Exploring barriers to carbon management in UK universities

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Abstract

In the race to Net Zero by 2050, organisations including universities are under pressure from governments and stakeholders to reduce carbon emissions. The University sector in the UK has significant social, environmental, and economic impacts alongside a leadership role in the society and is not exempt from challenging carbon reduction aspirations. Carbon management is gaining attention in academia, however, research in this area from an organisational perspective is in early phase. This paper explores barriers to carbon management in UK universities and highlights key challenges to be addressed. This research adopted a mixed-methods approach including a content analysis of eighteen universities' carbon management plans (CMPs) and seventeen semi-structured interviews with middle and senior managers in UK universities and other stakeholder organisations. The study found that UK universities are facing major barriers, namely, lack of funding, lack of stakeholder engagement - staff and student engagement, lack of human resources, lack of senior management leadership, complex buildings stock, estate development & business growth, potential conflicts & core business priorities and energy & carbon intensive research. The acknowledgement of these barriers could help senior and middle managers responsible for implementing carbon management strategies to achieve net zero by 2050 at the very latest.

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1. Introduction

The UK government announced carbon emissions reduction target setting the country on the path to net zero by 2050, leading the way in tackling climate change globally. Increasing pressure is on government and organisations to move faster. The government's new plan aims for at least 68% reduction in greenhouse gas emissions by the end of the decade, as compared to 1990 baseline (UK Government, 2020). This climate policy target aims to contribute to the United Nations (UN) Sustainable Development Goals (SDGs), SDG 13: Climate Action in particular. The SDGs are a call for action by all countries to promote prosperity while protecting the planet (UN, 2015). Various types of organisations are significant contributors to global carbon emissions and the business case for supporting low-carbon business practices is gathering momentum (Robinson et al., 2018). There is increasing pressure on universities to declare climate emergency and set more ambitious carbon reduction targets, for example, net zero by 2030. The Environmental Association of Universities and Colleges (EAUC) tracks sustainability commitments of universities including carbon neutral target and declaration of climate emergency (EAUC, 2021).

The UK university sector is a growing consumer of energy and resources and generator of carbon emissions (Brite Green, 2016). Historically, the higher education sector has been making its efforts to reduce carbon emissions due to their privileged position universities occupy as centres of research excellence and in cultivating 'thought leaders' for the future (HEFCE, 2009). UK university sector is extremely significant in terms of its population, economic contribution and societal influence and represents an important sector for long-term carbon management (Robinson et al., 2018). Therefore, universities must play a leading role to meeting not only the sector targets but national carbon reduction targets due to their wider impact which goes beyond their boundaries (Mazhar et al., 2017). Universities have significant potential to play a key role in supporting the transition to a low carbon economy (Davies and Dunk 2015). However, universities face a range of barriers and an improved understanding of those barriers/challenges is required so that these can be addressed through appropriate strategic interventions. This paper explores the barriers to carbon management in UK universities. The paper first sets the scene by presenting the wider context around carbon management and organisations including the barriers and justifies the research methodology including the research methods and the sample. Then the research findings are discussed in terms of barriers to carbon management in UK universities before final conclusions are offered.

2. Literature Review

Business organisations are part of the society and they now face a challenge of not only reducing carbon emissions to mitigate climate change, but also provide understanding to how it could impact their operations (Okereke, 2007). Carbon has become a strategic part of the new competitive advantage for organisations, just like capital, human resources, and products (Schultz and Williamson, 2005). The adoption of carbon management entails monitoring, controlling, and reducing carbon emissions to mitigate climate change (Yunus et al., 2020). There is a business case for organisations to implement carbon management strategies for climate change mitigation. Companies can increase their competitive advantages by implementing carbon reduction strategies and targets (Busch and Wolfensberger, 2011).

Business organisations need to integrate climate change into strategic management process by carefully considering market activities as well as non-market and political responses (Kolk and Pinkse, 2005). During the last decade, the need to reduce carbon emissions has become one of the most tenacious environmental concerns and it is a fast-moving international phenomenon (Roosa and Jhaveri, 2009). The emerging issue of carbon management has been addressed using various terms, such as environmental management, sustainable development, eco-innovation, eco-efficiency, and eco-industrial development. Furthermore, researchers suggest various practical approaches to address the challenge of carbon emissions (Kang, 2011). Cadez and Czerny (2016) explored corporate climate change strategies of carbon-intensive organisations to identify configurations of organisations pursuing similar strategies and appraise the relationships between nineteen carbon reduction practices and their underlying strategies. It is argued that carbon management makes good business sense (Busch and Shrivastava, 2011) and organisations in various industries have started taking steps for carbon reduction and management (Wang et al., 2012). However, Boiral (2006) state that business organisations aim to maintain the status quo and do not address carbon emissions unless they are obliged to do so. This suggests that there is room for improvement and there are barriers to be addressed.

Liu (2012) described carbon management as a corporate effort to reduce the carbon impact of organisation's business activities. Not all GHG emissions are directly related to carbon, but these are included in the definition of carbon management in terms of carbon dioxide equivalents (CO_2e). However, in practice, carbon management is relatively a novel concept for organisations, effective strategies are required to integrate carbon management into operations (Wahyuni and Ratnatunga, 2015). Corbett (2013) states that carbon-reducing initiatives in organisations are varied as they range from green product innovations to encouraging behavior changes by customers and employees. Strategic management of carbon is complex matter and starts with understanding the ways carbon management can affect the organisational activities – both tangible and intangible. Strategic carbon management provides an understanding of the way in which organisations are translating strategic issues into management actions in the context of their carbon impact (Bebbington and Barter, 2011). It is needed to examine the strategic response of organisations to carbon reduction.

The higher education (HE) sector, due to the nature of its business activities, emits direct and indirect carbon emissions (HEFCE, 2010). Cortese (2003) argues that HE plays a critical role, but its role is often overlooked in making this vision a reality. There are various opportunities at the sector level to change growth and development pathways for lowering emissions through a range of measures (Altan, 2010). Research carried out by Bryan et al. (2011) suggests that the most cost-effective opportunities to achieve carbon reduction targets exist in the Further and Higher Education sector. The HE sector has seen significant policy shifts in terms of its governance by first the Higher Education Funding Council (HEFCE) and now the Office for Students (OfS). Famously back in 2008, HEFCE had written to all Vice-Chancellors that future capital funding would be linked to carbon reductions. With the removal of student number control in 2015/16 and the increase in student fees as the primary means for income (Hillman, 2014), universities became subject to market forces. HEFCE was eventually replaced the OfS and any central influence around issues like carbon management were removed. A cursory

glance at the Office for Students website will find no reference to sustainability or carbon management which is a major policy shift and could be detrimental to the carbon management agenda. In this evolving policy landscape, there is a need to understand that how HEIs can strategically reduce and manage their increasing carbon emissions. This review suggests that there exists written material on the role of HE in carbon management, but not many studies have focused on actual carbon management practices and challenges. The case of HEIs' energy and carbon emissions reduction are considered more complex than other organisations due to heterogeneity of the sector (Altan, 2010). Most of the discussions on carbon management are regarding scope 1 and 2 emissions. The focus of carbon emissions reductions in universities seems to be mainly on buildings' energy consumption, because buildings are the larger contributor in carbon emissions and are in the direct control (Klein-Banai and Theis, 2013). Robinson et al. (2015) provided a reality check on carbon management in universities with a focus on English Russell Group universities. They found that current CMPs are not a good indicator of future performance and the HE sector in England has underestimated the challenge. All the universities have set carbon reduction targets, but the targets are extremely ambitious and may be unachievable due to certain barriers which need to be understood.

2.1 Barriers to carbon management

Okereke (2007) researched that there are several drivers and motivations for carbon management. For example, 'profit' and 'energy prices' as the most important drivers. On the other hand, Okereke (2007) proposed three barriers to enact carbon management within UK FTSE 100 organisations, which include a lack of strong policy framework, uncertainty of government actions and uncertainty in the marketplace. Subramaniam et al. (2015) argue that the regulatory landscape relating to carbon management has now become a political controversy. There exists uncertainty in government policies and increasingly changing technological developments also raise significant challenges to implement carbon management. Okereke (2007) suggests that the absence of a clear, long-term, and robust government policy framework imposes limitations on key decisions and many organisations find it difficult to justify investment decisions. There exists uncertainty and companies fear a change in policy stance of government, which can be a problem for organisations. Liu (2012) summarised barriers to carbon management in his study of Chinese industrial organisations. These barriers are divided into four categories: (1) structural barriers, (2) regulatory barriers, (3) cultural barriers and (4) contextual barriers. However, there has not been any detailed analysis of barriers to carbon management within public sector. However, some studies in the context of higher education and local authorities identified barriers to carbon reduction and climate change mitigation. Allman et al. (2004) explored barriers to address climate change in local authorities. Major barriers were a lack of awareness/interest of stakeholders, lack of funding, lack of coordination between departments, lack of government guidance, insufficient staff or staff time and other business issues having a higher priority,

In HE, EAUC et al. (2015) found that securing finance is the major barrier to deliver sustainability, followed by a lack of human resources, lack of senior management commitment and lack of student engagement. Butt (2014) found that staff and students do not see what it is in it for them and staff's loyalty is predominantly towards the university's business. Arvidsson

(2004) conducted research on environmental management practices in Swedish universities and explored a lack of time and resources and organisational structure as the key barriers. Pryce (2012) argues that there are opportunities for public bodies through low or no-cost measures such as optimisation of the existing facilities and behaviour change. Altan (2010) in a study of energy reduction in universities stated that growth of the HE sector is one of the biggest challenges universities are facing. The goal of energy and carbon reduction is difficult to achieve given the level of growth in the HE sector, and this is one of the major barriers. Andrews et al. (2015) found that universities that invested capital in building envelope, infrastructure and mechanical systems made more progress in energy and carbon reduction in USA, suggesting a key role of investment to scale up carbon management. Barriers to carbon management are studied mostly from industrial organisational context. Whilst there is limited literature on barriers to carbon management in universities, this section provided an overview of why organisations implement carbon management and what stops them doing so. This suggests that there is a gap in the study of barriers, providing an opportunity for further investigation.

3. Research Methods

The research adopted a qualitative approach to develop an improved understanding of barriers to carbon management in UK universities. This research was exploratory in nature using content analysis and semi-structured interviews as the research methods for data collection. Content analysis of a sample of eighteen universities' CMPs was carried out. The majority of the universities (eight) were from the East Midlands region in England and five were selected from other groups and regions in the UK to make a representative sample. Two universities were from Scotland, two from Wales and one from Northern Ireland. Among these, five universities belong to the Russell Group of UK universities and thirteen were from other post and pre-1992 universities. Carbon management plans and strategies were chosen for the analysis. Out of the total eighteen CMPs, the plans of the sixteen universities are available on their websites. There are two universities that do not have CMPs publicly available on the website. One of them has put a summary of the CMP and the other has placed it on the corporate website, but it is only available on staff web pages.

A total seventeen interviews were conducted with middle and senior managers in estates and facilities management departments of case study and other English universities (22 were approached but 5 did not respond). The other key senior individuals from the HE sector organisations in the UK were interviewed to gain sector level perspective. The participating universities are drawn from pre-1992 (four) and post-1992 (five) universities in England, UK. The distinction between the pre- and post-1992 universities is made to elaborate some of the challenges being faced by the two groups such as nature of business operations and estate. Keeping in mind the available time and resources, one interviewee was selected from each university to represent the organisation, apart from the case study university, where seven interviews were conducted. The interviews were conducted either face to face (eleven) or by telephone (six), depending upon the location and time commitments. The interviews lasted for between forty minutes and an hour. CMPs and interview transcripts were systematically reviewed, and the data were transferred to the qualitative data analysis software package,

NVivo for thematic analysis in line with the research aim. The qualitative data was coded under the themes and sub-themes for the analysis and produce findings. Table 1 presents the names of the eighteen universities with the titles of carbon management documents and Table 2 presents the interviewees' details.

Table 1: Demographic information of universities

No.	Name of the University	Name of the Document	Year
1	De Montfort University	Carbon Management Plan	2011
2	University of Leicester	Strategy and Implementation Plan	2007
3	Loughborough University	Carbon Management Plan	2010
4	Nottingham Trent University	Strategy and Implementation Plan	2008
5	University of Derby	Carbon Management Plan	2009
6	The University of Northampton	Carbon Management Plan	2011
7	University of East Anglia	Carbon Reduction Plan	2012
8	University of Cambridge	Carbon Management Plan	2010
9	Leeds Beckett University	Carbon Management Strategy	2012
10	University of Lincoln	Carbon Management Plan	2011
11	University of Nottingham	Carbon Management Plan	2010
12	University of Birmingham	Carbon Management Implementation Plan	2010
13	University of Bradford	Ecoversity - One Planet Strategy	2011
14	The University of Edinburgh	Climate Action Plan	2010
15	Heriot-Watt University	Carbon Management Plan	2009
16	Cardiff University	Carbon Management Plan	2013
17	Aberystwyth University	Implementation Plan	2007
18	Queen's University Belfast	Carbon Management Plan	2013

Table 2: Interviewees with job title, type of interview and organisation

No.	Job Title of the Interviewee	Type of Interview	Type of Organisation
1	Environmental and Sustainability Officer	Face-to-face	Post-1992
2	Energy Manager	Face-to-face	Pre-1992
3	Energy Officer	Face-to-face	Post-1992
4	Carbon and Energy Manager	Face-to-face	Pre-1992
5	Sustainability Manager	Telephonic	Post-1992

6	Environmental Manager	Telephonic	Post-1992
7	Transport Coordinator	Face-to-face	Post-1992
8	Director of Estates & Buildings	Telephonic	Pre-1992
9	Director of Estates	Telephonic	Post-1992
10	Head of Estates Management	Face-to-face	Post-1992
11	Deputy Procurement Manager	Face-to-face	Post-1992
12	Head of Environment and Energy	Telephonic	Pre-1992
13	Director of Sustainable Development	Face-to-face	Post-1992
14	Research Fellow	Face-to-face	Post-1992
15	Director of Climate Change Policy	Face-to-face	Post-1992
16	Head of Sustainable Development	Telephonic	HE sector organisation
17	Chief Executive	Face-to-face	HE sector organisation

4. Findings - Barriers to Carbon Management in Universities

This section presents barriers to carbon management as a result of the content analysis and semi-structured interviews. Although CMPs do not specifically identify barriers, they have discussed the key issues which can impact the effective implementation of carbon management. As the content analysis did not gather a comprehensive list of barriers to develop a complete picture, interviewees were asked about the barriers to carbon management based on their experience in universities. Therefore, the university managers discussed key barriers according to their own situations, whereas other interviewees from the sector organisations gave their personal views on what they perceive as barriers to carbon management in the sector. The interviewees have varying opinions on barriers and different universities are facing different barriers, but majority of them are in common which need addressing through appropriate interventions.

4.1. Lack of funding and resources

Funding and resources are critical to implement carbon management strategies (Mazhar et al., 2017). The implementation of energy and carbon reduction projects requires considerable financial investment, as Andrews et al. (2015) suggested that investment is key to scale up carbon management. The majority of the interviewees, twelve out of the seventeen, mentioned the issue of funding and resources and declared that funding is important for implementing carbon management strategies, whereas three of the interviewees argued that funding tends not to be a problem for implementing the strategies. However, resources refer to mainly HR here. The findings are in line with what Rayman-Bacchus and Pearman (2017) found that staff need financial support to develop sustainability related ideas further. The Sustainability Manager at

a post-1992 university argued that carbon management is about implementing projects and for that, universities need funding.

> *"I think a lot of it to do with coming up with projects and then having the funding to be able to put projects in place really, so a lot of it is to do with getting funding actually, so we have funding from various different places to do different projects. We would struggle if we haven't that funding, yes, so getting funding is important"* [Sustainability Manager]

The other group of the interviewees argued that funding should not be a problem for implementing strategies. There are low and no cost measures related to behaviour change and engagement. These low hanging fruits could be utilised as one of the first options for carbon management. The Director of Climate Change Policy at a post-1992 university further mentioned that funding should not be an excuse of middle managers for inaction. Funding is important for large-scale projects, but low and no cost small-scale projects could have significant contribution.

> *"The money is important because energy efficiency tends to be capital intensive, so of course it's important, but it tends not to be the problem in most cases"* [Director of Climate Change Policy]

Universities have multiple internal and external sources of funding available to them. Most of the universities have ring-fenced internal budget for estates to invest in carbon reduction projects and they also utilise external funding sources. The construction and maintenance budget can serve dual purpose, carbon reduction and new construction/refurbishment. The Head of Sustainable Development described these sources of funding and argued that there are a lot of funding opportunities.

> *"They have got their own resources of course which include loans, charitable donations and so on, money from the research councils, properties disposal, commercial income, those sort of things, they got income from the student loans, companies paying students' tuition fees, income from international students fees then they got a blend of money. There is also money available from Renewable Heat Incentives and Fee-in Tariffs as well, so there are quite a lot of opportunities"* [Head of Sustainable Development]

However, the Sustainability Director at a post-1992 university argued during LinkedIn conversation that *"a marketing team gets given a marketing budget to keep things up to date; many universities do not have a carbon fund for getting on with routine work"*. This indicates that many of the universities lack a dedicated budget for carbon management. This is in line with what EAUC et al. (2015) stating that finance is the major barrier to sustainability including carbon management in universities.

4.2. Lack of human resources (HR)

Another important barrier which was evolved during the analysis was lack of human resources (HR). EAUC et al. (2015) also state that lack of human resources is one of the barriers to sustainability and carbon management. Four interviewees mentioned resources as HR and their

skills to implement carbon management strategies. HR seems to play an important role in the carbon management process and this involves knowledge, skills and experience of middle managers who are responsible for implementing it. A Research Fellow emphasised the role of technical knowledge of operational staff as follows:

> *"Other factors are also technical knowledge, may be the operational people also need to have good communication and to really implement the projects"* [Research Fellow]

There has not been much focus and discussions on the role of HR in embedding carbon management in universities. The Director of Climate Change Policy stated that carbon and energy management is part of an energy manager's job, but he also has to deal with managing facilities and estates related issues. This indicates that an energy manager has many duties in the job description and more HR support would be helpful.

> *"You normally have an energy manager, he needs to do his job, but his job tends to be much broader than just carbon, he has facilities to manage, estates to manage and carbon. So, he has to integrate carbon management into his normal job, which is already difficult, so he needs support, he needs resources to help him do that"* [Director of Climate Change Policy]

Seven interviewees presented 'resources', including HR, as a barrier. All these interviewees emphasised the importance of resources and in contrast, one of them mentioned that it as a smaller issue than others. But, the seven interviewees reported that there is a lack of HR and they need more resources to deliver carbon management. This indicates that HR has a key role to deliver carbon management.

> *"We need more resources, human resources as well"* [Research Fellow]

> *"For delivering the projects, you are going have to people to deliver it. So staff resources are equally important, but not just the staff, but they are going to have to be expert in the field or relative expert"* [Head of Estate Management]

In addition, four managers mentioned a lack of time as a barrier to carbon management. The time may be considered as a resource. University staff are busy in their jobs and they consider carbon management as an extra item to deal with. They are mainly focused on their primary role and responsibilities, which have been officially assigned to them as part of job description. In regard, the Deputy Procurement Manager at a post-1992 university mentioned:

> *"We don't have time and resources to manage the little tasks, so it's changing the mind-set or educating people to look at these aspects"* [Deputy Procurement Manager]

4.3. Stakeholder engagement – Staff and student engagement

Stakeholder engagement emerged as one of the key themes in the study Universities are attempting to engage different stakeholders for carbon management (Mazhar et al., 2017). Ten interviewees mentioned that stakeholder engagement is an important part of carbon management and all of them are trying to achieve the results through engagement initiatives. Universities have a range of internal and external stakeholders, but it is mainly discussed from

staff and student perspective. The Head of Sustainable Development discussed the role of internal and external stakeholders and suggested a collaborative approach.

> *"I think it relies on kind of combined action from a number of people including sector bodies like AUDE, estates' director group has done tremendous job on carbon reduction, like Universities UK and Guild HE and the NUS. I think it probably needs students as well to be vocal and clear that it is important to them"* [Head of Sustainable Development]

Staff and student engagement is a key part of stakeholder engagement. The content analysis indicates that universities are trying to engage staff and students with appropriate engagement strategies. Ten universities (out of the eighteen) have clearly elaborated the role of staff and students and their engagement in carbon management. Loughborough University's CMP highlights an important role of staff and student engagement for carbon management:

> *"If the university is serious about meeting the challenge of achieving the targets set out within this plan and be seen as a leading low carbon campus within the Higher Education sector, every member of staff and the student body needs to engage in the carbon agenda"* [CMP Loughborough University, p. 3]

Ten out of the seventeen interviewees mentioned the issue of behaviour change for staff and students as an important barrier and indicated a lack of staff and student engagement. An Environmental Manager of a post-1992 university presented this barrier by arguing that:

> *"Behaviour change, people are just stuck in their ways they always done it, not willing to change, so it's really big one. That's the main one, so it could be behaviour change"* [Environmental Manager]

All the stakeholders have their primary roles to fulfil, so it is hard for them to spare time and get involved in carbon management process to develop a culture of carbon management. Similarly, Liu (2012) found cultural barriers in the context of Chinese industrial organisations. The issue of engagement could be due to a lack of knowledge and understanding on environmental issues and focus on their main duties (education or work). Butt (2014) found that staff and students do not see what it is in it for them and their focus is towards the university's core business. An Environmental & Sustainability Officer mentioned the 'Green Impact' and 'Students Switch Off' projects as the key engagement tools, but many universities are implementing these projects as reflected in their CMPs.

> *"We do student switch off project in the halls we own and run, and we are also doing the Green Impact project for staff. We also work with DSU (DMU Students Union) to try and raise awareness about environmental issues"* [Environmental and Sustainability Officer]

This quotation indicates that to engage staff and students, universities are carrying out campaigns and behavioural change activities. Students' Unions have been active recently to reduce emissions, but there is not much involvement as universities would like to see across the staff and student population. Pryce (2012) argues that there are opportunities for public sector organisations through behaviour change strategies.

4.4. Lack of senior management leadership

Leadership from senior management is one of the most important components of carbon management and was mentioned by fourteen out of the seventeen interviewees. Similarly, Mazhar et al. (2019) and EAUC et al. (2015) state that senior management commitment is a key factor for the carbon management process in universities and they may struggle for it. A Research Fellow stated that *"I think yes, one of the success factors is the leadership and commitment at the top level".* The Chancellor of a pre-1992 university said that carbon management can only be embedded in a university if it is driven by a VC at a strategic level. If carbon management only exists in estates, then it is unlikely that there will be strategic buy-in at the top level required to drive change.

> *"The whole question about properly embedded carbon management only works if it is driven by the VC and by the whole of his/her team. If it is stuck in the Estates Department, and simply relegated to a matter of managing assets and infrastructure, then it's very unlikely that there will be the kind of buy-in that will be required to really drive behaviour change"* [Chancellor]

However, senior management commitment varies from university to university; but almost all of the universities' senior management commitment is reflected through their CMPs and other strategic documents. Throughout the interviews, the role of senior management leadership was brought up and discussed frequently as shown in the following extract of an interview with the Head of Sustainable Development at the HE organisation.

> *"I think it needs high level leadership and championing from either the vice chancellor or another member of senior management team"* [Head of Sustainable Development]

Eight out of the fourteen interviewees mentioned that senior management is committed to carbon management, whereas six interviewees mentioned that there is a lack of senior management leadership and they presented this as a key barrier. Therefore, there may be a mix of approaches in the sector. Some of the interviewees mentioned that they are still trying to engage senior leadership. They argued that senior management teams are key stakeholders and middle managers need their strategic support for effective implementation. The Transport Coordinator at a post-1992 at DMU thinks that VC seems to be engaged and considers sustainability agenda to be very important for the university business by mentioning:

> *"Actually, I think the VC does believe in it. I think that he does consider the sustainability agenda to be very important, both to him and to DMU as a business. I think that he is doing it for the right reasons"* [Transport Coordinator]

4.5. Complex buildings stock

The issue of complex and historical listed building stock emerged in the interviews and CMPs which is in agreement with Altan (2010). Many of the universities have old, historical, and diverse nature of building stock, which is complex for estates managers to deal with in regard to improving carbon management. Therefore, these universities are struggling to work with this type of buildings. In addition, some of the universities have listed buildings and estates

managers can only do limited work on those buildings. This may be due to historical nature and existing façade of the buildings. *"Some institutions will have major parts of their estate in conservation areas and may have an extensive range of listed buildings, which will significantly influence their estate development strategy plans. Others may have relatively little property in this category"* (AUDE, 2013, p. 13). Therefore, this is a challenge which universities are facing to improve carbon management performance of their building stock. Older universities especially pre-1992 universities seem to be facing more of this problem. The Head of Environment and Energy at a pre-1992 university (Russell Group) stated that complexity of buildings is critical and does not support carbon management.

> *"The main challenges are around the estate, the diverse nature of it, and the historical listed buildings"* [Head of Environment and Energy]

An Environmental Manager argued that there is always room to improve a building to a certain extent. There comes a point where you cannot do much more to the fabric of an existing building to make it more energy and carbon efficient. A Sustainability Manager supported the above argument by stating that there is always room to improve a building to a certain extent.

> *"I think there is always a space to improve one thing I mean one of the issues is, if you got all the buildings, there is only certain amount of things which you can do with all the buildings. There comes a point where you cannot actually do much more to the fabric of the buildings to make the efficiency much better, but unless you spend a lots and lots of money, so there is a sort of point where you have to actually say ok you cannot do more to the building fabric because it's going to cost us a lot more money, so you are restricted by the buildings themselves"* [Sustainability Manager]

The Director of Sustainable Development raised an important issue and stated that building users find energy use in buildings as a complicated issue due to their controls. They do not feel control over heating, ventilation or lighting. This suggests that there may be a lack of understanding and communication.

> *"Buildings are too complicated, the controls are too complicated, people do not feel they have control of their heating, their ventilation, their lighting sometimes and because of that they cannot do anything about it, if you allow and give people level of control, if they understand how things work and they can put things right and they quite often reduce emissions and this building is a good example, this building is very poorly controlled"* [Director of Sustainable Development]

4.6. Estate development and business growth

Estate development and business growth are critical issues because universities are growing in their business and they have to develop infrastructure as part of estates. The growth in estate size and business, as a result of strategic decisions, is producing more emissions, because of facilities, departments and laboratories etc. Two of the universities, the University of Derby and Cardiff University, quoted on the key issues of increase in student population and size of estate. The data from the content analysis is used in this section to avoid repetition.

> *"We have also experienced a steady increase in the student population and to reflect this and the changing size of the estate* [University of Derby Carbon Management Plan, p. 7]

> *"Cardiff is set to continue the expansion its estate and an increase in capital spend is expected in the coming years, in common with other Russell Group universities*" [Cardiff University Carbon Management Plan, P.9]

An Environmental Manager of a growing post-1992 university argued that the university is growing, as other universities. With growth, staff and students want more facilities resulting in higher emissions.

> *"You are constrained by the fact that the sector is still growing, as I say we are a relatively new university and we are still growing, so that constraints you because people want to do more things and have more equipment and more laboratories, so when people want more things because the university is growing, obviously the carbon emissions associated with those things increase as well, so I guess that's a tricky thing from our perspective"* [Environmental Manager]

In contrast, three universities mentioned that they still have done well in carbon management, despite the continuous expansion of the campus and business growth. This indicates that universities can implement carbon management successfully with business growth, which is a key to sustainable business.

> *"The most notable success to date is achieving an absolute reduction in our carbon emissions since 2005/06, despite expanding our campuses and increasing student numbers. This is a challenge that many other HEIs are struggling to meet and provides an excellent platform for on-going carbon reduction success"* [University of Lincoln, Carbon Management Plan, p.5]

4.7. Conflicts and core business priorities

Universities are working on carbon management in addition to the core business priorities. According to the two interviewees, carbon management is not prioritised over the core business activities in strategic decision-making in their universities. Furthermore, two of the interviewees (one senior and one middle manager) expressed their views on how carbon management has lost its inertia in other core business priorities and it is hard to put necessary resources in a financially tight situation of the HE market. Lack of priority to carbon management could be due to strategic conflicts, as there are a series of conflicts between carbon management and the core business activities. For example, internationalisation, business travel, students experience and out of hour's opening of facilities etc. are the main ones, which came up as a result of the study. The study findings complement what Allman et al. (2004) found in a study of climate change strategies in local authorities as there is an issue of other core business activities having a higher priority. Senior managers, who are the main decision-makers, have to handle these issues at the same time, which is the main business focus. The potential conflicts and priority to the business was reported by the Head of Environment and Energy.

> *"I think another one of the challenges particularly in business travel is this tension between perceived need to travel in order to meet the research and academic objectives to the university and trying to reduce emissions from travel, once again I think it comes down to raising awareness, is there a need to travel, not assuming that all travel is bad"* [Head of Environment and Energy]

The Energy Manager argued that the university needs to invest in buildings and capital projects, but the budget has been tight because of investment in other areas. Due to this, there is a matter of competition between carbon management and other business areas. The Head of Environment and Energy at a pre-1992 Russell Group university identified tensions between business travel and carbon management. He did not perceive that all types of travel are bad due to their benefits to the university. The Director of Estates and Buildings argued that universities are working in a very different environment now. Carbon management does not have a priority and it is considered as an important issue, but not urgent in decision-making. Therefore, focus remains on the core business due to a lack of strategic drivers such as HEFCE or national government drivers.

> *"I believe because higher education sector is now in such a different position now that it has ever been, I don't think it has been considered as the aimed priority, may be important still, but it's not urgent"* [Director of Estates & Buildings]

4.8. Energy and carbon intensive research

The government is driving universities to be at the leading edge of research and some parts of research can be energy and carbon intensive. Research intensive universities, which are predominantly Russell group universities, are mainly facing this barrier. This is in line with what Ongondo and Williams (2011) and Robinson et al. (2015) state that Russell Group institutions have the greatest challenge in altering behaviour, being among the UK's highest-emitting because of energy-intensive research. Three of the interviewees discussed energy intensive research as one of the barriers to carbon management.

> *"I think probably sort of research as well, the government is calling on universities to be at the leading edge of research and some parts of research can be really carbon intensive and I think it is a bit of challenge"* [Head of Sustainable Development]

In the content analysis, three universities mentioned the challenge of energy and carbon intensive research activities. All the three universities belong to the pre-1992 Russell Group. This suggests that this group of universities can be considered more energy intensive as compared to other groups. The University of Cambridge mentions the research growth in its CMP and proposes that future carbon reduction targets should take into account this research growth.

> *"It should be noted that in recent years the University of Cambridge has been particularly successful in the fields of research and teaching, and there has been a substantial growth in activity across the University. Research income, for example, has grown as an average rate in real terms of 8% p.a. in real terms. Energy consumption has grown steadily as a consequence of this growth, which has also led to a growth in the estate"* [University of Cambridge Carbon Management Plan, p.6]

The above quotation suggests that the university has been successful in growing teaching and research activities. This has led to growth in the estate, energy consumption and emissions indicating a direct link of energy and carbon intensive research and increase in emissions. The Head of Environment and Energy at a pre-1992 university supported this argument by reporting that universities conducting research have particular problems, which can lead to higher emissions in laboratories due to the equipment. The CMP of the University of Cambridge states that the management of emissions associated with research activities should be part of future plans, but this is not considered. However, the university should not use it as an excuse for not implementing carbon management.

> *"It is clear that, given the major importance of growing research-related emissions, their control and management should become a distinctive part of the future plan of the university. It should not be an excuse for the university"* [University of Cambridge Carbon Management Plan, p.10]

The activities of universities may differ and the largest contribution to carbon emissions comes from departments that are engaged in scientific research. The data analysis of English universities demonstrates that the Russell Group represents 15 of the highest 18 carbon intensive universities in England. Many of the universities that were not part of the Russell Group (at the time of writing) are likely to have a high volume of science and technology related teaching and research activities (HEFCE, 2010). This is the reason that Russell group universities are at the bottom of the UL.

> *"The university plan includes for an expansive capital program over the next 5 years. Even though the university ensures that its developments are BREEAM excellent as a minimum development within a research led university will inevitably result in an underlying growth in energy use from these new buildings. The estimated new build increase to 2015 is circa 30000m^2 and a corresponding estimated annual increase in CO_2 of circa 3000 tonnes"* [The University of Nottingham Carbon Management Plan, p.8]

5. Discussion and Conclusion

This study has highlighted key barriers and challenges for UK universities in order to adopt more efficient ways of implementing carbon management and address the climate emergency. This will help universities to advance understanding of the scale and importance of environmental challenges. This research guides universities who are under increasing pressure from internal and external stakeholders to reduce their carbon emissions. Especially the university sector in the UK which bring considerable social, environmental, and economic impact on the environment face criticism for not meeting the carbon management targets effectively which is their responsibility. The study highlights those practices which few of the universities are already undertaking in view of meeting their sustainability and responsible management goals, which need to be considered thoroughly for reducing the climate change effects.

Carbon management area is still developing, and limited research was available in context to address the wider issues which were limiting UK universities to promptly act to meet wider

sustainability goals. In contrast to the study of Robinson et al. (2015) where they provided a reality check of the actual carbon management practices undertaken by UK universities in the England, our study addresses those barriers due to which UK universities are not able to meet their carbon management targets and provide insights of actual reasons hindering in their way. Barriers to carbon management in universities were not explored in such detail in the past to provide insights into the strategic approach to managing carbon emissions. Although the study is focused on universities, there are implications for other organisations in terms of learning barriers to change.

The paper has explored those barriers to effectively meet carbon management goals in UK universities. It is clear that 'core business' – i.e. financial sustainability secured through the fee income of undergraduate students trumps all other priorities. However, the precarious nature of that situation, highlighted as a result of COVID-19, especially where some universities are dependent on high international student numbers has forced many universities to adapt, not least through the provision of on-line teaching. Future research can be undertaken as a result of this study such as, a need for carbon management framework identifying the processes and key steps for UK universities, as findings suggested that carbon management is still an afterthought in universities. Hence, carbon management framework to address barriers and perform carbon management could be essential for actual implementation. Future research could be undertaken to understand how carbon management can be more successfully mainstreamed within organisations in the current higher education climate and senior management leadership can be effectively engaged to integrate it within strategic management and decision-making processes. This would help address micro-level issues within the HE organisations. With regards to the carbon management plans and associated targets, a further analysis can be conducted to find out whether universities have updated their plans and managed to meet the desired targets. Universities now face a clear choice as to whether they allow Covid-19 to divert their attention to the perceived core issues around students' teaching and learning, estate management and future proofing or whether the need to adapt and change will allow them to see the synergies in embracing more flexible delivery and utilise new ways of working that are less carbon intensive. Therefore, universities need to act fast as it is the time for action and recover through this pandemic as responsible and low carbon sustainable business organisations.

References

Altan, H. (2010). Energy efficiency interventions in UK higher education institutions, Energy Policy, 38 (12), pp. 7722-7731.

Allman, L., Fleming, P. and Wallace, A. (2004) The progress of English and Welsh local authorities in addressing climate change. Local Environment, 9 (3), pp. 271-283.

Arvidsson, K. (2004) Environmental management at Swedish universities. International Journal of Sustainability in Higher Education, 5 (1), pp. 91-99.

Andrews, J., Levine, D., Kadamus, J., Finnegan, H., Li, B. and Sturk, R (2015). The State of Sustainability in Higher Education 2015: Emissions Metrics, Consumption Trends & Strategies for Success. USA: University of New Hampshire.

Busch, T. and Wolfensberger, C., (2011). The virtue of corporate carbon management, International Journal of Sustainable Strategic Management, 3(2), pp.142-157.

Brite Green (2016). Brite Green - University Sector Carbon Reduction Progress Report 2005-2015, Available online at: https://www.sustainabilityexchange.ac.uk/files/brite_green_-_university_sector_carbon_reduction_progress_report_2005-2015.pdf [Accessed: 29/03/2021]

Butt, L. (2014) Failing the Future: Key Factors Affecting the Management of Sustainability Programs in Universities in the Sydney Basin and Region, Unpublished PhD thesis, Macquarie University, Australia.

Boiral, O., (2006), Global warming: should companies adopt a proactive strategy?, Long Range Planning, 39(3), pp.315-330.

Bebbington, J. and Barter, N. (2011). Strategic responses to global climate change: a UK analysis, Chartered Institute of Management Accountants (CIMA), 7 (11), pp. 1-10.

Bryan, G., Cohen, R. and Stepan, P. (2011). Wider Public Sector Emissions Reduction Potential Research, A Final Report to the Department of Energy and Climate Change (DECC), UK. Camco, London, UK.

Cadez, S. and Czerny, A., (2016). Climate change mitigation strategies in carbon-intensive firms, Journal of Cleaner Production, 112, pp.4132-4143.

Cortese, A.D. (2003). The critical role of higher education in creating a sustainable future, Planning for Higher Education, 31 (3), pp. 15-22.

Corbett, J., (2013). Designing and using carbon management systems to promote ecologically responsible behaviors. Journal of the Association for Information Systems, 14(7), p.2.

Davies, J. C., & Dunk, R. M. (2015). Flying along the supply chain: Accounting for emissions from student air travel in the higher education sector, Carbon Management, 6(5–6), 233–246.

EAUC (2021), Sustainability Commitments, Available online at: https://www.eauc.org.uk/sustainability_commitments [Accessed: 21 June 2021]

EAUC, NUS, UCU and ACCDN. (2015). Sustainability in Education 2015: Survey research by the Environmental Association of Universities and Colleges, National Union of Students, University and College Union, Association of Colleges and the College Development Network, UK.

Hillman (2014), A guide to the removal of student number controls, Higher Education Policy Institute (HEPI), Oxford, United Kingdom.

HEFCE (2009). Research into carbon reduction target and strategy for Higher Education in England: HEFCE, Bristol, UK.

HEFCE (2010) Carbon reduction target and strategy for higher education in England, Bristol, UK.

Klein-Banai, C. and Theis, T.L. (2013) Quantitative analysis of factors affecting greenhouse gas emissions at institutions of higher education. Journal of Cleaner Production, 48, pp. 29-38.

Kang, M.J. (2011) A literature review of strategic carbon process management based on inter-firm cooperation: Potential, limits, and prospects: Innovation Forum IV, France.

Kolk, A. and Pinkse, J. (2005) Business responses to climate change: identifying emergent strategies, California Management Review, 47 (3), pp. 6-20.

LIU, Y. (2012). An empirical research of awareness, behavior and barriers to enact carbon management of industrial firms in China, Science of the Total Environment, 425, pp. 1-8.

Mazhar, M.U., Bull, R., Lemon, M. and Ahmad, S.B.S., (2019). Carbon management planning in UK universities: A journey to low carbon built environment. In University Initiatives in Climate Change Mitigation and Adaptation (pp. 33-56). Springer, Cham.

Mazhar, M.U., Bull, R. and Lemon, M., (2017). Critical success factors for embedding carbon management in organizations: lessons from the UK higher education sector, Carbon Management, 8(5-6), pp.379-392.

Ongondo, F.O. and Williams, I.D., (2011). Greening academia: Use and disposal of mobile phones among university students, Waste Management, 31(7), pp.1617-1634.

Okereke, C., (2007). An exploration of motivations, drivers, and barriers to carbon management: The UK FTSE 100, European Management Journal, 25(6), pp.475-486.

Pryce, T. (2012). Public sector looking to carbon management to drive resource efficiency, Available online at: http://www.publicsectorexecutive.com/Comment/public-sector-looking-to-carbon-management-to-drive-resource-efficiency [Accessed: 24/03/2021].

Robinson, O.J., Tewkesbury, A., Kemp, S. and Williams, I.D., (2018). Towards a universal carbon footprint standard: A case study of carbon management at universities, Journal of Cleaner Production, 172, pp.4435-4455.

Robinson, O., Kemp, S. and Williams, I., 2015. Carbon management at universities: a reality check, Journal of Cleaner Production, 106, pp.109-118.

Rayman-Bacchus, L. and Pearman, J., (2017). Evaluating Strategy in Practice: Implementing Carbon Reduction and Sustainability Strategy in University of Westminster. In Sustainable Development Research at Universities in the United Kingdom (pp. 327-349). Springer, Cham.

Roosa, S.A. and Jhaveri, A.G. (2009). Carbon reduction: Policies, strategies, and technologies: The Fairmont Press, Inc.

Subramaniam, N., Wahyuni, D., Cooper, B.J., Leung, P. and Wines, G. (2015). Integration of carbon risks and opportunities in enterprise risk management systems: evidence from Australian firms, Journal of Cleaner Production, 96, pp. 407-417.

Schultz, K. and Williamson, P. (2005). Gaining Competitive Advantage in a Carbon-constrained World: Strategies for European Business, European Management Journal, 23 (4), pp. 383-391.

UK Government, (2020), UK sets ambitious new climate target ahead of UN Summit, Available online at: https://www.gov.uk/government/news/uk-sets-ambitious-new-climate-target-ahead-of-un-summit#:~:text=A%20new%20plan%20aims%20for,decade%2C%20compared%20to%201990%20levels.&text=The%20Prime%20Minister%20has%20today,2030%2C%20compared%20to%201990%20levels. [Accessed: 16/03/2021]

UN, (2015), Transforming Our World: The 2030 Agenda for Sustainable Development, United Nations (UN).

Yunus, S., Elijido-Ten, E.O. and Abhayawansa, S. (2020), Impact of stakeholder pressure on the adoption of carbon management strategies: Evidence from Australia, Sustainability Accounting, Management and Policy Journal, Vol. 11 No. 7, pp. 1189-1212.

Wang, X., Ding, H., Wang, W., Zhang, L. and Xue, Y., (2012), A review of Carbon Emission Management from the perspective of logistics industry. In Proceedings of 2012 IEEE International Conference on Service Operations and Logistics, and Informatics (pp. 312-317). IEEE.

Wahyuni, D. and Ratnatunga, J. (2015). Carbon strategies and management practices in an uncertain carbonomic environment–Lessons learned from the coal-face, Journal of Cleaner Production, 96, pp. 397-406.