutions. However, the testing of the four-pillar process is beyond the scope of this thesis and should be considered as research in its own right.

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Appendix A Completed Questionnaire

Name: Female
Age: 30
Title: HR

How long did you work with MDIS? 6 years

So you were in the last building? Yes

Q1 What are your thoughts on the building compared to the previous building?

More expensive. I think the thing we get the most moans about is the heating, one area can be absolutely boiling and another area can be freezing so I don't really think it's been well thought out. In terms of the whole building it's quite noisy in certain areas. The roof was supposed to keep the noise in, but it's obviously not worked because we can hear babies screaming etc.

Q2 So what do you think in terms of working here compared to the last building?

It's better, purely because of where we sit.

What makes it better?

It's quieter for a start, and we can regulate the heat ourselves, whereas other people can't. It's lighter.

Do you think that makes a difference, that it's lighter?

Yes. Because if it's dark and dull it makes me tired and a bit grumpy, whereas if it's light I am generally happier.

So before you moved in did you have any inclination that it was a BREEAM building that you were moving into?

Only because you told me.

Q3 What does BREEAM mean to you?

In a nutshell it's supposed to be making it more green, better for the environment, cheaper to run, that sort of stuff.

So since you moved in would you have had any inclination it was a BREEAM building if you didn't know?

No.

Q4 What do you think of the services of the building and how they are controlled?

They are all controlled by Beth. Unfortunately for people downstairs, Beth has a problem with heat, she gets really hot, so she turns the heating down so then other people get cold, but she doesn't really understand that. In terms of the heating it's set to one level, but it doesn't please everybody, and we do get quite a lot of whinges about that but in terms of the lighting for instance, we had no idea it was going to cost as much as it did in the first 3 months, where it was just constantly on, whereas now they are off until it goes dark and then they're on.

So in terms of the controls, does the facilities manager controls everything, does the facilities manager control all of the building or just downstairs?

All of it. She doesn't do it on her own, Jay can help her, there are certain little temperature gauges that you can mess about with in different rooms.

So is there a final concentrated decision that one person had overall control of everybody?

What the facilities manager does is try to keep the temperature at an optimum level. But obviously if certain people are complaining that it's too hot or it's too cold they might alter the temperature to try and meet everyone's needs, so it's not constant.

Q6 Were you given any training or made aware of how to use the services or to control them? For example how to turn them on or off or to change the temperatures or settings?

We didn't no. We were just told not to touch anything so it could remain at the optimum heat and the way it had been designed it should remain at the same temperature throughout the building but that isn't the case.

In terms of the facilities manager, what about if they are off for the day?

Well Jay and Colin can stand in because they were both trained on everything anyway so when we first came in Beth wasn't trained on everything, it was Jay, Hannah, Colin, James, then some people were trained on the fire alarm, so I know how to turn the alarm on and off if I ever have to come in early or stay late or come in at the weekend, but we weren't trained on anything else other than the alarm system.

So when a few people have had training in the services in the office, how would that situation be dealt with?

Well there are going to be people trained – Kim for example, so there shouldn't ever be no-body here to deal with it. But if there is …..

Q7 In term so the services are there any manuals or guides or anything that explains how to use them?

Not that I am aware of no.

Do you think there should be so that it's explained how to use everything?

Yes because if there is no-one in the office who hasn't had training no-one can operate it if we do have an issue.

Q5 In terms of controlling the services, would you rather control your own workspace?

Yes. Because everyone is different aren't they. I mean I know it's very difficult because it's an open plan office and we are quite lucky where we sit because we can control it from the cupboard just outside, but that's only because we are controlling it for ourselves and marketing so it's very different but for everyone else it's open plan they have to go with the majority and unfortunately we are getting some people saying they have earache or their eyes are watering because they are sitting right underneath the air-conditioning, and then other people complaining they want to move because they are boiling and sat next to the window.

Do you think anything like that could affect people's behaviour?

Yes.

In what way?

Well for instance the person that was complaining that they were cold because they sit under the air-conditioning unit phoned in sick with a cold because they were so cold. Somebody else had to buy earplugs because they were suffering from earache. If people are constantly complaining about being cold and are being told something will be done, and it isn't, well it's not good for morale and then their attitude will then be passed on to other members of the team and then you have a problem.

So do you think it can make people feel fed up?

Oh yes.

Q8 So what do you think of the lighting levels in the building in general and in particular your workspace?

I have never had a problem and I have never heard anyone else have a problem with it. It's much better than the old office because lights used to go and you had to wait until somebody came to change it with a light flickering above your head. If there is someone with slight epilepsy, it's frustrating enough just having it flickering, without adding any other issues. But there is a big light in the middle of the room which costs a fortune to run, so you have got people walking in and if they haven't been turned on by 4 o'clock in the winter, you have got professional people walking in here and it's pitch black so I understand.

Is there ever a situation where you would want to turn the lights down a bit?

No I mean the lights are fine the only thing that we get is a bit of glare on the screen but they are anti-glare it just doesn't work.

So who turns off the lights?

Reception are in charge of it. I know there is 3 of them, but Helen sits in CSU and then there is 2 reception ladies. If one is collecting post and one is on the phone it might be 10-15 before they have realised it's gone dark, because it's not dark where they are sitting. So it is up to them to do it but in fairness it would be better if it just came on via a timber.

So are you saying that you'd rather it be automated?

Yes.

So when you say you would rather it be automated, are you talking about the main light?

Yes.

So in terms of the individual lighting to the workstations, is there a switch for them? Can you turn them on and off?

No. They are on PIR'S. I have come in some days when no-one else has been in and as I am walking in they just all come on. I have absolutely no idea if there is a main switch though.

So do you think that because you are so used to turning a light on or turning a light off, do you think that's always in your mind set?

I always switch lights off at home. I can't stand lights being left on. When my brothers at home every single light is left on and it drives me nuts.

So is there a system in place is for somebody to go round and check all the rooms that aren't automated to turn all the lights off?

Yes. People who are on the 6pm shift or the last one to leave has to go around and make sure everything is turned off.

Does anybody make sure that that's done every night?

There's 2 people, so they make sure they do it between them.

Q9 Are you able to locate or operate the lighting for your own workstation?

No.

And you are happy with the lighting level that is over your workstation?

Yes.

Would you prefer it if you had control to operate the lighting over your workstation?

I am happy as we have one single light. I suppose it depends what mood you are in, if you had a headache it would be nice to turn it down a little bit or up, that would be quite nice but that doesn't really apply to me personally because I am happy the way it is and I have never suffered from headaches or anything like that but some people do and I have heard people saying it would be nice to be able to turn the lights down a bit.

Q10 What do you think of natural ventilation in the office? Are there any openable windows?

Well actually we've got a window that does open where we sit, I don't know how to open it because we would need a hook to open a velux window. That would be quite nice in summer if we could have some fresh air.

Do you think that is different to the previous building?

Yes because we could open windows to open in the last building, but in the other office where we sat, sun would literally shine right through the window very bright in the morning all day. So this kind of atmosphere, sitting where we are is actually a lot better than before for Andy and I. It's warmer in winter and colder in summer, but it would be nice to get some fresh air now and again.

So would you say that was a downside not being able to open windows?

Yes, definitely. That's one of the things I said when I first stat down, can we open the window?

Why can't the windows above your head be opened?

They probably could open we just haven't got anything to open it with and it's so high.

Presumably there is a wand or something?

Maybe but we haven't got it. No-one has ever said anything or passed anything to us to open it. There was never any explanation given about it.

So you don't actually know if it's an automatic opener?

No, it's just a normal opening window with a lock on it. I had them before, a velux window, it's just got a hook on it.

Q11 Are you aware of any parts of the building being sub-metered for energy use?

No. What's that?

Q12 For example, a meter on something that measures the output or how much is being used, sometimes if you have a high loads areas you can have them sub-metered. For example the office space may be metered or there might be a separate meter for these lights.

Well it would be a good idea to do it for the lights and the drinks machine's must cost a fortune! They are always on and they are always heating. I mean I've been here until 8pm some nights and got a drink and the machine is constantly on and heating. It must be on all night, all weekend so it must cost a fortune but it would be interesting to know how much. I don't know how you would do it but it would be good.

So you are not aware of any parts of the building being sub-metered?

No.

Well I'm not sure where they are but this building has been awarded a credit for having certain parts sub-metered.

Well that does make sense, that's probably how they knew the lights were so expensive.

If there was a bar chart available stating what energy was being used at peaks and troughs, so for example around dinner time there was a peak in energy use and so on, if you could see how much energy was used in and around the building do you think that would make you want to investigate it to find out why?

If we could have an impact on it, if somebody said if you did this it would improve X, Y and Z. But I don't know in terms of lighting what we can do or what we can do with the heating or whether we can turn the drinks machine off at night? We could probably have more things turned off at night so they are not using energy.

Q13 On a general scale, how energy efficient do you think you are at work, in terms of turning off monitors, printers, photocopiers etc.

My printer, that is always on. So is the scanner, but that goes on standby. I always turned my computer and screen off.

So if that generally what most people tend to do?

Some people leave their screens on. They just press control; alt; delete and go home without turning anything off!

I actually counted up all the screens over a 3 day period and there was about 90% left on over the weekend.

Well mine stopped working for a while, so when I remember I will pull the plug out, but then again it goes on standby anyway. It seems to be working again now but it did stop for a while.

So do you think it makes a difference to the energy efficiency of the building if people turn thing off?

Yes. I think probably the majority of the screens you saw left on, the computers would have been left on too and they would have just control; alt; and deleted and obviously not logged out or turned their computers off. I saw ?? the other day and she was just control; alt; deleting before she went home and I asked her why she was doing that and she said "that's what I've been told to do", so I told her to switch her computer off at night. Now I know if you are going away from your desk for an hour, fair enough, but it shouldn't be just left all night.

So do you think if you had been given out information about energy and carbon costs associated with leaving things on overnight, do you think that would have an impact on people?

I think so yes. It's not asking a lot and if you can see the money it costs, I think they would change their behaviour yes.

Q14 So since moving to this building, do you think it's made you more energy efficient?

No. I don't think it's made me any more energy efficient than I was previously, because I haven't done anything different from what I would do, other than turn all lights off.

So it's not something that encourages you to be more energy efficient?

No.

Q15 What kind of things do you see might make you change your behaviour to be more energy efficient at work?

Education. If people actually told us what we can do to be more energy efficient and what to do then I would definitely do it, it's just one of those things that people need to be told what to do. We could have a rota.

So what about promps etc?

Yes I think that would be a good idea because people generally will just forget if they are not being reminded.

So do you think that signage would be a good idea to remind people to turn things off?

Well we don't want to start drilling holes in the walls but if there is something that could be put up saying "please turn the lights off" then yes.

So a polite approach?

Yes.

OK. I have just got a few questions on travel….

Q16 Are you aware that there is a travel plan in place to reduce CO2?

Kind of yes.

When you say kind of?

Well I know we were meant to be getting showers and I read something along the lines of we could get £2.5K towards it if we put showers in so I forwarded it to Jackie but I haven't heard anything back from it yet so I will chase it up in a couple of weeks & enquire about it. I know we was supposed to be putting a bike shed in and we were supposed to be getting showers as it would hopefully reduce CO2. I think you can claim an extra 20p for car sharing etc.

So have you ever seen this travel plan?

I've not seen it but I've heard of certain things and we do do the cycle scheme. Howell has got a bike on the cycle scheme.

Who decides what goes in the travel plan?

From here?

Yes.

It wouldn't be us, it would be Smith & Sons because they went for a European grant and the reason they got it was because they put that sort of stuff in it. So there was a survey undertaken of how many people cycled in to work and how many people used their cars etc.

So there was a survey done beforehand?

Yes, to find out who was cycling to work, who was driving, using public transport, all that sort of stuff.

So generally what was the results of those surveys?

I can't remember but we had quite a few people who get the train because they come in from Liverpool. I can get you the surveys if you want them. We did one for the car park and one for Smith & Sons as well. Mark Horsefiled did that so he will have the results.

So would you say that cycling was quite a big one because I was just wondering why you were looking at a bike store and showers?

Because to get the European grant, basically Smith & Son's had to say that they were going to provide x, y and z for whoever came here. So it's not us that went for this, it wasn't Smith & Sons so they asked us to fill in the relevant surveys etc.

Well I asked that because according to the BREEAM report there is actually a credit you can get for putting in cycles stores and showers and that was never achieved.

Well the cycles stores, they weren't put in straight away and there was quite a few people cycling to work when we moved here, one of them being Paul Platt, who is engaged to Beth who is our facilities manager, so she pushed it. But they were only put in about 9 months after we moved in. Before we had the bikes in the office and they were being kept under the stairs and we are not allowed bikes in the office because they could fall into the wall, fall down the stairs that sort of stuff, but I think the reason why the showers aren't in is because we'd have to pay for them, which is also why we haven't got the gym, but like is aid I had an e-mail through a couple of weeks ago saying we could get £2.5K towards putting the showers in.

So the surveys, they were done before you moved in, about how people travelled to work?

Yes.

So as part of that they survey was supposed to satisfy a European grant asking questions about how people got to work and part of the cycle scheme came from the European grant?

We had the cycle scheme anyway in the other office but there was only a few people who took it up, but obviously it's getting bigger now and it's being pushed. There's about 8 people on it but there's quite a few saying they would go on it if we had showers.

So did the cycle scheme not have anything to do with the European grant?

No. Basically they wanted people to have the option to cycle in to work, it has nothing to do with the European grant.

So we've got some people that cycle to work and some people that are on the cycle scheme but we haven't gone for the credit from BREEAM for cycle storage and showers.

Well to be honest I think that should have been Smith & Son's but they said that if we wanted showers we would have to pay for them ourselves and I think it just came down to money, as far as I am aware there was a bit of a stand off, but they did end up putting in the bike store because us and next door kept asking them, because one of the question in the survey asked people if they would cycle to work if there was facilities and quite a few answered yes to that.

Q17 BREEAM credits were also awarded for limiting the car parking spaces which is 1 space for every 4 users. Do you have any thoughts on that any whether limiting the spaces has worked?

From an operational perspective, no.

Why do you say that?

Well it's first come first serve, and that's absolutely fine, but we get quite a lot of agro from people who have been here for a long period of time or in the old office we had spaces for management level. So now it's on a first come first serve basis which has caused a bit of politics with regards to the car park. One guy who parks over in the street and pays for all day, then waits until someone goes out at lunchtime and then moves his car into their space. So it's caused quite a lot of tension and animosity and it's not something that we would see as our culture, but equally if someone goes to the car park and someone else takes that space then so be it. However, there is something in doing a car share scheme but we have never really taken it upon ourselves to say if you car share we will do x, y, z for you.

So from a European funding body when the surveys were undertaken, did a lot of them come back saying that most people drive to work?

Yes quite a lot of people do but sometimes some people will car share and sometimes they will get the train so while people drive they get the train as well.

So the largest number of people said they would use their cars to some into work?

Probably yes.

So what was the reason to limit the number of car parking spaces?

No idea because it was Smith & Son's that made that decision.

So do you think in terms of the decision process it is one of those situations where it was the tenant and landlord decisions being made?

I think it was probably the landlords decisions that were mostly being made without tenant input.

So in terms of having limited car spaces, were they allocated spaces or did you ask for a certain number?

Well when we first stared looking at the plans we had more spaces and then we had less spaces and I asked why the spaces had been reduced when we are a growing organisation? So that's going to have to be reviewed at some point because one of the things we say is that we provide free car parking for staff but that's going to have to come to an end if we only have a limited number and the amount of staff is increasing. There's nothing that I can say other than if they approached Gary and tried to do a deal, which does make sense to me.

So do you think that issues around car parking affects people's behaviour?

Yes. People think it's their god given right to have a space, especially those who had a space in the previous building.

Do you think that it going to affect behaviour in other areas?

Yes, I think it's a political issue and it's generally nothing to do with the building but to do with senior management and the people who are basically playing a game in the car park. Last week someone came in at 7am needed to go to a doctors appointment, Albi, bless him, knew that she'd been in earlier than he was in, puts a cone in her space and someone's come in and parked in the space and said sorry I'm saving it for someone. It's murder. It was just someone doing someone a favour who was doing the company a favour by doing overtime and coming in early.

Is there anything that you think would encourage someone to not drive as much or take the train?

Yes I think so, but it's the showers, I know if we had showers a lot more people would pick it up. I mean I would in the summer if I could have a shower here. I know it's 20 miles but what is 20 miles on a bike? If you look at most people that work here, they only live local – probably 8 miles maximum, and people in Liverpool could cycle to the train station then jump on the train. We've got places to put the bikes but it's the showers that puts people off. A care share scheme would be a good way to get into that, but at the moment is there any incentive for people to do that because it's not our building is it, it's Smith & Son's. I think that's why things haven't been done.

Do you think there is a reason to do it just to make the staff more sustainable and the business more sustainable?

I think your right in what you're saying, but you know as well as I do things like that will cost and it's money that they don't want to spend, to be blunt. Yes I can see the benefit in it personally, but it just comes down to cost to be able to do that.

Q18 So since moving here have you been encouraged to cycle to work?

No because there is no showers. I'd love to cycle to work.

Q19 So have you been encouraged to use public transport more?

No. I used to use public transport but for personal reasons I don't do that anymore because I've got the horses to deal with, I've got 6 horses, 3 dogs, cats that I have to get home to so I don't want to have to rely on public transport because the amount of times that it's gone wrong and I've been not able to get there.

So do you get an allocated space?

No I'm just always in early enough.

So if you didn't have a parking space and you had to pay for parking would that encourage you to take public transport?

No.

Q20 So there is nothing that could be done to encourage you to take public transport?

I used to get public transport like I said, but I got so frustrated with Mersey Rail, and because I was doing my degree at the time I used to have to get up in the morning, either go to the horse or do a bit of work, come here and then go to the horses and then go home and do more work, so I didn't have time for Mersey Rail to mess with my schedule. So that's where I've come from. I mean I car share now with Thong because she lives right near the stables, so it's brilliant and I can drive my car to the stables and leave it there and car share. Mark used to car share with Howell and Carl so there are people that car share.

Q21 Are you aware of any water saving technologies that have been installed in the building?

No.

For example PIR's on the taps, things like that.

In the toilets down there I know they have got sensors haven't they. Our's haven't. What they have done in there is they have got sensors on the taps so the water comes out when hands are placed under and then it stops so there's no water waste.

Do you think that encourages you to use less water?

Depends how much soap you put on your hands. Yeah probably.

Q22 Are you aware that there is a water meter?

No.

So if you was aware of the water meter and readings were taken showing peaks and troughs do you think that would make you want to investigate it further?

If I was in charge of facilities, obviously I would be looking at that and I would want to understand why there are peaks and troughs. Presumably there will be a peak at lunchtime, when people are using the toilet and kettle, things like that but I imagine the drinks machine would be the worst as it is left on all night, all weekend as far as I know. I've been here at 8pm sometimes and it's been on all night.

So do you think that turning a drinks machine off overnight and weekends could save money and help to pay towards showers for cycling scheme?

Well if you put that and the money we waste on lights together, then yes. The lights cost £20K in the first quarter.

So who made the decision to put that lighting in?

Smith & Son's. Basically everything other than walls, pods stuff like that, everything else is Smith &Son's, we chose where we wanted the walls and where we wanted the officed to be, everything else was them.

So surely if they had asked at the design stage what kind of lighting, heating etc?

Mark Horsefield would be the best one to ask because he managed the whole project from start to finish. So he will be able to show you plans etc.

Q23 So do you think you recycle more is this building than in the previous building?

No.

Q24 Are you aware of the dedicated recycling point in the building?

I know there is one outside where cardboard goes. I know there was a bin.

Is there anything dedicated inside?

Not that I am aware of no. There used to be in there where we put the cardboard but all we do now is put the cartridges in, that's it.

So in the canteen there is a draw that has recycling sections in it.

Oh yes so there is. I don't go in there.

So do you think that will make you recycle more?

No. I don't think it would make anyone recycle more unless they are in there and using the canteen anyway.

Q25 So what kind of things do you think would encourage you to recycle? What kind of things do you think the company could do that would make you want to recycle your own individual waste?

I think it's education really, if you go and ask all these staff now do you know where the recycling draw is…. I have seen it when I've been in there but the only time I go in the canteen is if I need to warm something up, but I've only probably been in there maybe twice in the last 18 months. So if you didn't use the canteen you wouldn't know it was there because people don't know unless they are told. Also, when I did go in it I wasn't sure what is going in where.

So if you was sat at your desk would you walk all the way over there to recycle a banana skin?

No. I would just put it in the bin. Bottles of water are a prime example, we were putting them in different bins and then the cleaner just put them into one and now all the different coloured bins have done.

Do you think perhaps smaller recycling stations around the building would help?

I think it's a good idea to have smaller bins and have signs to say that goes in there, whatever, I think that would be a good idea but then the cleaners need to be made aware of it too.

Just some general questions now…..

Q26 How important is sustainability/energy efficiency to you? Where do you put that on your own personal spectrum? It is important to you? On a scale of 1-10, 1 being not something you think about and 10 being important and at the top of the list?

At home it's very different from here. I am probably an 8 or 9 at home but it here it's completely different here.

Q27 So why are you more sustainable at home but you lose that when you come to work?

Probably because I know what I'm doing at home – the plastic bottles go in there, general waste goes in there, I know everything, all the information I need, and because I know that it's easy but because here it keeps changing and there doesn't seem to be any do this, do that, so no-body really knows what's going on so I think it's just easier to go, "whatever". It would be a lot more simple if people were to say this is what we would like you to do. If someone said to me put plastic bottles in this bin I would put plastic bottles in that bin.

Q28 So basically what you are saying is that your behaviour is interchangeable depending on the environment you are in?

Yes.

Q29 Are there any other things apart from the car park that you would change about this building?

Yes, I think only about the open space, I mean it's quite loud sometimes, I think if you are in a meeting room over there it carries. For instance I went over there once when I was doing my dissertation so I could have some free time to concentrate and IT were in there on a conference call and it was so loud and I think if you have got people in a meeting and you need to discuss things you don't want to hear everything else and I think sound carries too much. That's the only thing I can say from a personal perspective I don't like about this building.

So presumably you are talking about the area…

The three pods.

So why do you think there is no ceilings in there?

Don't know, haven't got a clue. Mark would probably know more than me. The pods are great, but the meeting rooms need to have an element of privacy I think.