



RESEARCH ARTICLE

# Exploring corporate engagement with carbon management techniques [version 1; peer review: 2 approved with reservations]

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## Abstract

This paper explores the different ways of managing carbon in organisational settings. It uses a sequential mixed methods approach – literature review, discussions with sustainability thought leaders, and online survey and interviews with company sustainability leaders – to consider and critique the use of the carbon management hierarchy (CMH) by selected corporate bodies in the UK. The derived empirical evidence base enables a triangulated view of current performance and potential improvements. Currently, carbon management models are flawed, being vague in relation to the operational reductions required prior to offsetting and making no mention of Science Based Targets nor the role corporations could play in wider sustainability initiatives. An amended CMH is proposed incorporating wider sustainability initiatives, varying forms of offsets, the inclusion of accounting frameworks and an annual review mechanism to ensure progress towards carbon neutrality. If such a model were to be widely used, it would provide more rapid carbon emissions reductions and mitigation efforts, greater certainty in the authenticity of carbon offsets, wider sustainability impacts and a faster trajectory towards carbon neutrality.

## Keywords

Carbon management hierarchy, carbon offsetting, Science-Based Targets, The Gold Standard, corporate sustainability, climate stability, UK carbon emissions, carbon neutrality



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## Open Peer Review

Reviewer Status  

Invited Reviewers

1

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report



report

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## Introduction

This paper is concerned with the different ways of managing carbon in organisational settings. Although its conclusions could apply to any organisational structures, the paper will take the organisation of private sector corporations within the UK as its case study. Introduced in 2008, the Carbon Management Hierarchy (CMH) was devised to assist corporations in prioritising actions to achieve carbon neutrality. The [Intergovernmental Panel on Climate Change \(IPCC\) report](#) highlights the necessity of far exceeding merely achieving neutrality. It is therefore clear that the CMH model requires revision. This paper focuses upon corporate responses to the CMH, a significant contribution to climate stability goals as UK companies account for 18% of national carbon emissions ([BEIS, 2018](#)).

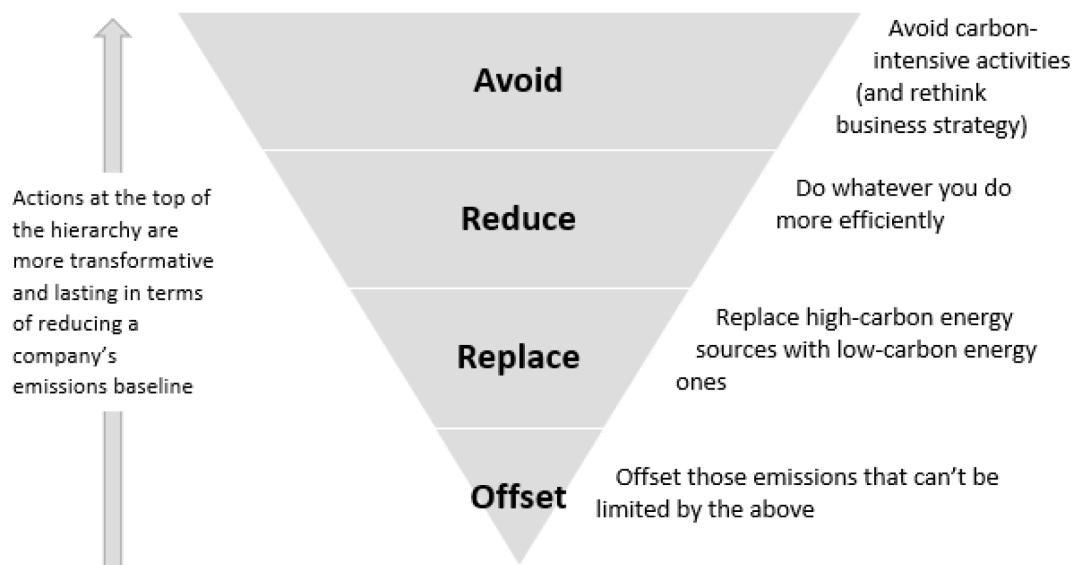
### Current implementation of the carbon management hierarchy

[Okereke \(2007\)](#) defines the five main motivations for an organisation's carbon management activities as profit, credibility and leverage in climate policy development, fiduciary responsibility, guiding against risk and ethical considerations. The CMH ([Figure 1](#)), conceived by Forum for the Future and adapted from the waste management hierarchy, has been in existence since 2008 when carbon management began to be seen as important in corporate sustainability discussions. Though fairly simple, the CMH model is useful by providing a conceptual framework for prioritisation of potential actions. It can also inform analysis of likely costs to reduce direct emissions prior to offsetting any residual emissions. However, there is no detail in relation to what constitutes any 'emissions that can't be eliminated by the above', potentially resulting in companies offsetting a larger proportion of their emissions than is really necessary. Consequently, basic 'scope 1' efficiency measures

and associated changes in behaviour may not take place within corporate practices and culture. Scope 1 emissions are direct emissions from owned or controlled sources. Scope 2 emissions are indirect emissions from the generation of purchased energy. [Scope 3 emissions](#) are all indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions.

[Raworth \(2017\)](#), amongst others, criticises the CMH model as companies need to move beyond minimising carbon emissions as the primary goal, instead adopting a restorative carbon strategy. (A restorative strategy is defined by net carbon sequestration – becoming 'carbon negative' – rather than simply reducing emissions.) At present, there is no statutory requirement to implement the CMH, which consequently has no formalised or standardised review process, with the associated risk that any agreed actions are essentially aspirational. Furthermore, the CMH model [lacks a feedback loop](#) where savings from emissions reductions are fed back into new emission reduction measures.

The final tier of the CMH relates to voluntary carbon offsetting, which grew by 200% between 2005 and 2006 ([Lovell et al., 2009](#)). Offsetting refers to the substitution of emissions forgone for emissions produced ([Murray & Dey, 2009](#)), a [mechanism](#) where one's own emissions are offset by paying for reductions in emissions elsewhere. Purchasers buy carbon credits from projects that claim to reduce carbon emissions, which is often a cheaper and easier option than reducing the emitter's emissions at source ([Downie, 2007](#)). However, carbon offsetting has fallen out of favour in recent years, its rapidly declining popularity and credibility due in part to abuse of the [offset mechanism](#), concerns around discouraging personal accountability and an uneasiness around a perceived



**Figure 1.** The carbon management hierarchy (adapted from [Forum for the Future](#)).

environmental and economic discrimination. Some critics feel that offsetting schemes shift attention away from the need for those buying offsets to reduce their own emissions, discourage personal accountability, magnify inequalities, perpetuate neo-liberal global capitalism and the commodification of nature, engender environmental and economic discrimination, and perpetuate a sense of continued imperialist attitudes or ‘CO<sub>2</sub>lonialism’ and the ‘paying off’ of one’s guilt (Ciscell, 2010). Furthermore, with less focus on reducing emissions at source, there is concern that [attention is diverted away](#) from practical progress towards a low carbon economy and the development of green technological solutions, crowding out other potentially progressive schemes such as cap-and-trade and carbon allowances (Ciscell, 2010; Dhanda & Hartman, 2011; Downie, 2007; Lovell *et al.*, 2009; Pontin & Roderick, 2007).

There are also challenges around the measuring of offsets, regarding whether they yield the reductions providers propound and concerns related to the cost of carbon credits. Offsets are priced according to market dynamics, which risks accelerating a ‘race to the bottom’ with higher quality, potentially more expensive projects being less sought after and therefore ceasing to operate. Recognising these risks and the need to more closely mirror true social cost of Carbon values, The Gold Standard commissioned a group of economists to research the [true socio-economic benefits](#) of their projects. Findings from this study identified a monetary value of \$21–\$177 per Imperial ton of reduced CO<sub>2</sub> emissions, leading the economists to explore how to better reflect this value within their accounting mechanisms and urge offset purchasers to consider these additional wider sustainability benefits when choosing projects. Assessment of the contribution of offsetting to ‘additionality’ (carbon reductions are additional to a business-as-usual scenario and ‘sole ownership’) has proven problematic, for example where sale of credits to different purchasers occurs (Dhanda & Hartman, 2011; Lovell *et al.*, 2009).

The principal industry response to the above criticisms has been to argue for self-regulation with the intent or hope of restoring credibility. The Gold Standard acts as a standards and certification body that aims to achieve best possible outcomes in climate and development projects. It has the advantage over some standards in that it requires the offset project to have social and environmental benefits and a well-developed stakeholder engagement process as well as aiding a transition towards a low-carbon economy. Critics of The Gold Standard suggest it could impede the creativity of the market in developing new solutions. Critics also query the credentials of those assessing the sustainable development benefits (Drupp, 2011). However, many see The Gold Standard as well suited to fostering high sustainability benefits whilst transitioning to a low-carbon economy (Drupp, 2011). The Gold Standard is currently working in partnership with the Science Based Target Initiative (SBTi). The SBTi recognises that scope 1 and 2 emissions reductions will not be enough, and that an ‘emissions gap’ exists despite the [United Nations Framework Convention on Climate Change \(UNFCCC\) Paris Agreement](#). This gap can be

legitimately filled or financed via credible offsetting schemes; “Reduce at home, Finance abroad” is the new mantra for both corporations and countries, the [financing of projects rather than the claiming of carbon credits](#) which mitigates risks around double-counting.

Once appropriate standards are in place, there are some obvious advantages for companies opting to offset those emissions that are outside their direct sphere of influence. Offsets often encourage a transfer of funds from developed to developing economies that otherwise would not exist (Doyle & Erdmann, 2010, cited by Dhanda & Hartman, 2011). High-quality offsetting also provides [a multiplicity of sustainability benefits](#) going beyond climate change. Offset projects can therefore potentially aid development and alleviate poverty issues with the added advantage of developing countries ‘leapfrogging’ fossil fuel technologies (Lovell *et al.*, 2009). Furthermore, offsetting projects can educate the public about climate change, demonstrate to policymakers an appetite for change and contribute to positive corporate image (Dhanda & Hartman, 2011). Finally, with the IPCC target of keeping global temperature rises to [within 1.5 degrees](#), offsets may be a quick and relatively inexpensive means of achieving corporate neutrality in the short term, whilst enterprises endeavour to make the necessary long-term changes to their own performance (Lovell *et al.*, 2009). Nevertheless, offsetting cannot be considered as a substitute for the structural change required by an organisation to reduce its emissions of climatically active gases.

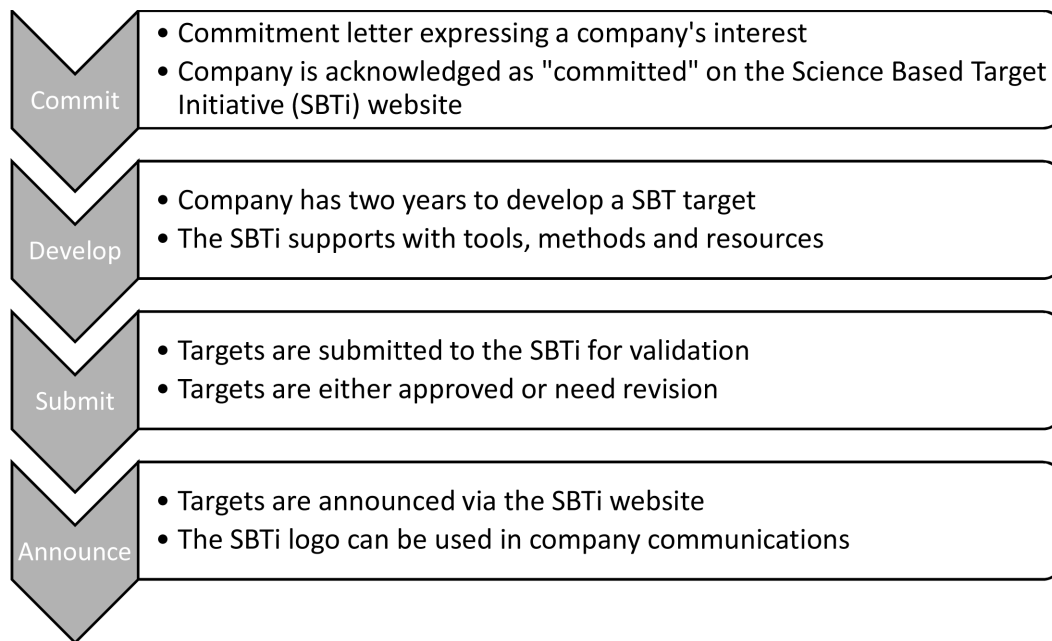
#### Science-based targets (SBTs)

SBTs are a relatively new concept, having gained popularity at the 2015 UNFCCC COP21 in Paris. SBTs aim to accelerate the reduction in global temperature by helping companies take intensive action to curtail their emissions. SBTs quantify a corporation’s ‘fair share’ of the total greenhouse gas (GHG) emissions reductions required to keep below 2°C. More recently a 1.5-degree target has been introduced as part of the SBT approach, and some companies, for example BT and Pukka Herbs, are now addressing this challenge.

There are four stages a company takes when adopting SBTs; Commit, Develop, Submit and Announce ([Figure 2](#)):

[Many advantages](#) have been proffered for companies adopting SBTs. These include strengthened credibility and investor confidence, since targets are based on what is required to mitigate the impacts of climate change rather than what feels practicable. SBTs can also promote innovation, [improve sustainable operations](#) and reporting, and enhance policy influence (Marland *et al.*, 2015).

However, several challenges are associated with practical implementation of SBTs. SBTs are founded on an egalitarian principle, assuming every company will act to address mitigation of climate change. In reality, this is far from the case. By the end of 2019, only [732 companies worldwide and 81 companies in the UK](#) had taken action on SBTs. This minimises



**Figure 2.** The four stages of adopting science-based targets (SBTs).

the cumulative contribution of leading companies, but potentially also puts them at a competitive disadvantage (Trexler & Schendler, 2015) and results in them having to do **more than their fair share**. SBTs only require the reporting of scope 1 and 2 emissions, yet a company's scope 3 emissions can make up a very substantial proportion of its carbon footprint. Omitting these indirect emissions could significantly skew emission mitigation strategies.

## Method

The ethical basis of the research approach was approved by the University of the West of England's Faculty of Environment and Technology Research Ethics Committee and can be described as an explanatory sequential mixed methods approach using data gathered via textual and empirical methods. All participants were given a Participant Information Sheet and signed a Consent Form. The literature under review was limited to that dating from 2000 onwards and consideration was given to the hierarchy of evidence to ensure reliability. That said, for some topics such as onsetting and SBTs, there was very little academic literature and so options were limited, and grey literature was also incorporated. Literature was UK-based where possible so as to be relevant to the area under research. However, by limiting the literature review to a specific time period and geographical space, there was a risk that some historical/non-UK-based learning could be missed. A flexible approach was therefore adopted with a broadening of scope where deemed relevant. A structured literature review with key search terms was supplemented by discussions with sustainability thought leaders that in turn, informed development of an online survey. The survey was piloted with

two companies, then adjusted and submitted to the 32 UK companies who, at the time of writing (2018) had adopted SBTs. Once survey results were returned, a stratified sample of company sustainability leaders (varying company type and carbon management experiences) was interviewed about their carbon management practices. This empirical evidence (literature review, questionnaire and interviews) was then triangulated and distilled to identify critical elements to be included in the CMH. These proposed amendments to the hierarchy were then cross-checked for suitability, effectiveness and efficiency with three key thought leaders in the sustainability professions.

## Online survey

The SBTi keeps an online record of any companies taking action on SBTs. This online database was filtered to show just those companies which are UK-based; 32 companies at the time of enquiry. Web-based surveys have the advantage in that they are less time consuming, less costly, less susceptible to errors, more convenient and more innovative in design (Fleming & Bowden, 2009; Hardre *et al.*, 2010; Van Gelder *et al.*, 2010). However, web-based questionnaires are not without their disadvantages. Follow up of undeliverable emails can be time-consuming and associated response rates risk being low. Methods to ensure sufficient response rates were employed and as such a response rate of 25% was achieved. A 'total survey design' strategy was employed to ensure that all aspects – the frame, the size, the design, the quality of the questions, the response rate and the mode and quality of the data collected – were considered at the design stage. The survey was piloted by both a sustainability consultancy

responsible for SBT-setting and a company which has adopted SBTs. The survey closed by explaining that it was stage one of a two stage process, alerting respondents to the possibility of further information gathering via interviews. The survey ran for two months from November 2017. Qualitative data relating to carbon emissions and quantitative data in relation to views on carbon offsetting, onsetting, insetting and the Science Based Targets initiative were collected. The use of closed questions ensured ease of use for respondents and less ambiguity about the response meanings. There were, however, free text options to allow respondents to answer accurately if the suggested responses did not suit their situation. Ordinal levels of measurement were also used to help ascertain the extent of challenges or opportunities that were afforded by offsetting/onsetting/insetting techniques.

### Qualitative research interviewing

A semi-structured qualitative research interview was conducted, allowing free discussion focusing on themes rather than exact questions. Stratified sampling was employed in order to get a wide range of company type and carbon management experience. Eight organisations were identified as candidates, providing a cross section in terms of organisational size, annual budget, number of employees and location of operations. Interviewees were sent a brief description of the research topic, whilst being mindful of the risk of inadvertently slanting their unconscious or conscious frame (Wengraf, 2001). Questions were kept brief and simple, with the interviewer probing, verifying answers and employing active listening so as to get meaningful responses. Interviews were then written up in summary form rather than verbatim and sent to respondents for comment and amendments. In order to undertake the interviews with sustainability consultants the approach was slightly amended, with participants being emailed findings and preliminary conclusions, the CMH amendments and model in advance of the interview. This ensured interviewees had time to digest the information and formulate their opinions. This can have the disadvantage, however, of providing a less natural process.

In terms of data analysis, different analytical methods were used dependent upon the methodology. To present this data, a side-by-side approach was adopted, starting with the quantitative data and then discussing the qualitative findings that either confirm or disprove the statistical results, whilst triangulating this with insights acquired from the literature review.

## Results

### Description, analysis and synthesis

The cohort of companies responding to the questionnaire included a small architectural practice, a large international telecoms company, a large food and clothing retailer, a national student residence provider, an accreditation and certification company, a large transport company, a small organic beverage company, and a large provider of products for the food and drink industry. The first five of these organisations were interviewed as part the second phase of the methodology. These empirical findings form a useful contribution towards establishing

the relative importance of the varying carbon management techniques available to corporations. With a 25% response rate, the survey responses have given a useful insight into the practices of the eight UK companies taking part. Caution must be exercised, however, in relation to their representativeness of the population as a whole.

### The opportunities and challenges in relation to offsetting

Figure 3 presents the high-level challenges associated with offsets identified by survey respondents, with priority 1 being the most problematic for an organisation. The table indicates that challenges around costs (three occurrences in priorities 1 and 2) and a lack of perceived benefit to stakeholders (two occurrences) are problematic for offsetting being more widely adopted.

In relation to the opportunities associated with offsets, for the three companies who were offsetting some of their scope 3 emissions, it can be seen in Figure 4 that the reputation and simplicity of offsets are strong motivators for their adoption. The positive reputation response is surprising, given the level of negativity offsets have received within academic and grey literature.

When interviewed, three of the five companies felt that offsetting should be discouraged, because it was a distraction from in-house energy efficiency efforts. One company representative saw it as fundamentally wrong to place the burden of their emissions on someone else whilst another cited the problematic nature of getting sign off for the additional cost of offsetting scope 3 emissions, which engendered no tangible return for the business. That said, there was recognition that where reductions at home are unavoidable e.g. business flights, there could be a place for offsets and that it is certainly better than doing nothing. Such negativity in relation to the role of offsetting is unsurprising given the extensive literature available related to ethical concerns.

That said, four of the six people interviewed recognised the wider social sustainability benefits which offsets can afford: giving a very tangible, visible, human dimension to carbon conversations and catalysing change in the developing world. This opinion was shared by a subsequent interview with the global director of a sustainability consultancy, referring to offsets as the 'loose change carbon emissions'; those emissions which don't really belong to anybody and which can enable wider sustainability benefits, such as habitat restoration. He advised that "such actions do not sit within a corporation's inventory; however, it is important that there is a way of allowing them to take place".

Other cited advantages of offsets were its relative affordability, its reliability, its immediacy, the fact that offsets are an easy message to relay and that they are fundamentally the right thing to do whilst on a zero-carbon trajectory. It was generally agreed that an offsetting-type mechanism is currently the only way that a company can achieve carbon neutrality and

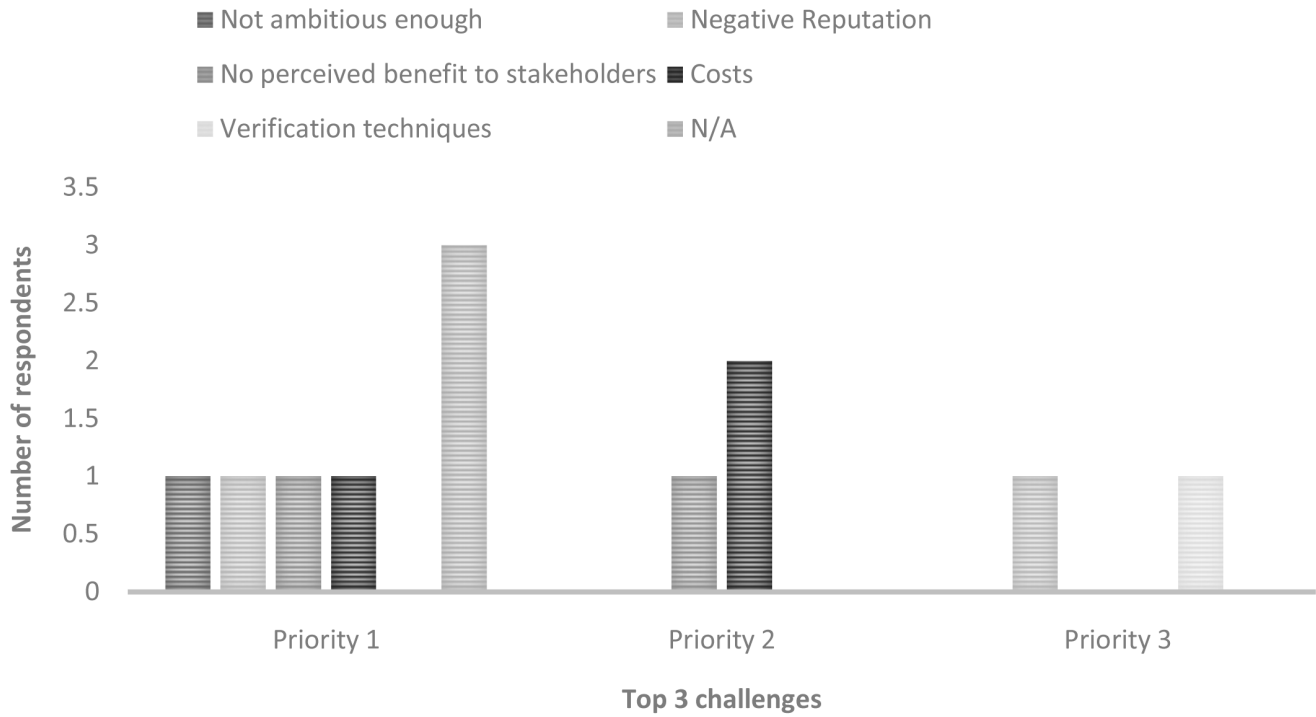


Figure 3. The top three challenges with adopting offsets for the research cohort.

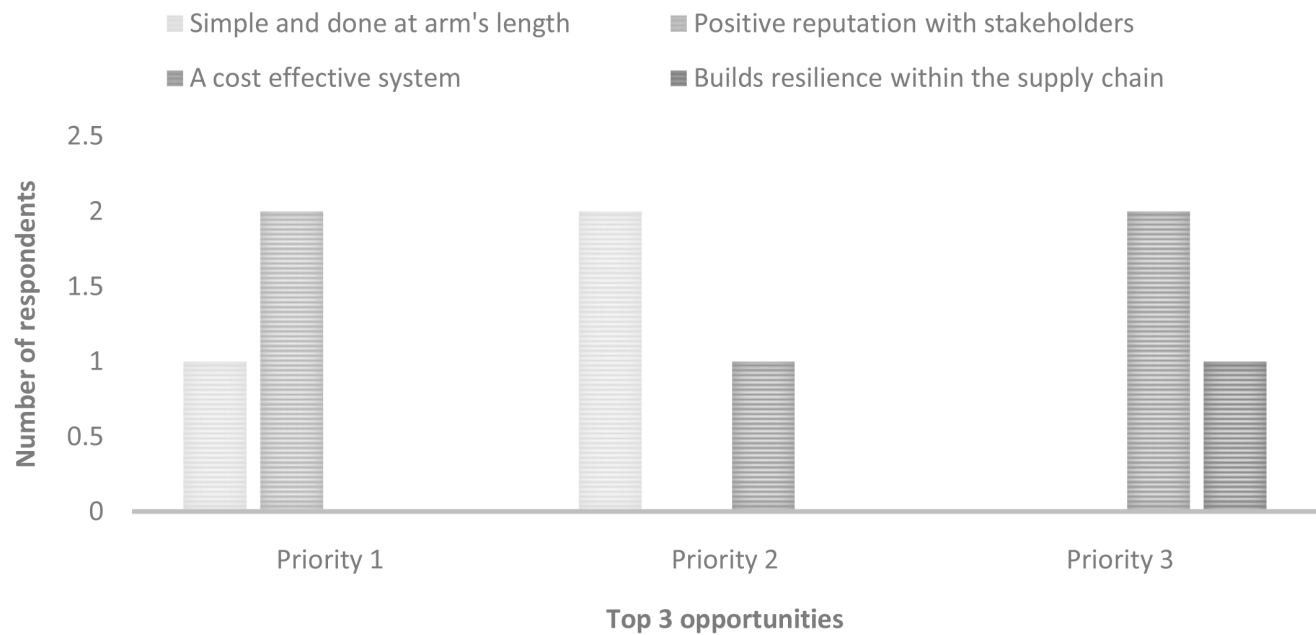


Figure 4. The top three opportunities identified by the research cohort.

so will remain a necessity until in-house emissions can be sufficiently reduced. Several cited these advantages under the proviso, however, that any purchased offsets were of an appropriate quality, with The Gold Standard being cited as the preferred certification body.

The practice of insetting (offsetting along the supply chain) was also discussed and drew mixed opinions. Representatives from a participant which carries out insetting activities stressed that this can be seen to have more business relevance than offsetting but warned that in practice, it can be challenging. There are limited insetting projects to choose from and any insetting will be an additional expense for the company. A climate specialist at a third sector environmental body stated that insetting is “just good offsetting for those wanting to market it as something distinct from offsetting, which has had a bad rap”. Risks around double-counting were also cited, as there is not currently a developed enough mechanism to monitor commodity flows within the supply chain.

The results presented in Figure 5 confirm the findings of Okereke’s (2007) study, that the perceived benefits to a company’s reputation remain a major driver for adoption of SBTs. Standardisation was also a significant motivator, and responses were fewest in relation to the fact that such targets galvanise action and aid verification. Of course, these classifications do overlap somewhat.

The predominant motivation for adopting SBTs appeared to be the need for credibility and standardisation. However, on

further discussion with those five companies interviewed, motivations differed slightly with the desire to pursue a sustainable carbon trajectory, to protect a company’s reputation and to be seen as a strong climate leader being cited.

Despite some challenges associated with taking action on SBTs, respondents were strong proponents for their adoption. SBT-setting was regarded as having a strong rationale, which was important in terms of credibility. SBTs stretching targets and associated impact were important to companies, aiding their future-proofing efforts. It was also felt that SBT-setting made both commercial and strategic sense, helping to link individual pieces of climate action in to one coherent package of measures. SBTs also allowed a means of comparison between different companies and helped companies see where they were able to make biggest impact.

Figure 6 presents the top three challenges respondents have experienced in relation to taking action on SBTs. Issues in relation to scope 3 measurements and reductions are the most cited challenges companies are experiencing. This is borne out in subsequent interviews with companies and adds weight to the need for an amended and updated CMH, which offers best practice guidance in relation to these emissions.

Other challenges around communication, equity and economics were also raised. These issues are discussed in turn below.

**SBT measurements, target setting and reductions.** Concerns over inconsistencies in the forms of measurement, particularly

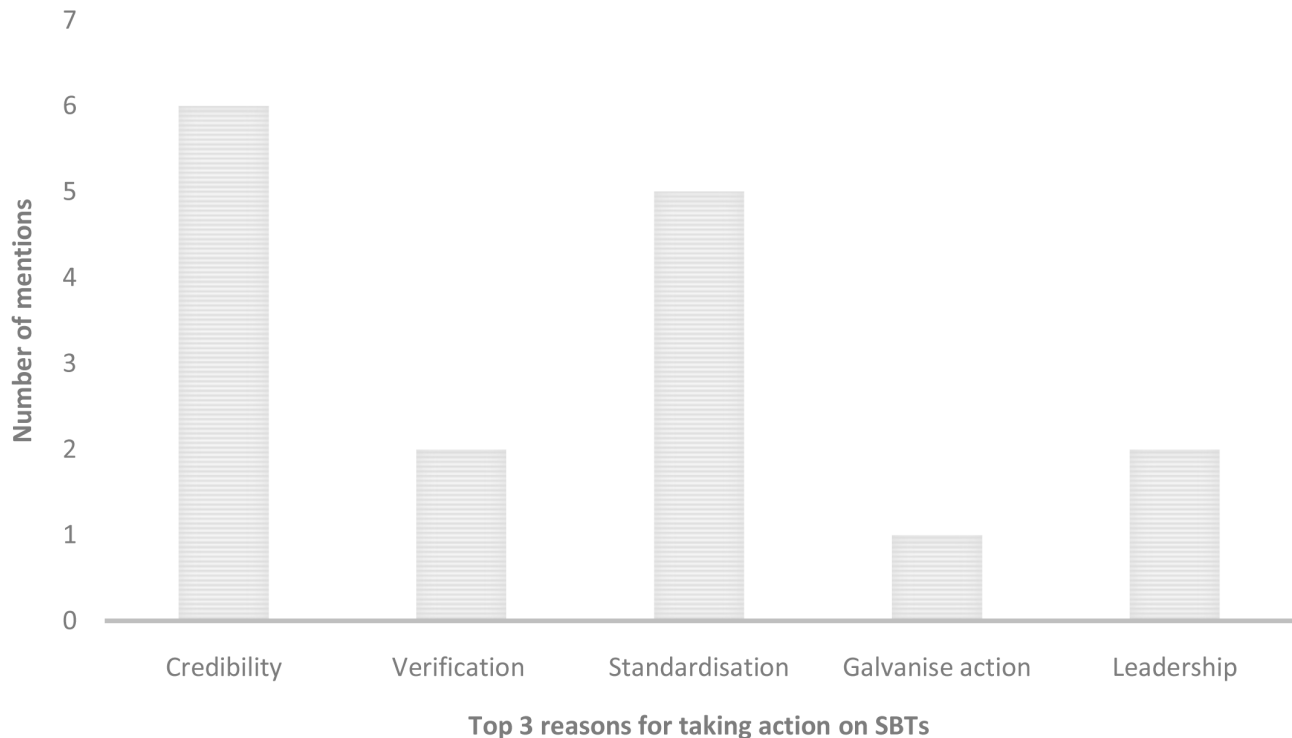
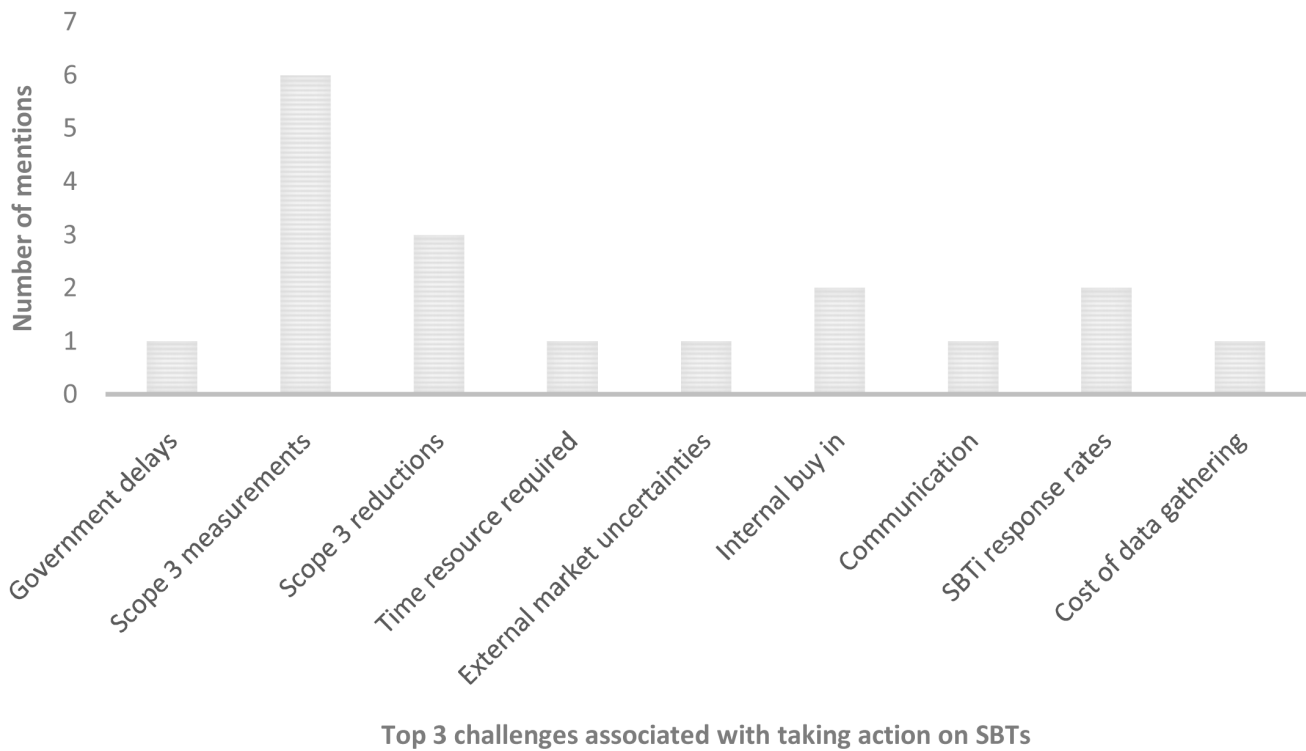


Figure 5. The top three reasons for the surveyed companies taking action on science-based targets (SBTs).





**Figure 6.** Survey respondent's top three implementation challenges.

of scope 3 emissions, were cited by several interviewees. They explained that scope 3 emissions calculations invariably necessitated modelled estimations, and this therefore cast doubt on the credibility of any data produced.

Similarly, measurement of achievements against scope 3 emissions reductions has proven problematic, with inconsistencies around what has been signed off by the SBTi and queries around who claims for certain reductions e.g. if two companies have the same supplier. The claiming of reductions is also in question for those along the supply chain; one company's own scope 3 emissions are necessarily another company's scope 1 or 2 emissions and with the introduction of Nationally Determined Contributions (NDCs), companies will want to make those reductions claims for their own country. The picture is further complicated by the limits to the influence that companies have on their scope 3 emissions, SMEs difficulties in comprehending SBT protocols without support from a sustainability team and challenges with communication outside of one's own team. Several companies cited some operational challenges around working collaboratively with the SBTi due to time delays on queries. In addition to communication issues with the SBTi, ensuring effective communication of the complex nature of SBTs to senior decision makers was also deemed challenging but was considered to be of strategic importance, since internal buy-in is necessary to move decisions forwards. The challenge associated with basing one's targets on a fair share when not all are adopting SBTs, and the

challenge associated with the need for all emitters to combine their efforts to meet ecological limits were also cited. All agreed that more needs to be done to ensure avoidance of the devastating climate impacts of a world beyond 2°C warming; whether that be through those taking action going beyond their 2°C targets (two companies stated that they would consider offsets to achieve this) or through the encouragement of a wider adoption of SBTs.

Others were more optimistic about SBTs however, with one interviewee suggesting that if larger companies have adopted SBTs, emissions reductions will be driven down through their extensive supply chains over time. Another interviewee hopes that those early adopters of SBTs will inspire others to act. Whilst others felt that the wider adoption of SBTs could be achieved through communication and government intervention.

Interviewees acknowledged that decisions are often driven by economics rather than by concerns around climate change, with the environmental benefit often being deemed a 'nice-to-have' secondary benefit. Generally speaking, companies do not at present factor in the very real costs associated with climate change, despite the SBT methodology's encouragement of long-term visioning. One interviewee stressed the need to balance the triple bottom line and not solely focus on the environment, warning that otherwise the company would go out of business. Another stressed the need for wider adoption of

sustainability actions, otherwise they would be at a competitive disadvantage.

### Revising the carbon management hierarchy

Following the engagement with the research cohort, a number of key insights emerged which have enabled a redefinition of the CMH (Figure 7). It continues to prioritise those actions which are most transformative and lasting in terms of reducing a company’s baseline emissions, however the key differences between the new model of CMH and the original are as follows. Instead of aiding a company in reaching carbon neutrality, it now assists a company in going ‘beyond neutral’, incorporating wider sustainability initiatives. A novel development is the proposal that a new scope, 4 (wider sustainability impacts), is introduced into the CMH. In addition, it is proposed that the accounting frameworks, SBTs and The Gold Standard, are formalised as part of the CMH. SBTs are the proposed frameworks for scope 1 and 2 emissions due to their alignment with global carbon reduction commitments, however further work is required to address inconsistencies in

the accounting methodology and risks around double-counting. Similarly, The Gold Standard is the proposed framework for scope 3 emissions due to its credibility and immediacy. Finally, the Sustainable Development Goals are the suggested framework for scope 4 emissions since these have more credibility and can be implemented with relative ease.

All companies that adopt SBTs need to take action to reduce their scope 1 and 2 emissions, the avoid/reduce/replace elements of the hierarchy below. Such actions will assist global efforts to keep warming below 2°C but may take some time to initiate. In the meantime, if a company is still emitting more emissions than it is reducing, further actions need to be taken via offsets in order to achieve carbon neutrality. Also, all companies need to take scope 4 wider sustainability actions, those wider sustainability actions that don’t necessarily relate to carbon.

A summary of the new conceptual CMH model and their associated justifications are presented in Table 1:

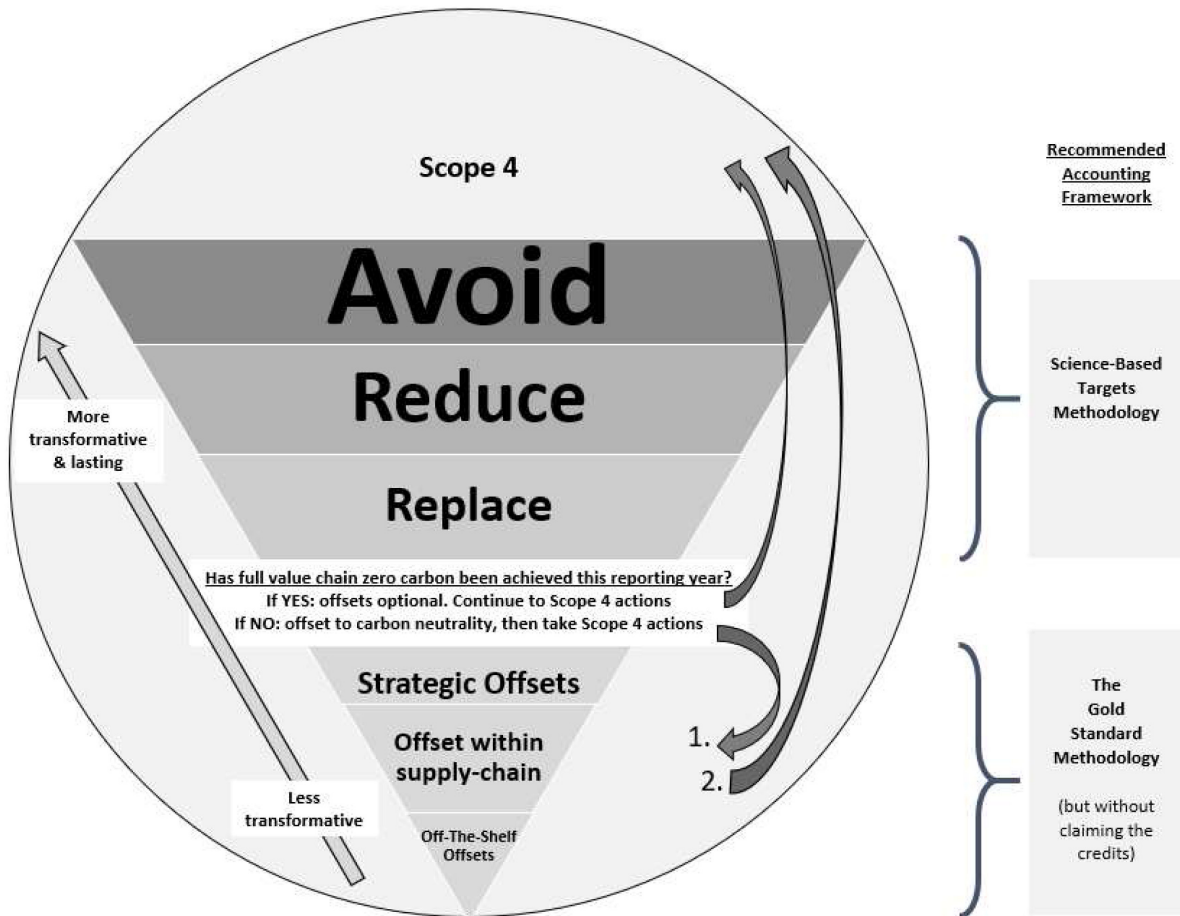


Figure 7. Amended carbon management hierarchy.

**Table 1. Justifications for amendments to the carbon management hierarchy.**

Amendments	Justification
To include science based targets (SBTs) as the recommended accounting framework for the first three tiers of the hierarchy	Companies are supportive of aligning with the 2°C global warming target. SBTs are very ambitious with long-term visioning
To require all companies to achieve at least carbon neutrality year on year (whether through SBTs or offsets) (Reframe re Intergovernmental Panel on Climate Change)	Standardisation and credibility are effective drivers for change Mitigates some ethical and credibility concerns associated with offsets Accelerates uptake of SBTs and overall global emissions
To prioritise strategic offsets e.g. national grid capacity building, over insets (offsetting within the supply chain)	Forecasts predict that without such action, society will miss the 2°C and 1.5°C target Companies are likely to accelerate their 'avoid/reduce/replace' activities if the alternative is to pay for offsets
To include offsetting within the supply chain into the CMH	Not all companies are adopting SBTs yet so those engaged need to be even more ambitious Has the greatest impact in overall decarbonisation It takes time to get to zero and offsets are useful due to their immediacy.
To have 'off-the-shelf' offsets as the final tier (i.e. all other offsets – not strategic, nor within the supply chain)	Its prioritising is useful as it builds resilience within the supply chain Has PR advantages
To add The Gold Standard as the preferred verification body for all offsets. The Gold Standard offsets through biogas, water filters, cook stoves, wind and forestry (Gold Standard, 2019)	Advantages around immediacy and relative simplicity Offsets serve as an incentive to the company to reduce its direct emissions
To avoid claiming credit for any of the offsets	Accepted as a credible verification body: voted Best Voluntary Standard 2017 Already established and so can be put into practice immediately.
To include a scope 4/wider sustainability actions circle encompassing the hierarchy but to not count these within the carbon accounting	Avoids risks around double-counting following the introduction of Nationally Determined Contributions (NDCs) Supports the idea of "filling the financial gap" following the Paris Agreement
To consider aligning these wider sustainability actions with the Sustainable Development Goals (SDGs)	Avoids double-counting Wider sustainability issues are addressed 'Loose change' emissions are tackled
To incorporate an annual deadline by which point a company needs to have achieved carbon neutrality or better (whether via SBTs or offsetting)	Helps with prioritisation Can aid PR activities e.g. if a food retailer, SDG 2 'zero hunger' or SDG 3 'good health and wellbeing' can be cited A company's growth or shrinkage is recognised and targets are adapted accordingly Ensures alignment with the most up to date climate change projections Gives an incentive for companies to invest in scope 1 and 2 reductions with sufficient rapidity

It has been found that offsetting could have a role alongside SBTs. Although there are challenges associated with offsetting, these can be overcome when combined with the adoption of SBTs. Similarly, offsetting can alleviate some of the challenges associated with SBTs thus creating a symbiotic, mutually beneficial relationship. The following recommendations merit further elaboration.

Offsets have received criticism as they shift attention away from personal accountability, with unscrupulous companies merely offsetting their emissions rather than addressing their own carbon reductions. With the introduction of SBTs addressing these direct emissions reductions however, such concerns are mitigated. Interviewees cited 'costs' as a challenge for offset and inset activities. Such challenges can be mitigated if companies take a long-term view of their carbon management strategies (as recommended within SBT methodology) and reinvest any financial savings from direct emissions reductions back into their sustainability strategy. As noted previously, due to the egalitarian approach of SBTs, the maths only works if all global companies are to take action and if such action happens contemporaneously. Currently, despite best efforts from those companies interviewed, the 2°C target will be missed partly as a consequence of only a small proportion of companies having acted on SBTs. With the introduction of offsetting to carbon neutrality, a company can ensure that at the very least they are not further exacerbating global GHG emissions levels. Meanwhile, there will be a strong motivator to act on direct emissions reductions as this would reduce the offset bill.

One limitation of the CMH model is that it could be open to misinterpretation and could mistakenly be viewed as sequential in nature. This is not the case and yet a pictorial representation highlighting where the biggest transformations can occur has proven problematic. A company could carry out offsetting activities, for example, alongside or even before the scope 1 and 2 reductions provided all such activities have been completed by the end of the reporting year. Further work to better reflect this model pictorially would mitigate misinterpretation.

***SBT and The Gold Standard Methodologies.*** Discussions are ongoing about the setting and reporting of SBTs and about the interplay between SBTs and offsetting, particularly in relation to risks around double-counting. Further work is required to ensure that SBT-setting methodologies work for all types of business and to ensure that wider sustainability outcomes are better represented within The Gold Standard methodology. There is also no recognition of historic emissions and lifetime emissions calculations within the methodologies despite the fact that CO<sub>2</sub> can remain in the atmosphere for hundreds of years. Such inconsistencies need to be clarified as soon as practicable to avoid risks to the credibility of these techniques.

## Conclusions

Following the literature review, eight candidates were identified. A structured engagement with that cohort enabled key

issues to be identified which in turn allowed a new model to be conceptualised for carbon management.

It can be concluded that there is merit in an adapted CMH that incorporates SBTs and varying forms of offsets. Such amendments lay out best practice carbon management which goes beyond carbon neutrality and contributes towards keeping the global temperature increase below 2°C. These conclusions were ratified by three key thought leaders in the sustainability professions.

That said, it is currently not enough for just 81 UK companies, or indeed 732 companies globally (as of Jan 2020), to be using SBTs to take action on climate change. Not only does there need to be wider adoption of SBTs and offsets, but also a polycentric approach to climate change at multiple scales and levels; households, companies, communities and governments, all actively participating. Corporate interventions are not the answer to the mitigation of climate change impacts but may form a part of the solution. Their action on climate change are prerequisites to a government's receptiveness to policy change and companies must take seriously their role in spurring government into more ambitious policy actions. Companies need to 'embrace a new era of business-unusual' and 'Stop doing just better and do enough. Enough to get well below a 2°C world' (Andrew Steer, President and CEO, World Resources Institute). The amended CMH proposed in this research will aid such a transition to a low-carbon economy.

## Data availability

Dryad: Exploring corporate engagement with carbon management techniques. <https://doi.org/10.5061/dryad.c2fqz6167> (Piper, 2021)

This project contains the following underlying data:

- Survey\_results\_for\_research\_into\_Exploring\_corporate\_engagement\_with\_carbon\_management\_techniques\_ANONYMISED.xlsx. Survey results for research into Exploring Corporate Engagement with Carbon Management Techniques

Data are available under the terms of the [Creative Commons Zero "No rights reserved" data waiver](#) (CC0 1.0 Public domain dedication).

Access to this dataset requires registration with an IEEE account, which is free.

The interview data cannot be anonymised to the extent that the identity of the interviewees and their employers is protected. Those wishing to apply for access to the data will be able to request to see the MSc dissertation of the lead author where further discussion of the interview methodology and the outcomes of the interview process is available. Reasonable requests for access will not be refused.

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# Open Peer Review

Current Peer Review Status: ? ?

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## Version 1

Reviewer Report 12 July 2021

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### Zoe P. Robinson

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This paper presents a mixed methods study exploring corporate engagement with SBT and offsetting principles leading to recommendations of a development of the Carbon Management Hierarchy.

The paper uses a robust mixed methods methodology, including the use of thought leaders to support and corroborate the new framework development. This provides a worthwhile contribution to reflection on emerging approaches to carbon management in the corporate sphere. However, in order to improve the impact and accessibility of the paper further recommendations are made below.

1. The shading of the bar graphs needs changing to make these more easily distinguishable.
2. The structuring of the paper needs some more consideration. It seems odd to jump straight into offsetting in the results, a more logical starting point would seem the broader engagement with SBT. Consideration of the SBTs section of the paper still sits under the heading of offsetting.
3. The relationship between scope 3 and SBT, offsetting and the gold standard needs further clarification. The implication seems to be that carbon neutrality can be reached in scope 1 and 2 hence why offsetting focuses on scope 3 – this needs clarification.
4. The methods section uses language of onsetting and insetting. Onsetting is not used again and is not explained, and the description of insetting is not explained clearly 'offsetting during the supply chain' needs further explanation, and is not the only way that the term insetting is used. Therefore more clarification of these terms is needed in the introduction. Examples would help.
5. Benefits of standardization are highlighted a couple of times, but what this means needs unpacking. Is this internal standardization or standardization across corporations? What is the benefit of standardization (particularly if there are flaws in the standard).

6. These isn't an acknowledgement that carbon reduction activities and commitments are taking place in corporations outside of the SBT initiative. There is a danger that signing up to SBT is seen as the only way to address carbon emissions in an organization.
7. 'Beyond carbon neutral' is taken here to mean inclusion of other sustainability benefits, but discussion and desirability of carbon negative is also needed here, particularly in line with the argument that not all organisations are involved in SBT. This is important as a key criticism of SBT seems to be the idea of 'fair share' as setting that as a target, when we know not everybody is doing the same, ties us into failure.
8. Further expansion of the different sorts of offsets recommended in the new model is needed, particularly around strategic offsets. And how strategic off sets and off the shelf offsets differ. Does the Gold Standard only relate to off the shelf offsets – could or should it be extended to what are seen as strategic offsets?
9. It is good to see issues such as the danger of viewing the hierarchy as sequential being considered, and therefore the recommendation of carbon neutrality being reviewed on an annual basis. The need to offset early could be highlighted more, as could discussion of building in greenhouse gas removal as part of the CMH beyond any need to account for those emissions – and as just a part of standard carbon management practice.

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes

**Is the study design appropriate and is the work technically sound?**

Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**

Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**

Not applicable

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Yes

**Is the argument information presented in such a way that it can be understood by a non-academic audience?**

No

**Does the piece present solutions to actual real world challenges?**

Yes

**Is real-world evidence provided to support any conclusions made?**

Yes

**Could any solutions being offered be effectively implemented in practice?**

Yes

**Competing Interests:** No competing interests were disclosed.**Reviewer Expertise:** Sustainability and organisational change; sustainability and education systems**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

Reviewer Report 10 June 2021

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1. Page 3, *Current Implementation of Carbon Management hierarchy*, the author should describe more about the scope 2 and scope 3 emissions, as both are indirect emissions generating from different sources. On what basis the emissions have been divided in these two categories.
2. Page 5, *Online survey*, the author should mention on how the survey questions was designed, what was the purpose of survey – to evaluate organizations on how they are reducing carbon or the type of strategies they have adopted for carbon reduction or both?
3. Page 5, *Online survey*, the author should also mention if total survey error was calculated or not? If not, why?
4. Page 6, *Results*, the cohort of companies mentioned by the author shows are all different, how the responses given by different type of companies which will be having different levels of Scope 1/scope 2/scope 3 emissions, how the author normalized the responses?
5. Page 7, *Figure 3 and Figure 4*, the legends are similar and difficult to understand.



6. Page 10, *Revising the carbon management hierarchy*, the author has added a new scope – 4 (wider sustainability impacts), the rationale behind adding this new scope is not clear. How the actions for mitigating scope 4 emissions will help in achieving carbon neutrality?
7. Page 11, *Figure 7*, The author has indicated which actions are less transformative and which are more transformative & lasting; it appears to be pre-mediated as the author has not discussed much about the weightage of the actions for emission reduction. The survey and interviews suggest that that the biggest problem with scope 3 emissions is measurement and reduction, if the measurement is problematic then offsetting associated with these emissions will also be complicated, then how can it be interpreted that these emissions are less transformative?

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes

**Is the study design appropriate and is the work technically sound?**

Partly

**Are sufficient details of methods and analysis provided to allow replication by others?**

Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**

Yes

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Yes

**Is the argument information presented in such a way that it can be understood by a non-academic audience?**

Yes

**Does the piece present solutions to actual real world challenges?**

Yes

**Is real-world evidence provided to support any conclusions made?**

Not applicable

**Could any solutions being offered be effectively implemented in practice?**

Not applicable

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Urban Air Quality, Vehicular Pollution, Indoor Air Quality

**We confirm that we have read this submission and believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however we have significant reservations, as outlined above.**

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