Framing sustainable development challenges

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Framing sustainable development challenges: Accounting for SDG-15 in the UK

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Framing sustainable development challenges: Accounting for SDG-15 in the UK

Abstract

Purpose: This research seeks to explain how a national government becomes capable of constructing an account of its biodiversity performance that is aimed at enabling formulation of policy in pursuit of SDG-15: *Life on Land*.

Design/methodology/approach: The research examines a case study of the construction of the UK government's annual biodiversity report. The case is analysed to explain the process of framing a space in which the SDG-15 challenge of halting biodiversity loss is rendered calculable, such that the government can see and understand its own performance in relation to this challenge.

Findings: The construction of UK government's annual biodiversity report relies upon data collected through non-governmental conservation efforts, statistical expertise of a small project group within the government, and a governmental structure that drives ongoing evolution of the indicators as actors strive to make these useful for policy formulation.

Originality/value: The analysis problematises the SDG approach to accounting for sustainable development, whereby performance indicators have been centrally agreed and universally imposed upon all signatory governments. The analysis suggests that capacity-building efforts for national governments may need to be broader than envisaged by the *2030 Agenda for Sustainable Development*.

> *We've got this classic history of people going out and recording nature, so we've got a huge amount of data. We've also got a huge amount of civil infrastructure that sort of sits around it. It's something that's evolved. It's not something that you could necessarily design* (Interviewee 1, Biodiversity Indicators Forum).

1. Introduction

Research in accounting for sustainable development seeks to explain the role that accounting can play in addressing the pressing social and ecological challenges facing humanity (Bebbington & Larrinaga, 2014). This research agenda rests upon a basic understanding that accounting frames calculable spaces, which enable new possibilities for thought and action (cf. Miller & Power, 2013). Thus accounting can be deployed to create conditions in which people see and understand the world in ways that make it possible to address sustainable development challenges (Cuckston, 2018c). Sustainable Development Goal 15 (hereafter, SDG-15), *Life on Land*[1], identifies biodiversity loss as a fundamental sustainable developmental challenge. SDG-15 specifies this challenge as being:

> To sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss (UN, 2016, p. 1).

Extant accounting for biodiversity literature has sought to explain how different organisations have achieved various forms of calculability for performance in relation to biodiversity (Cuckston, 2018b). In line with the dominant approach in social and environmental accounting research, much of this work focusses on corporate reporting on biodiversity (Adler, Mansi, & Pandey, 2018; Adler, Mansi, Pandey, & Stringer, 2017; Atkins, Grabsch, & Jones, 2014; Atkins, Maroun, Atkins, & Barone, 2018; Boiral, 2016; Maroun & Atkins, 2018; Rimmel & Jonall, 2013; van Liempd & Busch, 2013). However, the signatories to the *2030 Agenda for Sustainable Development*, which incorporates the SDGs, are the 193 member states of the United Nations (UN, 2018a). Whilst corporations are being encouraged to engage with the SDGs (UN, 2018c), it is acknowledged within the 2030 Agenda that 'primary responsibility' (UN, 2015, p. 10) for addressing the challenges of sustainable development lies with national governments.

> [C]ountries are expected to take ownership and establish a national framework for achieving the 17 Goals. Implementation and success will rely on countries' own sustainable development policies, plans and programmes (UN, 2018a).

[1] Planetary biodiversity loss is covered in two SDGs. SDG-14, *Life below Water*, focuses on the biodiversity of the world's oceans and is primarily concerned with achieving sustainable fisheries. SDG-15, *Life on Land*, is concerned with terrestrial biodiversity.

Accordingly, if accounting research is to contribute to achievement of the SDGs (cf. Bebbington & Unerman, 2018), then it is crucial to understand how national governments seek to account for their performance in addressing sustainable development challenges. The aim of this paper is to explain how a national government becomes capable of constructing an account of its biodiversity performance that is aimed at informing policy decision-making on biodiversity. It is well-established in the policy and public administration literature that governments tend to be characterised by a separation between politicians, who make decisions on the policies that a government will adopt and pursue, and the civil servants/bureaucrats who do the technical work to inform such policy decision-making and to implement the resulting policies (Losada & Esteve, 2018; May & Winter, 2007). Accordingly, the focus of analysis within this paper is on the technical work of government bureaucrats, rather than the policy decision-making of politicians. As such, throughout this paper the term "national government" is used to refer to this government bureaucracy (cf. Gron, Bro, & Andersen, 2019; Wimmelmann, Vallgarda, & Jensen, 2018). This focus has enabled the in-depth analysis of processes involved in seeking to construct policy-relevant accounts of biodiversity performance. An understanding of how national governments are able to account for their sustainable development performance – such as, in this case, their performance in addressing biodiversity loss – may potentially generate insights that can be deployed in other organisational contexts, such as in corporations. Thus, this paper seeks to open up an opportunity to rejuvenate organisation-centred research into accounting for biodiversity, such that this stream of research can become a potent force for biodiversity conservation (Cuckston, 2018b; Feger et al., 2018).

The SDG Indicator Framework seeks to render calculable and comparable each country's performance, against each goal. The Framework explicitly specifies how national performance on sustainable development is to be measured. These measurements are promoted within the 2030 Agenda as being 'key to decision making' (UN, 2015, p. 12).

> A robust follow-up and review mechanism for the implementation of the 2030 Agenda for Sustainable Development requires a solid framework of indicators and statistical data to monitor progress, inform policy and ensure accountability of all stakeholders (UN, 2018b).

SDG-15 specifies 14 indicators, which all signatory governments are expected to report to (see table of SDG-15 indicators in appendix 1). To facilitate this, the 2030 Agenda specifies the need for capacity building to 'address gaps in national statistics and statistical coordination […] so as to better enable the use of country-generated statistics in the calculation of global SDG indicators' (UN, 2017, p. 8). This raises the question as to whether these statistical efforts to 'strengthen the national statistical systems' (UN, 2017, p. 8), in order to comprehensively report on the agreed SDG

indicators, will be sufficient to render calculable the sustainable development challenges facing national governments in a way that enables new possibilities for biodiversity-related thought and action. This paper problematises the UN SDG global standardised approach to accounting for sustainable development, particularly in respect of the SDG-15 indicators on biodiversity performance. The paper will argue that the work of framing a calculable space, which enables the formulation of policies in pursuit of SDG-15, requires much more than the ability to report on the prescribed SDG indicators. In order to advance this argument, this paper studies how the UK Government seeks to achieve calculability for its national biodiversity performance. The UK has a long history of recording and reporting on nature (cf. Atkins & Thomson, 2014; Thomson, 2014) and identifies itself as a global leader in biodiversity reporting (HM Government, 2018), making it a useful case study for this purpose. Based on extensive analysis of documents and interviews with 19 key individuals involved in the construction of the UK Government's national biodiversity indicators, this study will show how the ongoing process of framing a calculable space for biodiversity performance at the national level is driven by heterogeneous actors striving to better comprehend the evolving set of challenges they are tasked with helping to resolve. This analysis has important implications for understanding the kinds of calculative capacities and infrastructures that national governments – and perhaps other kinds of organisations, such as corporations – will need to build if they are to account for sustainable development in ways that enable pursuit of the SDGs.

The remainder of this paper is structured as follows: the next section will establish Callon's (1998) concept of framing a calculable space as a powerful way of analysing accounting for sustainable development; section 3 will review the literature on accounting for biodiversity to reveal how extant research has studied various organisations' efforts to achieve calculability for biodiversity performance; section 4 will set out the methods of data collection and analysis deployed in this research project, section 5 will describe the findings of this research, explaining how the UK Government achieves calculability for national biodiversity performance; section 6 will discuss these findings and the implications for policy and research on sustainable development; section 7 will conclude the paper.

2. Calculability

> Calculation and agency are two sides of the same coin. The agent-network is by construction calculative, but calculativeness could not exist without calculating tools, most notably the lowly and often disclaimed tools of accounting (Miller & O'Leary, 2007, p. 710).

A basic tenet of research into accounting as a social practice – including research into accounting for sustainable development – is that accounting actively constructs and transforms the reality it purports to represent (Hines, 1988; Miller & Power, 2013). Thus, the hope that lies behind accounting for sustainable development research is that accounting can be used to make sustainable development challenges visible to organisations in ways that enable forms of thought and action conducive to addressing these challenges (Unerman & Chapman, 2014).

A powerful way of analysing the capacity of accounting to construct and transform reality is offered by Michel Callon's (1998) concept of framing a calculable space. Underpinning this concept is the idea that calculation involves complex socio-technical arrangements of human beings and material devices, including calculating tools. To make sense of this, Callon makes use of Goffman's (1974) metaphor of framing, whereby a socio-technical arrangement is understood to frame a space in which certain forms of calculation become possible. Within such a frame, some things are brought in and some things are excluded, such that actors can see and comprehend the world in ways that enable them to judge possible courses of action and the potential consequences of these actions. In this way, the capability to act (MacKenzie, 2009) of any socio-technical arrangement depends upon how it frames a calculable space. This means that an actor's calculative capabilities depend upon their access to, and embeddedness within, such socio-technical arrangements.

The concept of framing a calculable space has been influential within the accounting literature, particularly as a way to explain how accounting is used to simultaneously define and measure organisational performance (Miller & Power, 2013). In this sense, the ability to set organisational objectives, goals, or targets, the ability to know what the organisation is seeking to achieve, is intimately tied up with the socio-technical arrangements used to measure performance (Miller, 2001). Consequently, rather than first laying down policies and then seeking to measure performance, the ability to formulate policies and make decisions is deeply entwined with the building of performance measurement infrastructure (Georg & Justesen, 2017; Jollands & Quinn, 2017; Kornberger & Carter, 2010; Power, 2015; Skaerbaek & Tryggestad, 2010).

The capability of a national government to address a sustainable development challenge, like biodiversity loss, thus depends upon how it is able to frame a space in which this challenge becomes

calculable, such that the government can see and comprehend possible courses of action. Governments make extensive use of quantitative performance indicators to frame the task of governing (Miller, 1990). This includes rendering the challenges of sustainable development calculable in ways that enable the formulation of strategies and policies to address these challenges (Russell & Thomson, 2009). In rendering a sustainable development challenge calculable, a national government is identifying an objective for governing and defining how its own performance in relation to this objective is to be understood and measured. Thus, rendering calculable the challenge of halting biodiversity loss means framing a space in which the government's performance in relation to this challenge can be defined, measured and transformed. How each SDG challenge is framed will, therefore, have a significant impact on a government's capability to address it.

Extant accounting literature provides little insight into how national sustainable development indicators, so central to the pursuit of sustainable development, are actually constructed (see Thomson, 2014). The work of framing a calculable space is further articulated by Callon and Law (2005), who define the achievement of calculation, within a framed space, in terms of three stages:

> **First, the relevant entities are sorted out, detached, and displayed within a single space.** Note that the space may come in a wide variety of forms or shapes: a sheet of paper, a spreadsheet, a supermarket shelf, or a court of law – all of these and many more are possibilities. **Second, those entities are manipulated and transformed.** Relations are created between them, again in a range of forms and shapes: movements up and down lines; from one place to another; scrolling; pushing a trolley; summing up the evidence. **And, third, a result is extracted.** A new entity is produced. A ranking, a sum, a decision. A judgement. A calculation (Callon & Law, 2005, p. 719, emphasis added).

The framing of a calculable space, therefore, requires consideration of each of these three stages. If a national government seeks to pursue a sustainable development challenge, like biodiversity loss, then three questions, corresponding to these three stages, will need to be addressed. Firstly, what entities are to be brought within the framed space? For the challenge specified in SDG-15, of halting biodiversity loss, this means deciding what kinds of biodiversity data are going to be included. Secondly, how are these entities going to be manipulated and transformed within the space? For SDG-15, this means deciding how this data will be combined and turned into useful measurements of performance in relation to addressing biodiversity loss. Thirdly, what kind of result will be extracted; what new entity will be produced? For SDG-15, this means deciding how these measurements of biodiversity performance will be reported. By exploring actors understanding of detachment, transformation and extraction this paper offers insights into how a national

government has framed and is framing a space in which its performance in relation to biodiversity is rendered calculable, enabling the formulation of its sustainable development policies.

Callon and Law's (2005) three stages of calculation offers a useful structure for this paper's analysis of how the UK Government has sought to achieve calculability for its biodiversity performance. The analytical aim is to explain how the framing work of the UK Government addresses each of the three questions posed by Callon and Law's (2005) three stages of calculation. The next section will briefly review how the extant accounting for biodiversity literature has explained organisational efforts to achieve calculability for biodiversity performance.

3. Accounting for biodiversity

The accounting for biodiversity literature is concerned with explaining how different organisations have achieved various forms of calculability for biodiversity performance (Cuckston, 2018b). Within this literature, the most prominent form of calculability for biodiversity is achieved by framing biodiversity as being a provider of economically valuable services (cf. TEEB, 2010). This enables organisations to see and comprehend biodiversity as a kind of "natural asset" or so-called "natural capital" (Barter, 2015). This framing has been heavily promoted within the accounting profession as a way to encourage organisations to recognise their responsibilities for stewardship of nature and biodiversity (ACCA, Flora and Fauna International, & KPMG, 2012; ICAEW, 2018). This form of calculability for biodiversity is, therefore, meant to encourage organisations to perceive their own self-interest in conserving biodiversity, thus incentivising responsible use of natural resources (Jones, 1996, 2003; Rimmel & Jonall, 2013; van Liempd & Busch, 2013). Studies of local government bodies in the UK and New Zealand have also found this to be the dominant framing (Gaia & Jones, 2017; Schneider, Samkin, & Davey, 2014; Weir, 2018), driven by the contemporary prevalence of cost-benefit calculations in local government decision-making, thus necessitating a financialised accounting for biodiversity (cf. Hrasky & Jones, 2016).

Similarly, biodiversity offsetting mechanisms have been found to frame biodiversity in terms of numerical scores, based on easily measurable attributes of sites (Boiral, 2016; Cuckston, 2019; Ferreira, 2017; Sullivan & Hannis, 2017; Tregidga, 2013). This framing enables the commensuration, financialisation and marketisation of biodiversity values, whereby supposed biodiversity gains from conservation work on one site can be traded to compensate for biodiversity losses caused by development on another site. This is meant to facilitate an overall "no net loss" of biodiversity, thus providing an economically efficient means of appearing to achieve ecologically sustainable

development (Spash, 2015). Along similar lines, calculations of commensurable carbon offsets generated from forest conservation work, which frames biologically diverse habitats as simple stores of carbon, facilitates financialisation and marketisation as forests take on a financial value determined by supply and demand in carbon trading markets (Cuckston, 2013, 2018a).

In stark contrast to these *anthropocentric* framings that seek to represent biodiversity in financial terms, many accounting scholars have sought to frame biodiversity in accordance with more *ecocentric* principles (Christian, 2014; Hines, 1991; Maunders & Burritt, 1991). Framing biodiversity – i.e. Nature – in financial terms, it is argued, enables the justification of destructive activities. Conversely, seeing and understanding nature as being intrinsically valuable and fundamentally priceless enables a more spiritual connection with nature, which encourages people to seek to live their lives, and possibly to manage their organisations, in ways that are more in harmony with nature (Gallhofer, 2018; Russell, Milne, & Dey, 2017).

Whilst the tension between anthropocentric and ecocentric framings of biodiversity is important in terms of how humanity comes to think about its place on the Earth and its relations with other species (Gray & Milne, 2018), it is not clear how useful either form of calculability is for undertaking or managing biodiversity conservation or restoration work (Cuckston, 2018b). If the objective of accounting for biodiversity research is to contribute to addressing the challenge of biodiversity loss (cf. Bebbington & Larrinaga, 2014), then it needs to begin by seeking out the work of conservation and then looking to explain how (or whether) efforts to render biodiversity calculable have made this work possible (Cuckston, 2018c; Feger et al., 2018). Some studies have sought to do this by examining how conservationists use accounting techniques to frame biodiversity in ways that enable them to restore and/or protect particular ecological systems (Cuckston, 2017; Dey & Russell, 2014; Feger & Mermet, 2017). As discussed earlier, the SDGs place primary responsibility for addressing sustainable development challenges with national governments. Therefore, if biodiversity loss is to be halted by 2030, it is essential to understand how national governments can achieve a calculability for biodiversity loss that enables the formulation of policies to facilitate effective biodiversity work. Hence, the present study will contribute to the extant accounting for biodiversity literature by explaining how a national government – the UK – undertakes the work of framing a space in which the challenge of biodiversity loss is rendered calculable, enabling work in pursuit of SDG-15.

This has implications for accounting for biodiversity in other organisational contexts, such as in corporations. If corporations, and other kinds of organisations, are to contribute to halting biodiversity loss and achieving SDG-15, then they will need to design and implement means of

rendering calculable their biodiversity performance in ways that enable them to formulate organisational policies aimed at improving this performance. By studying the case of the UK Government's pursuit of calculability for its biodiversity performance, this research offers potential insights into how organisation-level accounting for biodiversity might be developed that is effective in enabling organisations to contribute to SDG-15. The next section will set out the methods of data collection and analysis used in this study.

4. Methods

Given the aim of the study is to inform the development of impactful SDG accounting through understanding how the UK Government achieves calculability for its biodiversity performance – an explanatory case study was considered to be an appropriate research design (Scapens, 2004). This research method allowed for an in-depth examination of the work of constructing this governmental accounting for its biodiversity policies and work.

The UK was chosen due to the following reasons. Firstly, the UK describes itself as a country "with a record of global environmental leadership" (HM Government, 2018, p. 19) and a country that "has shown leadership […] needed to address biodiversity loss" (JNCC & DEFRA, 2012, p. 4) and a long history of recording and reporting environmental indicators, including on biodiversity (Atkins & Thomson, 2014; Thomson, 2014). In addition, the UK has a highly developed infrastructure of environmental data collection that incorporates volunteers active in conservation work and citizen science (UKEOF, 2016).

The research project adopted a flexible data collection design, which allowed methods and themes to co-develop as the case study evolved. Actors were followed through interviews, document analysis and observations in order to allow triangulation amongst the different data sources. The research commenced with document analysis to establish how the UK biodiversity indicators developed over time. The document analysis involved a close reading of policy reports, biodiversity strategies, SDG and Aichi indicator sets and national and international biodiversity reports between 2005 and 2018. This document analysis then informed the interview themes and facilitated identification of the first interviewees. Themes emerging from the documents were followed up with semi-structured interviews with various actors involved in national biodiversity accounting practice. The themes explored within the interviewees included the use of biodiversity accounting tools, the UK Biodiversity Indicators, historical developments within the UK accounting for biodiversity approach, the benefits and challenges of accounting for national biodiversity, the effect

of the SDGs on the UK's national accounting for biodiversity, and the influence of national and international organisations on the UK accounting for biodiversity practices. Broadly, the aim of the interviews was to explore the framing work being done to render calculable the UK's biodiversity performance.

Overall, 19 semi-structured interviews with various biodiversity accounting actors in the UK were conducted between February 2018 and August 2018. A list of interviewees is provided in appendix 2[2]. All interviews were recorded and afterwards transcribed and notes were taken during, as well as after, the interview. Interviews took between 30 minutes and 2.5 hours. Interviews were either conducted face-to-face (8 interviews), or remotely using Skype or telephone (11 interviews).

A purposeful sampling method (Patton, 1990) was used to select interviewees based on their involvement in various groups, committees and panels in the national biodiversity accounting process. All interviewees are either still involved in the UK biodiversity accounting process or had been part of setting up or reviewing of the indicators in recent years. The primary data collection process started by interviewing two members of the biodiversity indicators *Project Group,* identified during the document analysis stage. These interviewees were particularly helpful in identifying further participants for the research. All subsequent interviewees were asked to recommend others, who were then followed up via email. In addition, interviewees were identified and contacted in person during observations or participation in policy meetings, workshops and conferences.

To allow the comparison between different official opinions and to ensure a balance in views and insights, a variety of organisations, professional backgrounds, and job roles have been included in this research. Overall, interviews have been conducted with individuals from 12 different organisations, including devolved governments[3], environmental agencies, research centres, and NGOs. Interviewees came from a broad range of backgrounds and held various positions within the organisations, including statisticians, biologists, a policy advisor, a strategy advisor, and a biodiversity evidence manager. Regrettably, whilst numerous policy representatives were approached for interview, all but one declined the invitation to take part in this study.

This study recognises the separation between the technical work done by the bureaucrats/civil servants and the policy decision-making done by politicians (Losada & Esteve, 2018; May & Winter,

[2] In order to help maintain the confidentiality of interviewees, the order that interviewees are listed in Appendix 2 does not correspond to the numerals assigned to interviewees in the Findings section.
[3] The United Kingdom of Great Britain and Northern Ireland (UK) consists of four countries: England, Scotland, Wales and Northern Ireland. Scotland and Wales have their own governments with certain devolved powers.

2007) in the interview sampling. Whilst the absence of direct interviews with politicians is a limitation of this particular study, it is consistent with the empirical focus of extant policy and public administration literature on the technical work done by governments (cf. Gron, Bro, & Andersen, 2019; Wimmelmann, Vallgarda, & Jensen, 2018).

In order to help understand the link between the indicators and policy, a wide range of publicly available UK biodiversity policy documents were analysed. Additionally, all published UK *Biodiversity Indicators Forum* meeting reports as well as all presentations given at the UK *Biodiversity Indicators Forum* were analysed. These included presentations given by the Head of the UK Biodiversity Policy Unit at DEFRA, the Head of Biodiversity Evidence at DEFRA as well as policy representatives from the devolved administrations. Besides the document analysis, the lead researcher also attended meetings of the *Scottish Biodiversity Strategy Science Support Group – Indicators Subgroup* and *BES/UK Conservation Agencies Symposium: Securing Our Natural Environment for Future Generations*[4] in order to observe current policy discussions and issues around the UK Biodiversity Indicators. This document analysis provided vital context concerning the link between the biodiversity indicators and biodiversity policy.

The flexible research approach taken within this study led to an iterative strategy of data collection and analysis and interpretation of the data. The interview data was organised and analysed using the thematical data analysis process outlined by Braun and Clarke (2006). After the interviews were transcribed, NViVo was used in order to establish initial codes, which were then collated into themes. At that time, first thoughts about the relationship between themes and codes were made and overarching themes were identified. These themes were then reviewed and revised in order to achieve cohesiveness. In an iterative process of going back and forth between the coded interview data and Callon's work on calculability, the three stages of calculation, elaborated by Callon and Law (2005), emerged as a useful organising structure for making sense of the coded data. The themes derived from the data analysis were arranged in terms of their significance for detachment, manipulation and extraction, as shown in Appendix 3. From this structure, coherent narratives concerning each of these stages of calculating the UK biodiversity indicators were synthesised to tell the story of the findings from this analysis. The next section presents these findings.

[4] This was a two-day conference with the aim of "bringing together policy officials, practitioners, natural and social scientists from across the UK and internationally to set the direction for nature conservation in the UK". See https://www.britishecologicalsociety.org/events/n4fg/ for details.

5. Findings

The UK Government has produced a report of biodiversity indicators, called *Biodiversity in your Pocket*, every year since 2007. This annual report of UK biodiversity performance provides an account of ongoing progress towards meeting the UK's commitments under international biodiversity goals and targets (DEFRA, 2019). The 2018 report contains 24 indicators. A list of indicators included within the 2018 set can be found in appendix 4. Documents show that policy officials from DEFRA and the devolved administrations involved in the development of the biodiversity indicators were clear that these should form an evidence base for UK Government biodiversity policy formulation, performance measurement and decision making.

> "Defra representatives confirmed that previous reports had perhaps been less useful for national application, but that the intention […] was that national and international reporting mechanisms would be aligned and that there was a clear intention to use the reports to inform UK policy." [Biodiversity Indicators Forum Meeting Report, 2006]

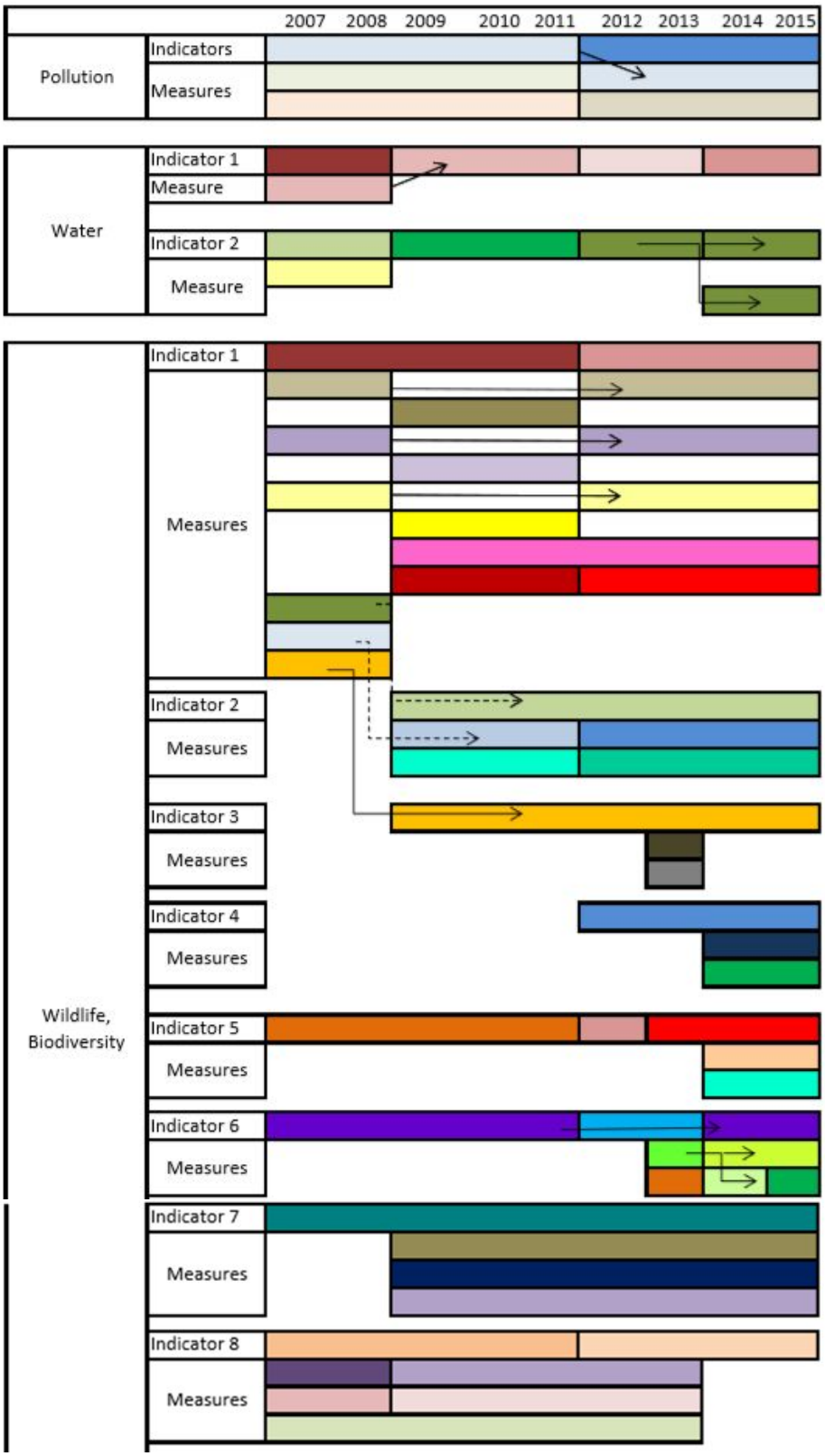
Interviewees have described the development of this indicator set as an ongoing work in progress.

> "The UK biodiversity indicators now, I think, are very impressive in terms of the way they can be updated. […] It's a huge improvement over what we had in the past. I think it's a continuing process. They're not as good as we would wish but they are very much better than anything we've had to date." (Interviewee 2, Environmental Agency)

Evidence of this ongoing process can be observed in the annual changes in the reported UK biodiversity indicators between 2007 and 2015 (see Fig. 1, constructed from analysis of the UK *Biodiversity in your Pocket* reports). In this period new indicators were introduced, changes in level of analysis, indicators removed, measures becoming labelled as indicators, and indicators becoming labelled as measures.

Biodiversity Indicators in your Pocket*

(* Color change indicates change in indicator; change within one color famliy indicates smaller change, the introduction of a new color family indicates bigger changes)



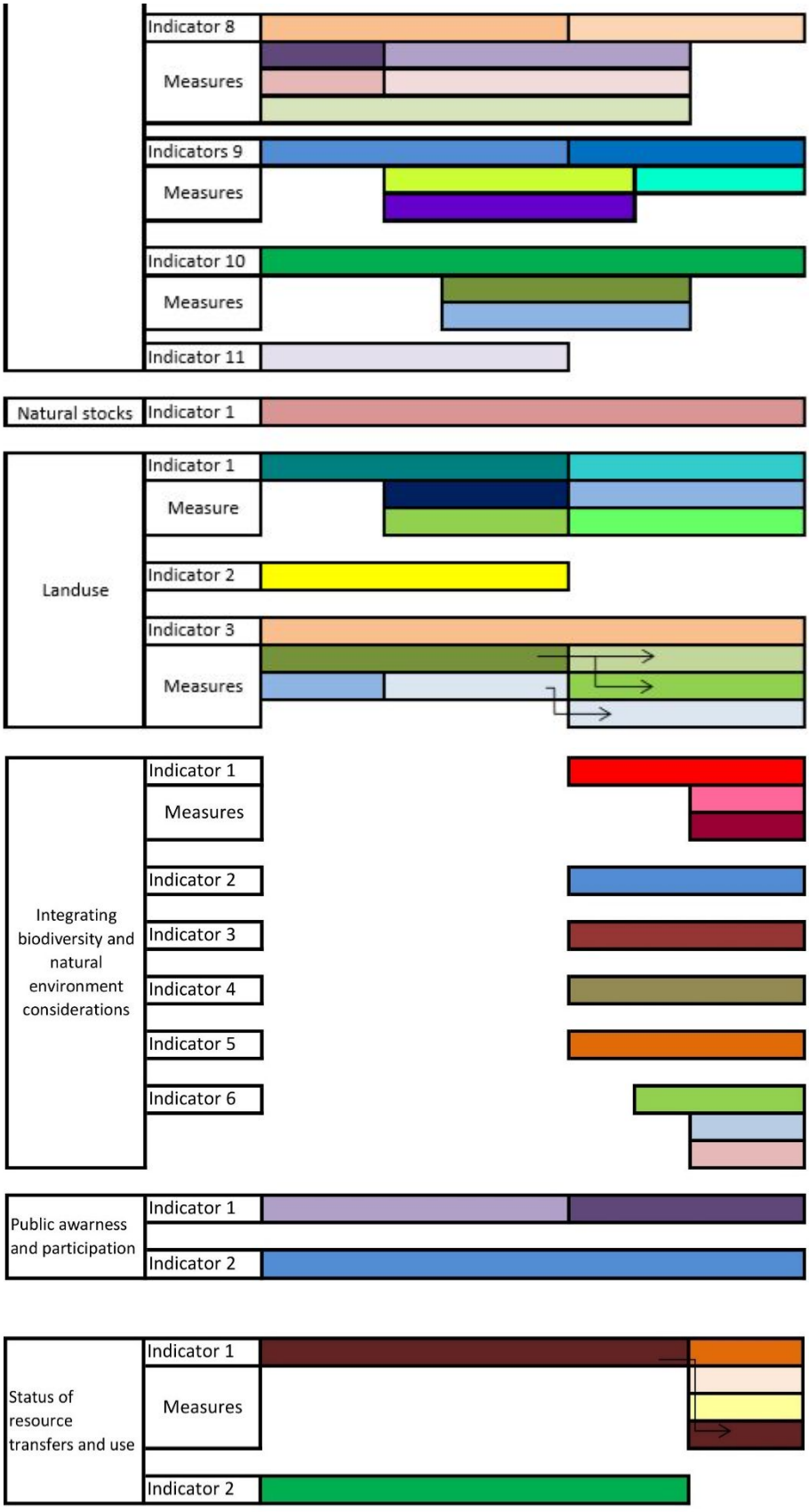


Figure 1: Changes in Indicators reported on in the UK Biodiversity Reports between 2007 and 2015.

Fig. 1 illustrates the extent of how the UK Government official reports reframed its biodiversity calculable space in which they are able to see and understand its performance. The following subsections seek to explain this seemingly perpetual work of (re)framing, to understand how the UK Government achieves calculability for its biodiversity performance. Drawing on Callon and Law's (2005) three stages of calculation, these three subsections will explain how the UK Government has detached, transformed and extracted (outlined in section 2, above) in order to frame calculable spaces for biodiversity policy formulation and performance measurement.

5.1 Detachment and layout in a single space

Callon and Laws' (2005) first stage of calculation concerns detaching relevant entities and bringing them together within a single framed space. Accordingly, accounting for biodiversity performance requires work to identify the kinds of biodiversity data that are going to be brought into such a space. Within the UK Government, this work is described as a collaborative effort involving four different groups, arranged so as to form what one interviewee described as the "UK Biodiversity Indicators Governance Structure" (hereafter referred to as BIGS), depicted in fig 2. This structure comprises the *Four Countries Group*[5], the *Biodiversity Indicators Steering Group*[6], the *Biodiversity Indicators Forum*[7] and the *Biodiversity Indicators Project Group*[8].

BIGS was described by interviewees as a hierarchical structure with the *Biodiversity Indicators Forum* acting as an external review board. Within this structure, the *Four Countries Group* sets the broad political direction, the *Biodiversity Steering Group* decides on the indicators to be extracted for use within the final reporting, and the *Project Group* performs the statistical transformations and produces the final indicators report, but with the initial data detachment work being undertaken by other organisations more directly involved in biodiversity conservation work.

[5] The United Kingdom of Great Britain and Northern Ireland (UK) consists of four countries: England, Scotland, Wales and Northern Ireland. The members of the Four Countries Group consists of representatives of these four Devolved Administrations, DEFRA and JNCC.
[6] The Biodiversity Indicators Steering Group consists of representatives of DEFRA, the Devolved Administrations, JNCC, Country Agencies and one NGO link.
[7] The Biodiversity Indicators Forum consists of representatives of Statutory and Non-Governmental Organisations and Academia.
[8] The Biodiversity Indicators Project Group consists of a JNCC Biodiversity Indicators Manager and DEFRA Statisticians.

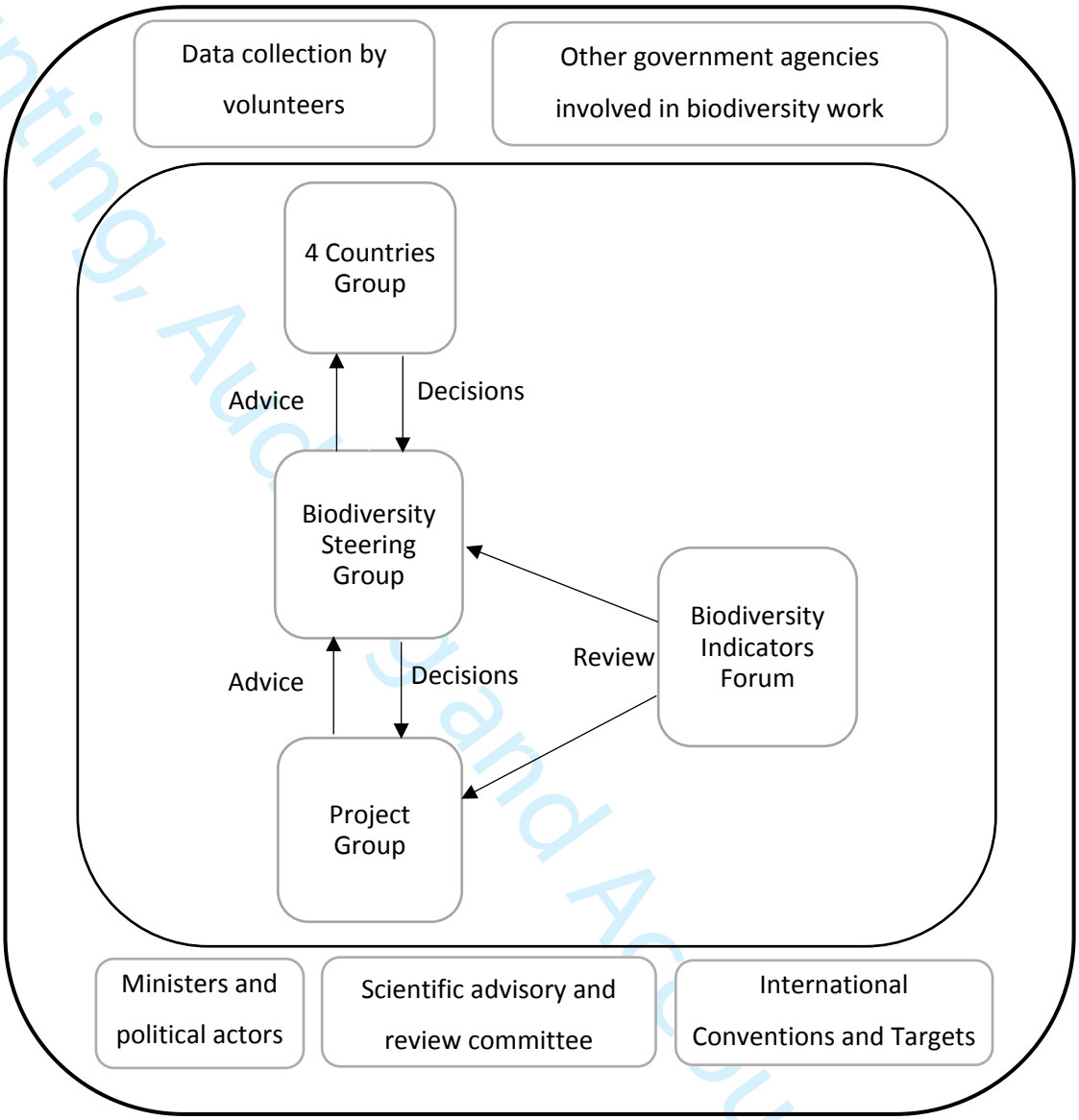


Fig 2. UK biodiversity indicators governance structure

"Let's just look at this from the government's perspective. At the top level we've got what's called the Four Countries Group, that's very senior civil servants from the devolved administrations and their statutory advisory bodies. So that's statutory only. And that basically sets direction. That's your mechanism for looking at what's going on as a result of devolution because environment is a devolved matter. We've got an indicator Steering Group and the idea of that is that that's my overall governance group in terms of who I am responsible to. […] And that includes people from an operational level from devolved administrations of the four countries and also includes an NGO representative. But no big steering group is ever going to actually produce a set of indicators because they're all busy

> doing their own jobs. What you need is a little Project […]. We are that Project Team. […] We report to the Indicator Steering Group on what we're doing and they give us direction […]. So it's a slightly organic governance process." (Interviewee 5, Project Group)

As part of this process external data sources are explored, relevant data identified and brought into the BIGS calculable space. Most of the initial detachment work takes place outside of the BIGS structure. These data sets were mainly collected by organisations directly involved in biodiversity conservation work, such as NGOs, other parts of Department of Environment, Farming and Rural Affairs (DEFRA), other government agencies or from public websites as described by the member of the *Project Group*:

> "For example, we have an indicator on the amount of volunteering work that people do. We get data from organisations that have volunteers, for example the Wildlife Trusts. […] Some data would even come from people's websites. There's a spend indicator that, some of it is from non-governmental bodies [and] you just go to the website and look at what they have spent on biodiversity. […] Other parts of DEFRA is another example where we would go for marine indicators. Go to the marine part of DEFRA and ask for their data. Or to the air quality part." (Interviewee 6, Project Group)

The majority of the data used within BIGS was originally collected by conservation organisations across the public and third sector prior to being extracted and detached from its original calculable space in order to be repurposed for national biodiversity indicator calculations.

> "[JNCC] actually fund people to go and do it, but the actual people who are doing it are the NGOs I guess. […] It might be RSPB or BTO or the Wildlife Trust […], all the specific NGOs that work for endangered species or wildlife." (Interviewee 4, Devolved Administrations)

It is important to note that the underlying data used for indicator calculations were originally framed by research centres and NGOs to support their specific everyday biodiversity groundwork. The scope of this work varies considerably and can be geographically specific, species specific, policy specific, project based or specific to the purpose or mission of a charity or NGO. The majority of biodiversity data in the UK is not produced from the work of government statisticians but rather originates from on-the-ground action by volunteers and NGOs.

> "Lots of the biodiversity indicators that are in the twenty indicators that [JNCC puts] together, they were designed, constructed, developed by lots of the NGOs." (Interviewee 7, Biodiversity Steering Group)

Consequently, data used for the UK Biodiversity Indicator Report has been collected using a broad range of different data collection methodologies, leading to inconsistencies in the quality of the data sets included. Thus, combining these different data sets into a single report was seen as difficult by interviewees.

> "To bring together the UK assessment for different biodiversity is really difficult because everything's been measured in different ways. So that's a real problem." (Interviewee 7, Biodiversity Steering Group)

As the data sets are brought into the BIGS calculable space, these data sets, as well as their calculative framing, tools and infrastructures, become detached from the biodiversity conservation work and their original purpose. These extracted data sets become individual entities within the BIGS calculative frame regardless that they were not collected for national biodiversity accounting purposes. However, these data sets do draw closely from those involved in conservation groundwork and even though statutory agencies now fund the data sets, the everyday data collection and maintenance is still being done by the NGOs.

> "Funding for the development and maintenance of those indicators is often through statutory public funding. Of course, the data that contributes to them are very often collected in the voluntary sector." (Interviewee 8, NGO)

This creates a form of independence between the reporters (the government) and the data gathers (the biodiversity workers). Rather than BIGS constructing UK biodiversity indicators purely based on the accounting needs of statutory organisations, national governments and international treaties, these indicators have been mainly driven by the data made available from biodiversity conservation work.

> "I think it's fair to say that what we've done with the indicators is to take what's available and reuse it. We've also developed new techniques to be able to analyse those data and that's good news. But saying I want to have a biodiversity statistic - *'Go away and collect me lots of new data'* is never going to work." (Interviewee 5, Project Group)

As described by the interviewees, collecting additional or new data is highly unlikely. Therefore, the availability and accessibility of pre-existing data sets is essential to the framing and calculative work of producing UK biodiversity indicator sets. Constructing UK biodiversity indicators can therefore be seen as a form of pragmatic, rather than idealistic, work.

> "You're extremely constrained by the data that's available, so they're a very pragmatic set of indicators […] these aren't necessarily the perfect indicators, these are the indicators we can measure and when we produced the report for those first set of indicators, […] the discussion section of those reports identified areas where we felt work to develop more and better indicators will be useful. But we have limited funding for this kind of work." (Interviewee 9, Academic Institution)

> "I think the overall perception was that they were often driven by the information that was available, not by the information that you would choose to answer the question that they were necessarily targeted towards answering. […] Decisions had been made basically, to accept data in the form that it existed in and do the best that could be done with that rather than saying, *'Right, this is what we need to know. This is how we would have to find it out.'* […] I think there's no doubt that the quality of those indicators is limited by the data available to inform them." (Interviewee 10, Academic Institution)

Based on the choice to reuse already available data sources, this stage is highly dependent on pre-existing data collection infrastructures established by a range of organisations involved in biodiversity conservation work. Each of these organisations have developed their own infrastructures enabling them to collect data that fulfils their own performance measurement needs. Accordingly, most of the time, data calculations and collection infrastructures were developed before and independently of the need for biodiversity indicator reports. The interviewee below describes a resulting lack of flexibility when it comes to NGOs being able to adapt data collection processes in order to satisfy all policy and reporting needs.

> "You need a whole infrastructure underneath it. […] I think that a lot of people, the policy makers, […] just don't realize all that effort and complexity that sits underneath the species trends that they find or get. The demands you sometimes get to do them a different way or, "Oh, wouldn't it be nice if they were like this" or six months earlier and you realize these people don't understand what's the amount of work, not just in this little indicator contract, but in the whole set of stuff that has to happen before that." (Interviewee 13, Biodiversity Indicators Forum)

In the detachment stage BIGS is involved in selecting which of the diverse range of biodiversity data sets are extracted from the calculations of others, rather than the initial calculative detachment from nature. There does appear to be some recognition of national data requirements through government funding of biodiversity work that includes the procurement of some data. However,

most of the time, these data calculations and collection infrastructures were developed before and independently of the need for biodiversity indicator reports, including those required for the SDG. Biodiversity calculations were not designed for indicators selected by BIGS, but instead the data already collected for other purposes drive the calculation and communication of the numbers representing the official UK biodiversity performance and policy formulation. Thus, the way that the framing work of the UK Government addresses the question of what gets brought into its calculable space is, in very large part, dependent on conservation work taking place outside of government. The biodiversity data that underpins the UK Government's work to establish calculability for biodiversity depends on a complex civil infrastructure of people and technologies recording nature for their own work, but doing so in a way that enables the government to make use of this data in its report. The UK Government's biodiversity indicators, including those accounting for SDG-15, could not be produced without this civil infrastructure, its underlying calculative capacities or biodiversity work being in place.

5.2 Transformation and manipulation

Callon and Law's (2005) second stage of calculation concerns the manipulation and transformation of those entities brought into any framed space. Accordingly, accounting for performance in relation to biodiversity requires work to determine how biodiversity data will be combined and transformed into useful measurements. Within BIGS, this transformation and manipulation work is primarily conducted by the *Biodiversity Indicators Project Group (Project Group)*, which is responsible for producing the UK biodiversity indicators reports.

Before the *Project Group* can start the transformation and manipulation of the biodiversity datasets into national biodiversity indicators, individual indicators have to be selected and the report curated by the *Biodiversity Steering Group*. This work is facilitated by the collaboration between public sector organisations, such as JNCC and DEFRA, and the *Biodiversity Indicators Forum*, comprising NGOs, academia and research institutions. This collaboration brings together scientific, statistical and political perspectives and priorities to specify each year what the content of the UK biodiversity indicators reports should be.

> "The development of biodiversity indicators in general in the UK is, I guess you could say, a collaboration between the voluntary sector and government." (Interviewee 8, NGO)

This specification work was heavily influenced by the data that was imported into the calculable space resulting from prior detachment decisions and was described as an iterative process between what the ideal indicators should be and what was realistic.

> "Okay well we have these data sets, they're not ideal, are we willing to accept them as […] indicators even though they're possibly not ticking all the boxes? In that sense, you see what I mean of it being iterative. […] It starts with a concept and an aim. Then you put it through the filter of what data is available." (Interviewee 11, Research Centre)

During the transformation and manipulation work, actors were influenced by the need to ensure the usefulness, as determined by the socio-technical configuration and dynamics of BIGS, of these indicators for policy and practice by mediating between the biodiversity conservation workers (data providers), researchers and the government policy makers.

> "We have a scientific advisory committee. It is made up of largely academics and they are a group that we go to and say: '*Right, we want to develop indicators; what do you think would be good things to put in there?'* There is always a link to government policy. Which sounds as though it could be quite awful, but in practice tends to work out quite well. You know things like planting trees sounds like a good thing. Well, ok, if planting trees is good, do we need an indicator for woodland quality or can we capture that through our site conditioning monitoring - Forest commission captures that on a wider basis." (Interviewee 12, Biodiversity Steering Group)

Likewise, policy makers are concerned to ensure that the indicators produced by the *Project Group* were as useful as possible, within the constraints of the funding available.

> "A lot of it was dealing with JNCC and the data that they collect and working with [*Project Group*] to try to steer them in the way that we wanted them to go in terms of data collection and the things that they could provide and analyse for us. […] How can we maximize the efficiency of our funding by getting the most out of [*Project Group*]? How can they help us?" (Interviewee 4, Devolved Administrations)

In order to ensure policy relevance, policy representatives from all devolved administrations are involved in the process of selecting the UK biodiversity indicators, via the *UK Biodiversity Steering Group*. The criteria used for indicator selection reflect various aspects of their usefulness to policy formulation.

> "Criteria for indicator selection were examined in relation to the main information needs of country agencies. Criteria included: illustrating outcome relative to policy objectives; providing clear trend data; being applicable at a variety of geographical scales; and allowing for frequent updates." (Biodiversity Indicators Forum Meeting Report, 2002)

It is only after the final indicators for inclusion in a report have been decided on, the extraction of appropriate data sets and calculative transformation methodologies have been determined by the *Biodiversity Indicators Steering Group*, that the *Project Group* starts the actual work of transforming biodiversity data into a biodiversity indicators report.

> "We are a *Project Group* who actually do the doing." (Interviewee 5, Project Group)

The transformation work, which involves the repurposing of pre-existing biodiversity numbers to fulfil UK Government needs is subject to additional standardised socio-technical requirements. In particular, the choice was made that indicators must adhere to the UK Government statistical C*ode of Practice*. This transformation process changes the qualitative attributes of the fragmented data produced by a range of different organisations into a single authoritative national account produced by the UK Government.

> "That involves for each of the indicators going out to the data sources, getting the data in, quality assuring the data, [...] so for each one […] there is a standard format […]. As a government statistician, I am also concerned that they adhere to the Code of Practice for official statistics." (Interviewee 6, Project Group)

During the transformation work, the *Project Group's* main concern is to ensure they are producing and publishing information that is compliant with the *Code of Practice*. It is through the socio-technical arrangements and calculative tools contained within the *Code of Practice* that the biodiversity data collected by conservationists is transformed and manipulated into legitimated statistical data that can be processed by any government statisticians for inclusion in official government documents or reports.

> "These are official statistics and what that means is that they are produced without interference from government. [...] And what [the Code of Practice] does is to expect you to work with policy customers users in terms of identifying the right statistics. But once you've done that, we then produce those statistics without the policy customers [saying] *'I am going to look at that number. Can you change it?' 'No.'* […] And that's really important because it's about the impartiality of official statistics." (Interviewee 5, Project Group)

Overall, during the transformation stage of the calculative process the *Project Group* involves manipulating multiple heterogeneous data sets into a scientifically acceptable and politically relevant set of biodiversity indicators that are compliant with the statistical *Code of Practice*.

> "We´re bringing together a multitude of information and what we're trying to do […] is to represent it in a fair way. That needs to be true to what's the data that we can do, it also needs to be fair to the users […]. What we're really trying to do is to say *'these are the facts'*, *'these are the percentage changes that are going on with this indicator'*. And here's the assessment objectively of whether that's going up or down compared with on a short-term or a long-term basis. What we're not trying to do is to say *'and this is the policy change that needs to happen.'* That's a policy response and that's their business not ours. And that again is important because it's not our job to drive the policy. Our job is to give the evidence of whether the policy is working or not." (Interviewee 5, Project Group)

Thus, the way that the framing work of the UK Government addresses the question of how biodiversity data is to be manipulated and transformed within the calculable space is shaped by a range of socio-technical factors and priorities, including political, institutional, scientific, biodiversity conservation work, but finally determined by the *Code of Practice* for government statistics. Once indicators have been selected within the governance structure, the work of manipulating the mass of data collected using the civil infrastructure discussed earlier into politically useful measurements that account for biodiversity performance is undertaken by a small team of trained government statisticians, aiming to produce what they consider to be a fair and impartial factual account of UK biodiversity performance.

5.3 Extraction of results

Callon and Law's (2005) third and final stage of calculation concerns extracting a result from the framed space. Accordingly, accounting for performance in relation to biodiversity requires work to determine how the measurements of this performance are reported. The UK Government reports on its own biodiversity performance in its annual UK Biodiversity Indicators[9] report. This report, containing 24 indicators in 2018, has been published every year since 2007 and is a key part of the evidence base for policy formulation and decision making on biodiversity.

[9] Previously known as UK *Biodiversity in your Pocket*.

> "These give the figures that allow those policy individuals (a) to respond back to ministers on questions that they get of what is happening, (b) to give objective figures in response to NGO lobbying because clearly the NGOs always want more. That´s their job. That's fine. But what's the evidence of what works and what doesn't? So this is part of the DEFRA evidence portfolio in terms of what is the information that we can bring to bear on whether or not policies are working." (Interviewee 5, Project Group)

However, even though interviewees repeatedly confirmed the purpose of these indicators as being for policy development, they also highlighted how the nature of the political environment limits the extent to which indicators can be seen to lead to distinct decisions on policy developments. Movements in indicators are unlikely to lead to immediate policy reactions, but rather influence conversations by adding to the existing evidence base. As a result, no direct policy developments or changes can be straightforwardly traced to movements in indicators, making it difficult to judge the extent to which the indicators do actually influence policy development.

> "Policy development is really […] why [the indicators] are used. Are we going in the direction we want and if we are not, what can we do? I think it influences and it will spark conversation, but I don't think it's 'Oh god, that's happened, right, we need to do something quickly.' That's just not how government works really […]. It's an added layer to the evidence-base on help inform on future actions. It's not immediate reactive. It doesn't promote that immediate reaction I guess." (Interviewee 4, Devolved Administrations)

Additionally, interviewees described the relationship between policy and evidence as complicated, in contrast to the more linear characterisation of how evidence informs policy.

> "Well, the relationship between evidence and policy is anything but simple. There is a kind of mantra which you have no doubt heard about, 'evidence makes policy', which is totally fatuous and over simplistic understanding of policies. […] It's particularly difficult where you're dealing with complex issues like the state of nature, which can be variously understood and interpreted and with different meanings attached to it." (Interviewee 3, Environmental Agency)

As outlined in Fig. 1, this set of UK biodiversity indicators was reframed nearly every year, due to what interviewees described as continuous improvements and adaptations, leading to changes in the results extracted for inclusion in the annual biodiversity reports.

Given the level of changes in the extraction work and the consequences for how UK biodiversity is framed, it is interesting to explore what has driven these decisions. Interviewees within public

sector bodies, NGOs and research centres referred to a sense that however biodiversity was currently framed it was imperfect, partial and could be improved. There was a recognition that they had not fully resolved the problem of calculating UK biodiversity. This recognition motivated these actors to continue to make what they classified as improvements.

> "In a way it's the department's own desire to make improvements. Because I could say that over the last couple of years […] what has influenced this is the Chief Scientist[10] asking questions. We had an *ad hoc* independent science panel[11], a bunch of scientists who looked up species indicators and made recommendations for changes, which we are doing as soon as we can. But it's not that somebody from outside, another organisation, said you want to do this. So, it´s that we´ve asked for that." (Interviewee 6, Project Group)

This desire for progress was also driven by scientific developments in biodiversity calculative methodologies. As the science associated with biodiversity challenges develops, so do the possibilities of more sophisticated and accurate calculative representations of biodiversity. Given that BIGS creates a space for different organisations to interact and work collaboratively, this has enabled new scientific developments to inform UK Biodiversity calculations, including the extraction work involved in producing the UK biodiversity reports and influencing international and supranational accounting for biodiversity. An example of these developments includes the adaption of taxa[12] specific methodologies for application to other taxa.

> "The methods rapidly developed to be more sophisticated and have better measurement in them and all these sorts of things that you need. And considered bias and precision. At the same time while that was happening that also stimulated lots of other people to copy that methodology, basically. So, once we published, you know, Wild Bird Indicators in the UK and Europe, people started to use our methodology to produce butterfly indicators across Europe and butterfly indicators in the UK and bat indicators in the UK and all sorts of different taxa groups have used the same methodology. […] There are twenty plus European countries now producing farmland birds indicators." (Interviewee 7, Biodiversity Steering Group)

Other reframings have been initiated by actors outside BIGS, such as Ministers or other political actors. Given that interviewees reported that they wanted these indicators to be useful for political

[10] The Chief Scientist referred to here is a public sector employee and not part of the scientific review panel.
[11] Also referred to as the scientific review panel.
[12] Taxa refers to any unit used in the science of biological classification, or taxonomy.

decision making, decisions on what should be extracted for inclusion in formal biodiversity reports changed accordingly.

> "I think the format and the information that goes into [a Biodiversity Report] has come down over the years in response to minister saying, *'Well, what does this mean? What is this?'* Which is why you have all of these different bits and pieces. I've never [been] entirely sure that the design and the concept is as clear as it could be. I tend to think that it evolves rather. […] I sense that it is more like an evolutionary process than a directed designed system." (Interviewee 1, Biodiversity Indicators Forum)

Another reason interviewees highlighted as leading to change in the extraction work for production of the biodiversity report were international agreements and targets, such as the UN Convention for Biological Diversity (CBD). Changes within international conventions have led to reframings of indicators, particularly between 2011 and 2012 in response to the CBD's Aichi Targets. However, there has been a notably limited impact from the UN SDGs on the BIGS extraction work.

> "The core of our ambition is the CBD and of course, […] everything relates ultimately to CBD. That's why we produced that account." (Interviewee 2, Environmental Agency)

> "I'm aware of [the SDGs] and I'm going to have to quickly try and look it up. It's a valid question but it's not necessarily something that we've looked at specifically." (Interviewee 2, Environmental Agency)

Interviewees tended towards a perception of international frameworks and goals as being helpful for instigating and coordinating global collective action. But a distinction was frequently drawn between common goals, which all countries need to work towards, and specific targets and indicators that are seen to be necessarily developed to suit a particular national context.

> "I think the existence of those high-level international frameworks and targets is useful because in principle at least it allows everyone to develop more local targets and indicators to fit in with that framework and aim towards a common goal." (Interviewee 8, NGO)

Interviewees stated that the changes identified in Fig. 1 have resulted from a range of different influences on the overall socio-technical arrangements in BIGS, but that there has not be a substantive change in the underlying calculative structure over the last decade.

> "The main things, the indicators right from the start, they were more or less what they are now, which is an aggregate trend made from individual species trends and split mainly by

habitat or we can split them other ways. What's changed since then is greater scrutiny of the data sets going in." (Interviewee 13, Biodiversity Indicators Forum)

Overall, most of the changes outlined above were described by interviewees as necessary and positive improvements that were embraced by the actors within BIGS, responding to research around calculating biodiversity increased and methods, as well as the political context in the UK. These changes led to more statistically credible indicators, filling data gaps and more confidence in their indicators.

> "We didn´t want metrics that were just about what was available, what we can use. We did have a context. We had a policy context that was used to say, *'What information do we need?'*. Then we tried to map that against the available data and we came up with a partial match. Where we did have available data sets, we started to develop them into an indicator form, which was new to us. Because they should be policy relevant and they have the characteristics of these more structured ways of expressing information within a policy context. Also, there were gaps and we started to work out ways of how we could fill knowledge gaps. That's a process that's continued to then in terms of trying to make the metrics that were used more directly relevant to the policy objective. I think on the whole, certainly in terms of biodiversity action, that ambition has provided a lot of stimulus for creating a better evidence base, making better use of the evidence that we have, putting it into a standardised format." (Interviewee 2, Environmental Agency)

Thus, the way that the framing work of the UK Government addresses the question of how a result is to be extracted from the calculable space is determined by an array of influences from interested actors, which collectively drive the ongoing evolution of the biodiversity indicator reporting over time through BIGS. The calculability created by BIGS on behalf of the UK Government, enabling an accounting for biodiversity performance, was seen to be a temporary achievement, subject to continual efforts at refinement and reframing.

6. Discussion

This paper uses the case of UK Government biodiversity indicators to problematise the SDG top-down standardised approach to accounting for sustainable development. The case findings, set out in section 5 above, have shown how the UK Government, through BIGS, works to render calculable

its performance in relation to the sustainable development challenge of biodiversity loss, in a way that enables policy formulation in pursuit of SDG-15.

The analysis here has not sought to judge the indicators themselves as being either "good" or "bad". Rather, the analysis has sought to reveal the socio-technical arrangements that collectively work to frame a space in which these indicators can be produced and reported. This is key to understanding how the UK Government is able to create conditions in which it can see and understand biodiversity loss and its own performance in addressing this problem. In this way, the analysis offers useful insights into how national governments – and potentially other kinds of organisations, such as corporations – can achieve the calculative capabilities necessary to account for and enable pursuit of the sustainable development challenges set out in the SDGs.

Firstly, a decision had to be made about what entities are to be brought within the framed space and therefore what kinds of biodiversity data are going to be included within the space. Rather than government agencies designing specific indicators and going out to collect the necessary data subsequently, indicators are largely driven by data that has already been collected for other purposes. Data collection processes are largely driven by organisations conducting their own conservation work. As such, there are clearly limitations to the UK Government's bottom-up approach to accounting for biodiversity, most notably in terms of issues around the consistency of the data over time and a degree of inflexibility arising from the difficulties of reconfiguring a calculative infrastructure made up of numerous organisations, each acting for their own purposes. Those producing the national biodiversity report are not able to collect the data they would like. This makes data availability, and a dependency on the nature of the detachment, transformation and extraction work undertaken by others as a critical part of this work. However, interviewees in this study have demonstrated an acute awareness of these limitations and have explained how they actively work to mitigate these limitations, aiming for continual improvement in the quality and policy relevance of the indicators. This is consistent with the findings of others that have problematised the assumption that organisations start with their strategies and then seek to measure performance (cf. Georg & Justesen, 2017; Jollands & Quinn, 2017; Kornberger & Carter, 2010; Power, 2015; Skaerbaek & Tryggestad, 2010): i.e. in the context of UK biodiversity reporting, the ability to formulate policy and make decisions is deeply entwined with the building and repurposing of performance measurement infrastructure.

Secondly, these entities are manipulated and transformed within the space, and the biodiversity data sets are combined and turned into *Code of Practice* compliant measurements of biodiversity performance. In this case study, it is the *Project Group* that repurposes the mass of biodiversity data

into defined biodiversity indicators, aiming to ensure compliance with the *Code of Practice*. The *Project Group* brings together and combines data from multiple sources, turning this into useful, legitimated, authoritative measurements of UK Government biodiversity performance.

And thirdly, the result of this process is extracted. For UK biodiversity, this means the *Project Group,* operating in the socio-technical context of BIGS, deciding how measurements of biodiversity performance will be reported as a set of national biodiversity indicators. The perpetual modification of these extracted indicators, highlighted in Fig. 1, is described by interviewees as a process of continual improvement and evolution. The analysis shows that these changes are driven by ongoing input from political actors, environmental agencies and external organisations, experts from research centres, universities and NGOs, as well as changes in international treaties or conventions. This continual process of refinement means that the UK Government's achievement of calculability for its biodiversity performance is inherently temporary and ongoing, which will impact on how the government can see and comprehend possible courses of action.

The following two subsections consider the implications of these findings, firstly, for implementation of the SDGs and, secondly, for future research in accounting for sustainable development.

6.1 Implications for policy and SDG implementation

This paper's analysis of the UK Government's work to report on its biodiversity performance has revealed how achievement of calculability depends upon a complex socio-technical arrangement of governmental and non-governmental actors. As such, this analysis serves to problematise the extant SDG approach to accounting for sustainable development, whereby indicators for all SDGs have been agreed at an international level and then imposed upon all national government signatories.

Whilst some SDGs, like SDG-8 on economic growth or SDG-13 on climate change, might lend themselves to universally applied indicators, others – including SDG-15 on biodiversity – are challenges whose calculability is highly contingent on local national circumstances. The UK is a densely populated country, dominated by a mosaic of urban and agricultural landscapes. The problem of halting biodiversity loss in the UK is going to be very different to countries with large tracts of relatively undeveloped natural habitat. Global priorities for halting biodiversity loss tend to be framed around biodiversity "hotspots", like rainforests, which support vast numbers of species in complex ecological systems (see Myers, Mittermeier, Mettermeier, Fonseca, & Kent,

2000), not in highly industrialised landscapes, like the UK. This paper does not, therefore, claim that the UK biodiversity indicators, and the process of producing these indicators, represent some kind of exemplar for other countries to follow. Rather, the aim here has been to use the case of the UK to problematise a seemingly implicit assumption within the SDG Indicator Framework that national performance on sustainable development challenges, like biodiversity loss, can or should be accounted for in a way that is straightforwardly comparable and commensurable across countries. Instead, the ideal that interviewees stated they were working towards are indicators that are policy relevant, statistically credible, locally applicable and reflecting contemporary scientific accuracy. Indeed, interviewees in this study explained that the SDG-15 indicators have had no substantive effect on how the UK Government accounts for its biodiversity performance, nor on the formulation of policy aimed at biodiversity conservation. The UK case demonstrates the very considerable framing work that is required to achieve a form of calculability that enables an accounting for biodiversity performance that is seen to be useful for formulation of policy. Different countries, with different national circumstances, will likely be faced with similarly considerable framing work – finding their own way of building and refining a calculative infrastructure – to render calculable their performance against SDG-15, and indeed against other SDGs.

The SDGs are a set of global goals, a vision for what the world could be like if humanity was able to act collectively in pursuit of a common purpose. The goals themselves, whilst being the result of what the UN (2019) describes as the largest consultation in human history, are inherently and necessarily top-down. The SDG-15 goal of halting biodiversity loss, for example, is a necessarily top-down challenge set for all countries to work towards. However, this challenge inevitably means different things in different national contexts. Accordingly, what it means to perform well or badly in respect of halting biodiversity loss will mean different things for different national governments. As such, governments need to figure out what it means for them. It seems unlikely that any national government will be equipped to do this without extensive engagement with actors that are actually pursuing biodiversity conservation in that particular national context. Hence, an effective accounting for performance in halting biodiversity loss – and likely for numerous other social and ecological challenges set out in the SDGs – appears to be something that requires a bottom-up approach. As noted by interviewees in this study, top-down global goals are useful for instigating and guiding the local development of indicators to measure performance. Given this, efforts to impose top-down indicators appear unlikely to be able to result in forms of calculability that actually help governments to formulate and implement effective sustainable development policies.

The 2030 *Agenda for Sustainable Development* calls for capacity-building to enhance national governments' capabilities to report to the SDG indicators. However, these capacity-building efforts are aimed at improving the work of national statistics offices. The analysis in this paper has shown that this is only part of the calculative process of biodiversity accounting and reporting. Capacity-building aimed solely at building statistical expertise will address the second of Callon and Law's (2005) three stages of achieving calculation. But the analysis here has shown that it is at least as important to have a civil infrastructure engaged in conservation work on-the-ground, to collect the data (i.e. Callon and Law's (2005) first stage of calculation) that can then be repurposed for national reporting. Likewise, the analysis has shown the importance of a multi-institutional, multidisciplinary governmental structure, such as BIGS, that can drive the ongoing evolution of the biodiversity calculability (i.e. Callon and Law's (2005) third stage of calculation), in order to continually reflect on its usefulness for policy formulation. This analysis suggests that in order to enable national governments to address the challenges of sustainable development, capacity-building should cover all these important aspects of framing a space in which these challenges become calculable.

The insights generated in this study may be relevant in organisational contexts beyond national governments. If other kinds of organisations, such as corporations, are to effectively contribute to SDG-15 then extensive capacity-building will be necessary in order to build and refine the kind of organisational infrastructures needed to render calculable their biodiversity performance. Organisational-level accounting for biodiversity has largely been driven by top-down standards – most notably the Global Reporting Initiative (GRI) – purporting to empower organisations to understand their sustainability impacts and thus make informed decisions (Jones & Solomon, 2013). Yet, numerous studies of corporations' reporting on their biodiversity performance has found this to be almost universally superficial and inadequate for informing management decisions or for discharging any meaningful form of accountability to stakeholders (see Cuckston, 2018b). Indeed, the vast majority of corporate sustainability reports simply declare biodiversity reporting standards to be irrelevant to their operations (Adler et al., 2018; Atkins et al., 2014). The present study suggests that for corporations to achieve a form of calculability for their biodiversity performance that will actually enable them to contribute to SDG-15, these corporations will need to engage in the kind of framing work seen to be taking place within the UK Government. Crucially, rather than rely on top-down standards like the GRI, which are highly unlikely to be directly relevant to the specific circumstances of a particular corporation's impacts on biodiversity (Boiral, 2016), corporations instead will need to develop bottom-up measures of their biodiversity performance based upon the context of their own operations. The present study implies that this requires extensive framing work to detach relevant data, manipulate and transform this data into coherent

and credible measures, and then extract these to produce a useful account of biodiversity performance.

Developing the capacity to account for biodiversity performance would thus likely require considerable investment of effort and resources at each of these three stages of calculation. The detachment of relevant data could require scrutiny of existing data sources (both within the organisation and from other organisations, such as conservation NGOs) that can be repurposed. It may also be that corporations have the resources to be able to work with conservation NGOs to identify new data needs and devise ways to extract such data. The manipulation and transformation of data into measures of performance would likely require clear procedures, akin to the UK Government's *Code of Practice*, for ensuring that measures of performance are derived in a way that is seen to be credible and legitimate. The extraction of results into an account of a corporation's biodiversity performance would likely require mechanisms to enable reflection on these results, perhaps by a range of internal and external stakeholders comprising a broad range of expertise, to drive refinement and evolution of this account, with the aim of continually improving the calculability of the corporation's accounts of its biodiversity performance. In summary, this study suggests that for corporations to meaningfully contribute to SDG-15 they might need to build themselves socio-technical arrangements along the lines of the BIGS structure witnessed here. Without this kind of framing infrastructure, corporate-level accounting for biodiversity is likely to remain a largely vacuous exercise that does very little to aid biodiversity conservation or sustainable development.

6.2 Limitations and implications for accounting for sustainable development research

Whilst the SDGs mark a substantive change in the international governance and accountability of sustainable development work, it is clear that the SDGs are dependent on existing calculative framings, tools and infrastructures, at least in the medium term. As part of the adaptive work to achieve the SDGs, there is a need to understand the socio-technical arrangements associated with governing and framing sustainable development. This paper has focussed on a single national government's efforts to render calculable a single sustainable development challenge. Given the disparity in history and resources of governments in different countries, and the complexities of the many challenges of sustainable development, the findings in this paper are not straightforwardly generalisable. Different governments may take different approaches to framing a space in which their own biodiversity performance becomes calculable. Likewise, different sustainable

development challenges may require different kinds of framing work to render them calculable. This observation suggests that a top-down form of accounting focussing on international comparability may be problematic if all countries are to address their SDG responsibilities and accountabilities.

However, in examining a single case study, this paper has demonstrated the potential insights from a form of analysis that can significantly advance the research agenda set out by Bebbington and Unerman (2018) concerning how accounting research can enable the pursuit of the United Nations Sustainable Development Goals. This analysis represents a shift away from a concern with the ideological motivations behind corporate reporting on sustainable development and towards a way of explaining how it becomes possible to account for sustainable development in ways that are useful for the pursuit of sustainable development.

Taking the challenge of halting biodiversity loss (i.e. SDG-15) as a case in point, extant accounting literature on this topic has been largely fixated with critiquing the anthropocentrism underpinning corporate reporting on biodiversity (cf. Cuckston, 2018b), highlighting the influences of neoliberal ideology, commensuration, marketisation and financialisation upon accounts of biodiversity as so-called "natural capital". In contrast, the analysis in this paper has not sought to problematise the UK Government's accounting for biodiversity *per se*. Rather, the analysis has explained how the UK Government has worked to construct a form of accounting that it considers useful for enabling the pursuit of sustainable development. The calculative framing, tools and infrastructure adopted makes very little reference to financialisation or marketisation, although it does attempt to make the numbers produced commensurable and compliant with a nexus of regional, national and international policies, treaties and conventions. The analysis has made clear that pragmatic factors other than ideology play a significant role in shaping the form of accounting that can be constructed.

This shift away from a fixation with ideological motivations, towards a more pragmatic analysis of the calculative infrastructure used to frame biodiversity performance, opens up an opportunity to rejuvenate research into organisation-focussed accounting for biodiversity. Rather than play out the now somewhat unhelpful anthropocentrism vs ecocentrism debate (cf. Cuckston, 2018b), the form of analysis developed in this paper could potentially be used to examine how corporations – especially those whose operations have large impacts on biodiversity or rely heavily on ecosystem services – are able to construct accounts that enable them to manage their biodiversity performance. It may be that some of these kinds of corporations have found innovative ways to render calculable their biodiversity performance. The present study offers a novel theoretical approach that can be applied to the study of these corporations, enabling researchers to discern best practices that might be adopted more widely (cf. Unerman & Chapman, 2014), enabling the

corporate sector to become a more potent force for biodiversity conservation and sustainable development.

If accounting research is to become a force for sustainable development – an enabler of the SDGs – then researchers will need to conceptualise the link between accounting and the organising of actions conducive to sustainable development (cf. Bebbington & Larrinaga, 2014; Unerman & Chapman, 2014). While the research design employed in this paper has enabled new insights into how the accounts of biodiversity conservation workers have impacted on the production of national biodiversity reports, we have not been able to investigate the impact of these national accounts on biodiversity conservation work. This is a limitation of this research and an area that requires further investigation. Additionally, the analysis within this paper revealed how the relationship between evidence and policy is anything but simple or linear. However, this paper particularly focusses on understanding and examining the UK Government's work aimed at framing a calculable space for biodiversity performance. As such, the analysis was predominantly centred upon the more technical and calculative infrastructure and tools used in order to render UK biodiversity calculable. Future research focussing on politicians and how they interact with those undertaking the technical work of government could potentially be helpful to better understand some of the political dynamics affecting the framing of calculable spaces and the interplay between calculative evidence and policy formulation.

The analysis in this paper offers a way to pursue this kind of research, using Callon and Law's (2005) notion of framing a space in which sustainable development challenges are rendered calculable. In this sense, accounting for sustainable development is not merely the reporting of performance indicators. This reporting is the only the third stage of the calculative process, with the report being extracted from the framed calculable space. Rather, accounting for sustainable development comprises all three of Callon and Law's (2005) stages of achieving calculation, encompassing all the processes of collecting useful data and then manipulating this in ways that produce useful measures that account for sustainable development performance. Informed detachment, manipulation and transformation, and extraction that repurposes data initially designed for on-the-ground biodiversity conservation work can be seen to mitigate against the partial and problematic detachment from nature that arises from trying to design and impose internationally comparable accounts for monitoring SDG performance.

This paper opens up numerous opportunities for future accounting research that can potentially act as an enabler of the SDGs. Further case studies on the construction of biodiversity reporting by other national governments could help establish whether the findings here translate to different

settings. Of particular use would be studies of governments in countries containing biodiversity hotspots, such as large tracts of natural rainforest. Similarly, additional cases concerning efforts by governments – or perhaps other kinds of organisations, such as corporations – to render calculable the challenges specified by other SDGs could further contribute to an understanding of how the work of accounting for sustainable development makes it possible to pursue sustainable development.

7. Conclusion

The principal contribution of this paper is reflected in a single interviewee quote, cited in the epigraph:

> We've got this classic history of people going out and recording nature, so we've got a huge amount of data. We've also got a huge amount of civil infrastructure that sort of sits around it. It's something that's evolved. It's not something that you could necessarily design (Interviewee 1, Biodiversity Indicators Forum).

If the signatories to the SDGs are to become capable of pursuing sustainable development, then it is clear that work must be done to enhance, not just statistical expertise within governments, but also the civil infrastructure that has been shown here to be necessary to the achievement of calculability. The analysis in this paper has suggested a fundamental limitation to the SDG approach to accounting for sustainable development, with centrally-agreed and universally-imposed indicators for problems that are highly contingent on national circumstances. The analysis here suggests that a potentially more useful approach would be to seek to build up the capacity of non-governmental actors on-the-ground to undertake biodiversity action, which includes the collection of data that can then be brought into national accounts of sustainable development suitable for the circumstances of the individual country. Furthermore, if other kinds of organisations, such as corporations, are to contribute to the pursuit of SDG-15 and other sustainable development challenges then they will likely need to build similarly extensive organisational infrastructures to render calculable these aspects of their sustainable development performance. This potentially vast programme of framing work, at governmental and organisational levels, offers significant opportunities for accounting research to become a potent force for sustainable development.

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Appendix 1: SDG 15: Life on Land — Indicators by Targets

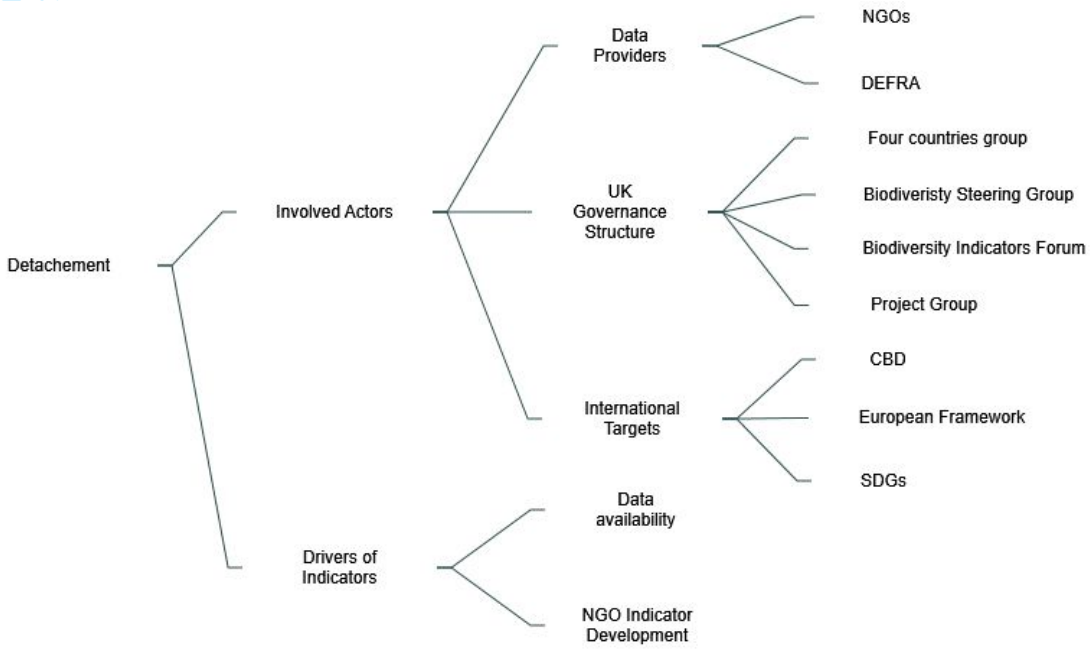
Target 15.1. By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	Indicator 15.1.1: Forest area as a proportion of total land area
	Indicator 15.1.2: Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type
Target 15.2. By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	Indicator 15.2.1: Progress towards sustainable forest management
Target 15.3. By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world	Indicator 15.3.1: Proportion of land that is degraded over total land area
Target 15.4. By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development	Indicator 15.4.1: Coverage by protected areas of important sites for mountain biodiversity
	Indicator 15.4.2: Mountain Green Cover Index
Target 15.5. Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	Indicator 15.5.1: Red List Index
Target 15.6. Promote fair and equitable sharing of the benefits arising from the utilization of genetic	Indicator 15.6.1: Number of countries that have adopted legislative, administrative and policy frameworks

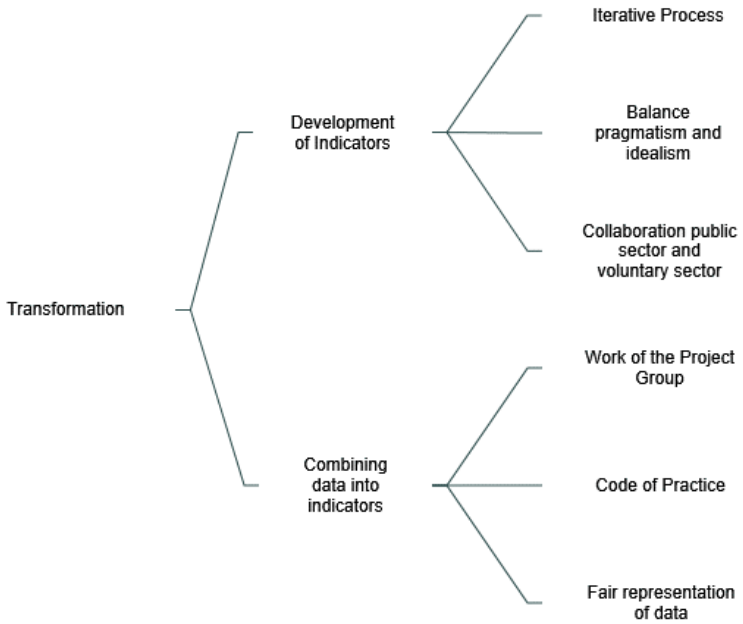
resources and promote appropriate access to such resources, as internationally agreed	to ensure fair and equitable sharing of benefits
Target 15.7. Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products	Indicator 15.7.1: Proportion of traded wildlife that was poached or illicitly trafficked (Repeat of 15.c.1)
Target 15.8. By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species	Indicator 15.8.1: Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species
Target 15.9. By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts	Indicator 15.9.1: Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011–2020
Target 15.a. Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems	Indicator 15.a.1: Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems (Repeat of 15.b.1)
Target 15.b. Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation	Indicator 15.b.1: Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems (Repeat of 15.a.1)
Target 15.c. Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities	Indicator 15.c.1: Proportion of traded wildlife that was poached or illicitly trafficked (Repeat of 15.7.1)

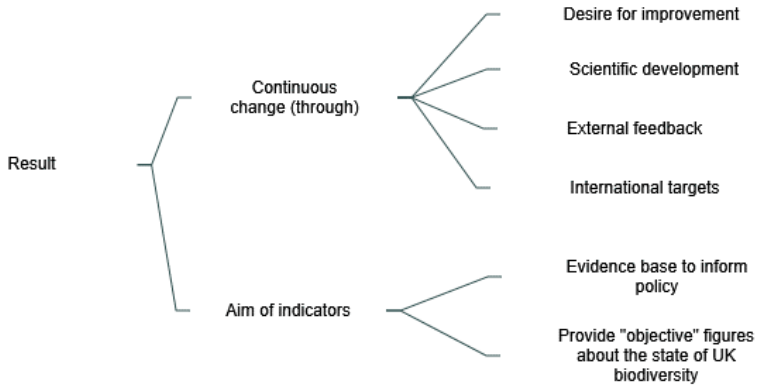
Appendix 2: List of Interviewees

Type of Organisation	Position
Government Institutions	Biodiversity Statistician
	Natural Capital Accounting Statistician
	Biodiversity Indicators Manager
	Principal Specialist in Conservation Ecology
	Senior Biodiversity Officer
	Strategic Direction Manager
	Evidence and Reporting Manager
	Information Management Senior Adviser
	Former Biodiversity Policy Advisor
Non-governmental Organisations	Principal Ecologist
	Head of Species Monitoring and Research
	Head of Conservation Science
	International Policy Officer
Academic and Research Institutions	Co-chair Ecosystem Health Indicators Sub Group
	Member Biodiversity Indicator Review Panel
	Macroecologist
	Plant Ecologist
	Senior Programme Officer Ecosystem Assessment and Policy Support
	Research Fellow Indicators and Assessment Unit

Appendix 3: Final coding structure for analysing interview data







Appendix 4: UK Biodiversity Indicators 2018

Indicator	Measure(s)
A1. Awareness, understanding and support for conservation	
A2. Taking action for nature: volunteer time spent in conservation	
A3. Value of biodiversity integrated into decision making	
A4. Global biodiversity impacts of UK economic activity/ sustainable consumption	
A5. Integration of biodiversity considerations into business activity	A5a. Environmental Management Systems
	A5b. Environmental consideration in supply chains
B1. Agricultural and forest area under environmental management schemes	B1a. Area of land in agri-environment schemes
	B1b. Area of forestry land certified as sustainably managed
B2. Sustainable fisheries	B2a. Proportion of fish stocks harvested sustainably
	B2b. Biomass of stocks at full reproductive capacity

B3. Climate change adaptation	
B4. Pressure from climate change (Spring Index)	
B5. Pressure from pollution	B5a. Air pollution B5a(i). Area affected by acidity B5a(ii). Area affected by nitrogen
	B5b. Marine pollution
B6. Pressure from invasive species	B6a. Freshwater invasive species
	B6b. Marine (coastal) invasive species
	B6c. Terrestrial invasive species
B7. Surface water status	
C1. Protected areas	C1a. Total extent of protected areas: on-land
	C1b. Total extent of protected areas: at-sea
	C1c. Condition of Areas/Sites of Special Scientific Interest
C2. Habitat connectivity	
C3. Status of European habitats and species	C3a. Status of UK habitats of European importance
	C3b. Status of UK species of European importance
C4. Status of UK priority species	C4a. Relative abundance
	C4b. Distribution
C5. Birds of the wider countryside and at sea	C5a. Farmland birds
	C5b. Woodland birds
	C5c. Wetland birds
	C5d. Seabirds
	C5e. Wintering waterbirds
C6. Insects of the wider countryside	C6a. Semi-natural habitat specialists
	C6b. Species of the wider countryside
C7. Plants of the wider countryside	
C8. Mammals of the wider countryside (bats)	
C9. Genetic resources for food and agriculture	C9a. Animal genetic resources – effective population size of Native Breeds at Risk C9a(i). Goat breeds C9a(ii). Pig breeds C9a(iii). Horse breeds C9a(iv). Sheep breeds

	C9a(v) Cattle breeds
	C9b. Plant genetic resources – Enrichment Index
D1. Biodiversity and ecosystem services	D1a. Fish size classes in the North Sea
	D1b. Removal of greenhouse gases by UK forests
	D1c. Status of pollinating insects
E1. Biodiversity data for decision making	E1a. Cumulative number of records
	E1b. Number of publicly accessible records at 1km² resolution or better
E2. Expenditure on UK and international biodiversity	E2a. Public sector expenditure on UK biodiversity
	E2b. Non-governmental organisation expenditure on UK biodiversity
	E2c. UK expenditure on international biodiversity