

RESEARCH ARTICLE OPEN ACCESS

Archetypes of the Implementation of Ecosystem Service Approaches in Business Organisations: A Meta-Analysis

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ABSTRACT

Humanity is dependent on ecosystems and the services they provide, yet unprecedented biodiversity decline continues. Ecosystem service (ES) and natural capital approaches offer a promising framing of the relationship between organisations and ecosystems, although not enough literature exists on their implementation and implications. We analysed 125 case studies from 81 companies to understand how the implementation of ES approaches aligns with the theory. Thematic and archetypal analysis of the data highlights that the implementation of ES approaches can help organisations contribute to ecosystem restoration, but only if implementation encompasses actions and monitoring, is collaborative and is adopted at scale. Our contribution is threefold. First, we provide new empirical evidence of ES approaches used by corporations. Second, we analyse the translation of theory into practice and identify areas for improvement. Third, we use archetypal analysis to discern patterns of implementation of ES approaches in corporate sustainability.

1 | Introduction

Humanity is exceeding planetary boundaries by causing unprecedented rates of climate change and biodiversity loss (Richardson et al. 2023; Steffen et al. 2015). Businesses play a role in helping humans live within planetary boundaries through corporate sustainability (Hoffman and Georg 2018). This article examines the use of ecosystem service (ES) approaches across 81 business organisations. Organisations have a growing interest in ES and natural capital approaches (Figge and Hahn 2021; Guerry et al. 2015; Hahn et al. 2017; Lamont et al. 2023; Tashman 2020). Yet there is limited evidence on their organisational use (Ahlström et al. 2020; D'Amato et al. 2015; D'Amato et al. 2018; Pogutz and Winn 2016; Thompson 2019; Wagner 2023). While there is

some management literature on the relationship between ecosystems and organisations, scientific evidence indicates continuing decline in the state of ecosystems (IPBES 2019) and more needs to be done to address this corporate-ecological disconnect (Ahlström et al. 2020; Lamont et al. 2023; Whiteman et al. 2013). The practice of corporate environmental sustainability has yet to achieve the goal of reducing the rate of global environmental decline (Guimarães-Costa et al. 2021). Bridging this research gap is important as business organisations have profound and global impacts and depend on ecological systems (D'Amato et al. 2022). Business organisations must 'manage their relationship with the natural environment so as not to destroy the very life-supporting foundations provided by nature' (Winn and Pogutz 2013, 1). Research has dispelled misconceptions that biodiversity loss is driven by a

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few sectors rather than by almost all (Panwar et al. 2023) and has brought disciplines together to explore public and private governance of our ecosystems (D'amato et al. 2022; T. Smith et al. 2020). Our contribution focuses on how organisations are implementing corporate sustainability theories across multiple organisations and what transferable lessons of best practice can be drawn.

Ecosystem services (ES) are 'the benefits people derive from ecosystems' (Millennium Ecosystem Assessment [MA] 2005), and natural capital is 'the stock of properly functioning natural assets (such as forests, wetlands, rivers, coasts) that yield a flow of valuable goods and services into the future' (van den Belt and Blake 2015, 668). In what follows, we use the term ES approaches to refer to both natural capital (the stock of environmental assets) and ESs concepts (the received flows of impacts and benefits). Biological diversity (biodiversity) underpins the health of ecosystems and the services it provides (Harrison et al. 2014). We examine the implementation of ES approaches in corporate sustainability, our hypothesis being that the practical implementation of ES approaches diverges from the theoretical corporate ES approach implementation framework (D'Amato et al. 2018). The aim of this research is to understand if, and how, implementation of corporate ES practice deviates from theory. This aim is focused around two objectives;

- The assessment of empirical cases against the refined D'Amato et al. (2018) framework for assessing and responding to corporate impacts and dependencies on ESs, and
- The analysis of these empirical cases to identify archetypes and the wider lessons these archetypes may hold for future implementation.

These research objectives help both the research and practitioner community learn lessons from empirical cases of implementation and identify areas to strengthen implementation in practice. The archetypes also highlight opportunities for further research to accelerate and improve implementation in specific organisation types, regions and sectors.

We seek to understand where deviations by practice from theory occur through conducting a meta-analysis of 125 case studies from 81 business organisations. We make three key contributions to the literature. First, we provide new evidence of the implementation of ES approaches in corporate sustainability practice across geographies and sectors. Second, we analyse the translation of ES approaches from theory to practice and consider areas for improvement. Third, we use archetypal analysis to identify patterns in the implementation of ES approaches in corporate sustainability.

In what follows, we will first review the literature on corporate environmental sustainability, corporate environmental reporting, integrated reporting, ES approaches and ES implementation theories and methods. We then outline the methods we use to analyse the cases and report our results. Next, we discuss the implications of our findings and our contribution to the literature before concluding, discussing the limitations of our study and areas for future research.

2 | Corporate Sustainability Practice and ES Approaches

Management research on the relationship between organisations and ecosystems has a long history. Starik and Rands (1995), Gladwin (1992), and Shrivastava (1995) established ecological sustainability as a field of management literature in the 1990s. Shrivastava (1995) noted that organisations were key drivers of development and yet they remained understudied as a source of environmental problems. Gladwin et al. (1995) discussed biophysical boundaries noting that some management research is conducted as if organisations had no biophysical foundations. Starik and Rands (1995) developed a seminal multilevel, multisystems theory for ecological sustainability in organisations. Since the 1990s, a (natural) resource-based view of the firm (Hart 1995; Tashman 2020), institutional theory (Hoffman and Jennings 2015), industrial ecology (Erkman 1997; Yeo et al. 2019) and approaches to environmental management tools and systems (Schaltegger et al. 2017; Welford 2016) have emerged. However, corporate environmental sustainability practice has had limited effect on the decline of the biosphere which is referred to as *the corporate-ecological disconnect* (Ahlström et al. 2020). ES approaches have potential for bridging this disconnect (Howard-Grenville and Lahneman 2021; Mace et al. 2014; Macellari et al. 2018; Pogutz and Winn 2016; Whiteman et al. 2013). ES approaches conceptualise the environment as a stock of capital providing environmental functions and beneficial services to humans. ES approaches are well established in the natural science literature, with a range of ES methodologies and tools developed over the last two and a half decades (Biggs et al. 2021; Katic et al. 2023; Potschin and Haines-Young 2016; Sukhdev et al. 2010). However, research is needed on corporate environmental sustainability practice in the 'real world' to better understand the connections between the theories and practice and help reduce the corporate-ecological disconnect. This article seeks to address that need.

Research on corporate environmental reporting is well established in both management and accounting literature (Boiral 2016; Unerman et al. 2018). Corporate reporting and disclosure can be either mandatory or voluntary, where voluntary reporting is understood as the sharing of information in the absence of laws or regulations requiring it (Lev 1992). Voluntary corporate reporting can foster the legitimacy of businesses among stakeholders (Montabon et al. 2007) and help establish their 'public license to operate' (Deegan 2002). Corporate reporting has expanded from financial reporting to environmental and social aspects which were earlier considered 'externalities' of the operations of businesses (Unerman et al. 2018). There is large literature on corporate environmental reporting and disclosure (Bebbington and Unerman 2020; Boiral 2016; Boiral et al. 2019; Gray and Bebbington 2000), but there is a gap on the link between corporate reporting and corporate action to address environmental decline.

While progress in corporate environmental reporting is promising, the depth, quality and robustness of the reporting vary. One criticism of corporate environmental reporting and disclosure relates to its potential to misrepresent the environmental performance of organisations (Boiral and Henri 2017; Gray 2010; Kareiva et al. 2015; Milne and Gray 2013) or

'greenwashing' (Lyon and Maxwell 2011). This misrepresentation can exacerbate an unsustainable relationship between an organisation and the environment and erode stakeholder confidence (Montabon et al. 2007). To build stakeholder confidence and address concerns about a lack of transparency, businesses increasingly have their sustainability reports assured through certification and independent consultants (Braam et al. 2016).

While there are many certified corporate reporting standards, such as the International Integrated Reporting Framework (Simnett and Huggins 2015) and the Global Reporting Index (GRI) (Christofi et al. 2012; Hedberg and Von Malmborg 2003; Herzig and Schaltegger 2006), corporate environmental reporting frameworks based on ES approaches are still in their infancy. The BS 8632 (G. S. Smith et al. 2023), the emerging ISO Standard 14054 (Bux et al. 2024) and EU INCA project Phases 1, 2 and 3 (see Hein et al. 2020) are addressing the issue, but there is not yet an international standard for independent verification of reports applying ES approaches.

Accounting research on social and environmental impacts of businesses examines both what is reported and how it is reported. Hoffman and Georg (2018) highlighted that research focuses on accounting techniques and, in particular, on the more technical aspects of how to account for activities not included in financial accounting (Bebbington and Unerman 2020; Unerman et al. 2018). The term 'integrated reporting' is synonymous with the term 'value reporting' (Livesey and Kearins 2002). Value reporting seeks to provide more transparent information to multiple users beyond investors (Clark Williams 2008). Both integrated and value reporting communicate to stakeholders a broader notion of value beyond financial value, including changes to cultural, intellectual, human (social), physical and natural capital. It is in this integrated reporting context that many of the case studies of ES approaches are mentioned.

There is also a growing literature on natural capital accounting. The British Standard BS86342 standardises how to account for natural capital as well as the emerging global standard ISO14054 (Bux et al. 2024). There is also a growing strand of biodiversity accounting research (Anthony and Morrison-Saunders 2023; Atkins et al. 2014; Boiral 2016; Boiral and Henri 2017; Boiral et al. 2019; Cuckston 2019). Other ways to approach ecosystems in corporate reporting include stewardship accounting (Jones and Solomon 2013; Siddiqui 2013; Skouloudis et al. 2019), certifiable standards (Boiral et al. 2018; Cuckston 2018; S Schaltegger and Beständig 2010) and off-setting (Cuckston 2019; Gamarra et al. 2018; Tregidga 2013).

ES approaches remain understudied in corporate environmental sustainability literature (Hahn et al. 2017; Williams et al. 2024). Whiteman et al. (2013) highlight the dependency of organisations on healthy ecosystems and emphasise that an organisation is only as healthy as the ecosystems within which it operates. Winn and Pogutz (2013) discussed the contribution of ES approaches to corporate environmental literature and the impact businesses have on ESs and later examined the Italian food company Barilla's use of sustainable agriculture (Pogutz and Winn 2016) and their application of ES approaches. Vihervaara

and Kamppinen (2010) explored the use of ES approaches in Finnish forestry organisations, finding that the adoption of ES approaches is increasing but that further stakeholder engagement is needed to mainstream them. Haffar and Searcy (2018) explored the relationship between biospheric integrity boundary and environmental target setting in businesses. D'Amato et al. (2018) examined natural capital approaches in Chinese organisations, developing a framework for assessing and responding to corporate impacts, dependencies, risks and opportunities of ESs.

These studies highlight why understanding the links between ecosystems, biodiversity and corporations is important by considering how those links affect dependency, impact, risk, opportunity and response practice (Hanson et al. 2008; Sukhdev et al. 2010). They follow a view that organisations depend on ecosystems both directly and indirectly, while creating both positive and negative ecosystem impacts. However, Ahlström et al. (2020) note that research on ES approaches in businesses is often theoretical and lacks empirical insight, while Winn and Pogutz (2013) highlighted the lack of empirical research on ES approaches and called for improvement of the knowledge base on the contribution of ES approaches to corporate environmental sustainability. This article addresses the gap by generating new empirical evidence on organisational use of ES approaches.

3 | Analytical Framework, Materials and Methods

We examine the use of ES approaches in organisations of different sizes and across sectors and geography to discern whether the implementation of ES approaches diverges from the theory and whether it advances environmental management practice. We analyse the implementation of the ES approaches using an abductive qualitative approach, drawing from corporate reports as our main material. We first conduct a thematic meta-analysis of the case studies of implementing ES approaches in corporate environmental sustainability reporting and then use archetypal analysis to discern patterns across cases (Rudel 2008).

We build on D'Amato et al. (2018), who examined the ES approaches in Chinese forestry sector businesses. They developed a framework for assessing and responding to corporate impacts and dependencies on ESs, and for the identification of related business risks and opportunities. We have adapted the framework by adding two additional stages indicated in Figure 1: a scoping stage (to clearly define the boundaries, motivations and location or context for further assessment) and a final stage, monitoring and evaluation, to assess success and provide a feedback loop for continuous learning and improvement (see also Small et al. 2023 for a detailed explanation of the adapted framework). We apply this adapted framework in our thematic analysis of case studies. Figure 1 illustrates the six stages of this implementation framework for assessing and responding to corporate impacts and dependencies on ESs.

3.1 | Data Collection

We collated examples of organisational use of ES approaches from corporate reports and created a database of them. The

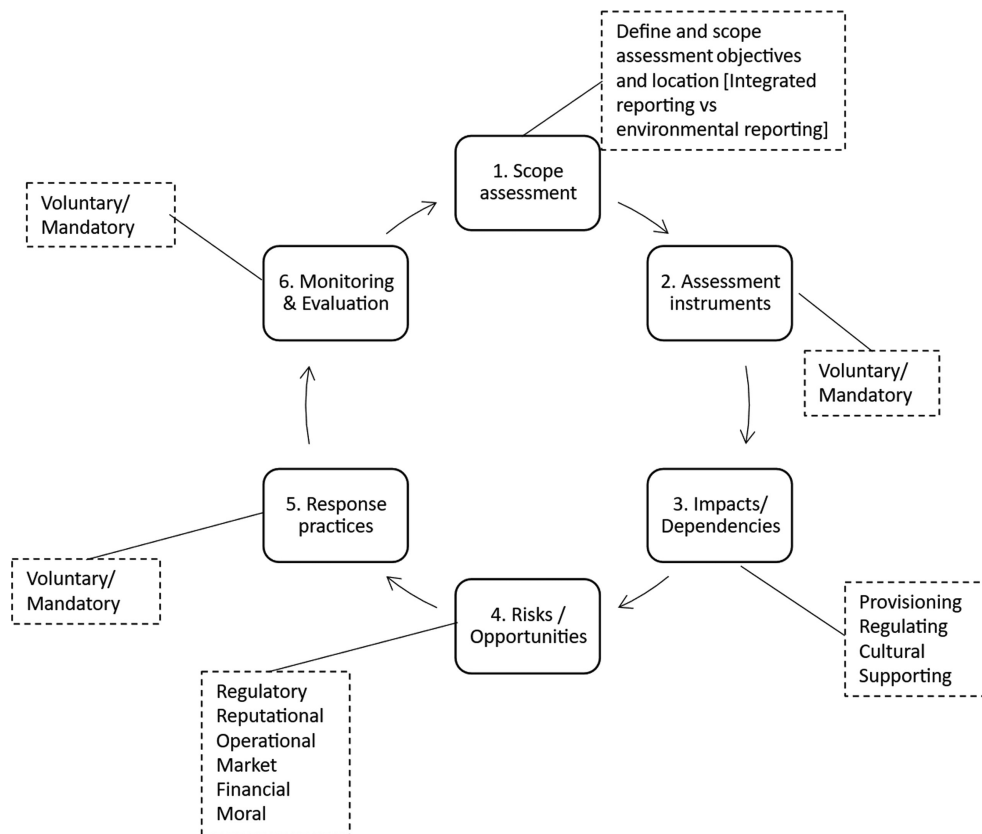


FIGURE 1 | ES implementation in corporate sustainability (simplified from Small et al. 2023 and adapted from D'Amato et al. 2018).

case study database was developed as part of work conducted with the Capitals Coalition. As a leading global coalition of organisations using natural capital concepts, the Coalition had an initial list of companies using ES approaches. The lead author then updated this list in partnership with the Coalition; a section of the list then informed the development of the database. This list was filtered to focus on private sector organisations only. Information about each case study was then extracted by desk-based research analysing publicly available corporate reports for each organisation and entered into the research database (see below).

We first gathered descriptive characteristics of each case study. This helped to develop the database, was useful in later stages of analysis and facilitated the development of inclusion and exclusion criteria for meta-analysis. Characteristics included the organisation name, type, size, reporting year, sector and geography. Reporting years of the case studies ranged between 2012 and 2019. Organisation types included investor organisations (9%), business-to-consumer (B2C) organisations (49%) and business-to-business (B2B) organisations (42%). The three largest sectors were materials (e.g., ArcelorMittal, Dow Chemicals and Tata Steel), consumer discretionary (e.g., Kering and Unilever) and finance (ABN AMRO, BNP Paribas). Organisations used consultants to support their ES assessment in 41% of the case studies, while internal expertise was relied on in 22% of the cases. In the rest of the cases, it was not disclosed where expertise came from.

3.2 | Qualitative Thematic Meta-Analysis

Meta-analysis offers robust methodologies and procedures for analysis (Hoon 2013). Qualitative meta-analysis is an approach for synthesising primary qualitative data from case studies (Habersang et al. 2019). It was chosen as an approach as the cases of organisational use of ES approaches were publicly available in corporate reports in large numbers; we found 172 cases prior to the application of the inclusion criteria.

Our qualitative meta-analysis followed the three stages described by Hofmann et al. (2011): selecting relevant studies and defining criteria for inclusion/exclusion; classifying the information provided in the selected studies to create a common vocabulary for the analysis; and analysis. Our inclusion criteria were as follows: (1) only for-profit businesses; (2) the cases need to focus on ESs; and (3) the cases need to provide sufficient data (i.e., a paragraph in a press release was not included as a case study). Second, a set of classifications were established for each criterion drawn from our theoretical framework in Figure 1. The criteria were developed and recorded in a separate tab in Microsoft Excel, and drop-down boxes were developed to ensure consistency in the analysis. The third stage included the thematic analysis of all reports.

We conducted thematic analysis of corporate documents to gather data. The themes (codes) were the stages indicated by our conceptual framework (Figure 1) (Terry et al. 2017). This allowed us to

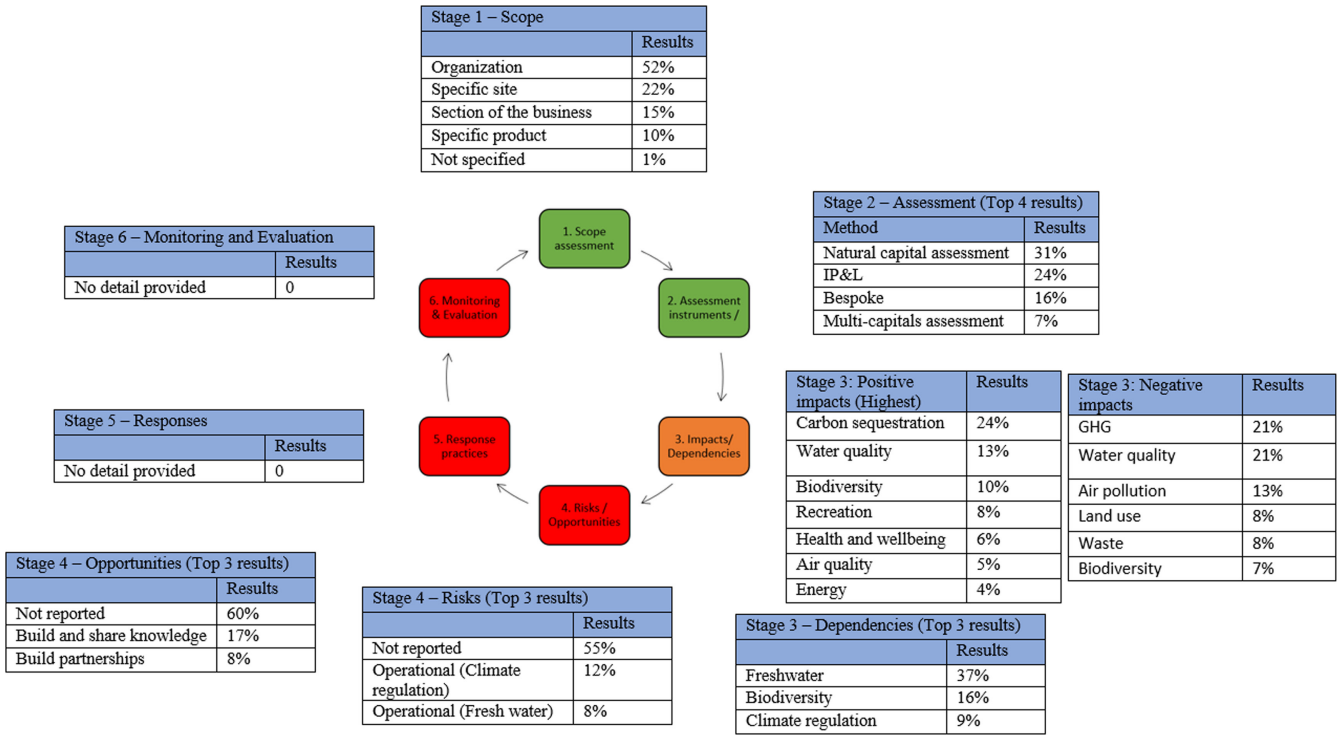


FIGURE 2 | Summary results from the conceptual framework (adapted from D'Amato et al. 2018) and a supporting traffic light coding.

populate each stage with the data emerging from the corporate reports. The first iteration of coding was based on our adaptation of the D'Amato et al. (2018) framework. In the second iteration of coding, additional secondary codes were developed, so that a final iteration used standardised coding criteria.

For each case, we analysed using our framework (Figure 1): the scope of the assessment (Stage 1); the assessment instrument (Stage 2); the assessed ecosystem impacts and dependencies a (Stage 3); the identified ecosystem risks and opportunities (Stage 4); response practices (Stage 5); and monitoring and evaluation (Stage 6).

3.3 | Archetype Analysis

Next, we conducted archetype analysis to discern modes of implementing ES approaches (Eisenack et al. 2021; Eisenack et al. 2019). Archetypal methods are used in qualitative meta-analysis of cases (Oberlack et al. 2019). Archetypes can be defined as 'depicting representative patterns' (Sietz et al. 2019, 33). The tenets of archetypal analysis are that there are recurrent patterns across the phenomena of interest (Eisenack 2012), that there are multiple models within the meta data (Oberlack et al. 2019) and that the attributes of cases can be described in an intermediate degree of semantic abstraction (Eisenack 2012). The abstraction should be general enough so that it can be found in more than one case, but not so general that it appears in every case.

The archetype approach [is] particularly useful when dealing with heterogeneous set of cases where there is a need to compare, generalize, or transfer insights across multiple cases. Archetype analysis identifies

a suite of archetypes to explain the phenomenon of interest. This approach enables researchers to capture critical details of heterogeneous cases while generalizing across them.

(Oberlack et al. 2019, 26)

The type of archetype analysis we conducted is systems archetype analysis, which identifies and explains common patterns as building blocks in the systems of concern to achieve cumulative learning from cases (Oberlack et al. 2019). We understand the relationship between organisations and ecosystems as a socio-ecological system and seek patterns in groups of cases (or building blocks) to understand implementation of ES approaches in corporate environmental sustainability. The identification of archetypes can be inductive, identifying similar patterns in a large number of cases (Sietz et al. 2017) or deductive, actively seeking manifestations of a particular theory (Manuel-Navarrete et al. 2007). We used an inductive approach, systematically organising the data by each database criterion (e.g., business type or geographic location) and analysing the reorganised and re-grouped data for archetypes.

4 | Results

4.1 | Analysis of Case Studies Using Our Conceptual Framework (Figure 1)

The application of our framework yielded results that are summarised in Figure 2 and interpreted in more detail below. We have used a colour coding system in the figure to facilitate interpretation; stages coloured green are implemented well, stages coloured orange need improvement, and stages coloured red are

implemented poorly to not at all. Figure 2 includes the six-stage adapted framework in the centre with a summary table of results for each of the stages around the outside.

For Stage 1: Scope of the Assessment, the majority of assessments had an organisation-wide scope (52%), followed by assessments of a specific site (22%), a section of the business (15%) or a product (10%). Just 1% of cases did not communicate the scope of the assessment. Most cases had an international scale (46%), followed by national (26%), site (20%) and unknown scale (2%).

The majority of assessments focused on direct operations (58%), while some also covered value chains (18%). Upstream and direct operations (7%) and downstream operations (5%) were less common scopes of assessment, and 12% of cases did not report scope. Our finding that the majority of case studies focus on direct operations resonates with the earlier literature (see D'Amato et al. 2018), but our findings also highlight emerging awareness of the need to cover value chains in ES assessments in almost a third of cases.

For Stage 2: Assessment Instruments, all assessments in the case studies were voluntary. Over half of them were natural capital assessments (31%) or integrated profit and loss accounts (24%), followed by bespoke assessments (16%) which included specific tools developed by consultants to undertake natural capital or ESs assessments. Other methods such as multicapitals assessment, ecosystem valuation assessments and life cycle assessments made up the remaining 29%. Additional information on methods used in cases is in Table S1.

For Stage 3: Impacts and Dependencies, most cases (89%) involved an appraisal of positive and negative impacts of the business on the environment. The remaining 11% of cases did not appraise impacts, indicating a risk of greenwashing. The most common positive ES impacts were carbon sequestration and water quality improvement, followed by enhanced biodiversity. Biodiversity was assessed in 10% of the cases, which suggests an emerging understanding of the relationship between biodiversity, natural capital assets and the services it provides. Some identified impacts and criteria in the assessments are not really ESs, and there are also deviations from the theory in the implementation of ES approaches. Some of the criteria in impact assessments are just historic environmental management assessment criteria. Table S2 provides a full list of positive impacts in the assessments, and Table S3 provides the negative impacts. Greenhouse gas (GHG) emissions and water pollution were the most common negative impacts in the assessments, followed by air pollution.

Only 29% of the cases included an appraisal of the dependencies of the organisation on ecosystems. Those organisations that do report on dependencies most often cite dependency on fresh water (37%). Biodiversity dependence, which we note underpins all other ESs, is the second most often reported (16%) and climate regulation is the third most often reported dependency (9%). Other reported dependencies included reliance on pollination, disease regulation, and soil fertility.

For Stage 4: Risks and Opportunities, risks are often mentioned in the case studies as the rationale for undertaking

an assessment, but the majority of cases (55%) offer no detail on what the risks are to the business or ecosystems. Climate change was the most common reported risk (12%) and the availability of freshwater was the second most common (8%). The remaining 25% of cases reported a range of ES risks. Somewhat surprisingly, 60% of the case studies did not report any opportunities. The ability to share knowledge on ESs (8%) and to build partnerships (2%) were the most commonly reported opportunities. Acknowledgement of these opportunities is encouraging, as they are crucial for addressing the global challenges of ecosystem decline, as explored further in the discussion.

For Stage 5: Response Practice, a large proportion (39%) of the cases did not explain how the findings of their ES assessment would be responded to. Those that did provide response details most often mentioned continuing to report (17%), making further commitments (4%) and sharing knowledge (4%). This suggests that the ES assessments implemented in organisations are not translating into action.

For Stage 6: Monitoring and Evaluation, only one of the 125 cases indicated that the KPIs they had established as part of the ES assessment would be monitored. This is a substantial weakness in the implementation of ES approaches, which hinders continuous learning in the organisation, and will be expanded on in the discussion below.

4.2 | Archetypal Analysis

Building on the first stage of analysis, we sought to discern archetypes of the ES approach implementation in the case studies. We identified three archetypes: (1) multinational corporations (MNCs) (42 cases or 33% in this group) mostly use integrated reporting approaches; (2) (all) consumer-oriented organisations using ES approaches to report on climate change (29 cases or 23% in this group); and (3) organisations reliant on the sale of ES

TABLE 1 | Archetypes observed across the global application of ecosystem service approaches in corporate reporting.

Archetype	Type of organisation	Reason
Integrated reporting and multinational corporations (MNC)	Multinational corporations	Aligns with existing processes and reporting practice
Consistent inclusion of climate change in consumer facing organizations	Consumer facing organizations	Social license to operate
Global representation of resource-based industries	Resource based industry	High level of ecological embeddedness

(e.g., forest products and water) (35 cases or 27% in this group) manifest global application of ES approaches in corporate reporting, as summarised in Table 1. Each archetype is then explained below in more detail.

4.2.1 | MNCs and Integrated Reporting

Over a half of assessments by MNCs such as Kerring or Coca Cola use a profit and loss method or method consistent with existing corporate accounting methodologies; either an integrated profit and loss (IPL) or environmental profit and loss (EP&L) or natural capital protocol. Of the 42 MNC case studies, 36% used either IPL or EP&L and 40% used a natural capital assessment compatible with corporate reporting. These methods made up 76% of the sample, which suggests that MNCs prefer to use methodologies that integrate with existing corporate reporting procedures. MNCs are by definition based in more than one country and likely to have established reporting protocols to account for regional variances and to obtain a social licence to operate. Our findings corroborate the results of Pritchard van der Horst (2018), who found that MNCs wish to align with an established method of reporting.

4.2.2 | Consumer-Oriented Organisations Using ES Approaches to Report on Climate Change

Consumer facing organisations such as Nespresso and Unilever formed another group with a distinct ES approach implementation archetype. All of the cases (35) that reported on the organisation's ES impacts in detail analysed impacts on climate change. While all cases went on to analyse also other ES, the result highlights the centrality of climate change for consumer facing organisations. No matter what the geography or sector, climate change is key to consumer facing organisations, either driven by consumers or as part of their social licence to operate. The archetype also highlights how the climate change and biodiversity agendas are intricately interconnected in the implementation practice of corporate environmental reporting.

4.2.3 | Organisations Reliant on the Sale of ES

Organisations that are directly reliant on the sale of units of an ES flow such as forestry and water companies have a global presence in six of the seven continents of the world. For example, forestry companies reporting on using ES approaches are present in the United States, Russia, Latin America, Denmark and the Republic of Congo (as well as China; see D'Amato et al. 2018); tea and coffee production in India and Columbia; salmon fishing in Norway and the UK; and water utilities in the United Kingdom, Australia and Switzerland. The majority of resource-based industries (55% of the 43 cases) focused only on their direct operations in their ES approach, rather than including their supply chain as well. The database indicates a global spread of these organisations, and this uptake of ES approaches across these resource-based sectors will be explored further in the discussion.

5 | Discussion

Our research provides new empirical evidence on how ES approaches are being used in corporate environmental sustainability reporting. They are used in all kinds of organisations across a range of scales, with global analysis of direct operations being the most common approach. In what follows, the first section draws on the corporate ES approach implementation framework (Figure 1) and discusses the translation of corporate ES approaches from theory to practice. The second section builds on the archetypal analysis and considers the implications of its results.

5.1 | Implementation of ES Approaches From Theory to Practice

The level of detail and assessment becomes weaker throughout the implementation process: Stages 1–3 contain more detail than Stages 4–6. From the second section of Stage 3 (dependencies) through to Stage 6 (monitoring and evaluation), most case studies are rather scant in detail. Below, we discuss the strengths and weaknesses of current practice in relation to the literature.

Four strengths can be observed in the implementation of ES approaches in businesses: good scoping of assessments (Stage 1) with common themes across scales, sectors and regions and global reach; all case studies (Stage 2) were voluntary initiatives often by investors; good understanding was manifested of the impacts (Stage 3) particularly in relation to climate change and water use; and finally, the opportunity (Stage 3) to collaborate to address global challenges and share knowledge.

The meta-analysis indicated that ES approaches focus most often on climate change and water use/quality and less frequently on biodiversity. Given the urgency of the climate change agenda for corporate environmental sustainability, it is promising that climate change issues are noted as the most common impact in the assessment (Richardson et al. 2023). However, there are also intricate links between climate change and biodiversity loss and biospheric integrity (Rockström et al. 2018). Given the rise of biodiversity on the political and research agendas (Schröter et al. 2023) it is a deep concern that biodiversity is not afforded more significance in corporate assessments. Our meta-analysis suggests that ES approaches can be used across sectors, geographies and supply chains as well as across scales and organisation type. ES approaches offer finer granularity in corporate environmental sustainability reporting by drawing attention to the stocks of natural capital and flows of ESs. This finer granularity has the potential to improve corporate environmental sustainability reporting.

Several investment organisations produced case studies of investment projects where ES approaches were used to inform their investments. The case studies varied in depth, breadth and application but exemplify the demand from financial investors to understand ecosystem risks and opportunities for investment. There is thus awareness of environmental risks to business and demand by those seeking to justify ethical investments.

However, investors also require independent assurance or certifiable standards in ES use in corporate environmental reporting to avoid greenwash. While the use of ES approaches to inform investment decisions may advance corporate environmental sustainability, the approaches need to be robust, transparent and earn the trust of stakeholders.

Our analysis suggests that through the application of ecosystems service approaches, there was an awareness of the opportunity and need for greater collaboration and knowledge sharing when undertaking assessments. As noted by Lamont et al. (2023), multinational and transnational organisations have a great potential to lead and contribute to ecosystem restoration. If ES approaches help identify opportunities for business organisations to partner for the restoration of ecosystems on which they depend, it may be possible to work at scale towards ESs restoration. This offers potential for planetary-scale change and a significant opportunity for the implementation of ecosystems services.

Finally, the results indicate that organisations are aware of their impacts on ecosystems, with established methodologies such as Life Cycle Assessment (LCA) used to inform their ES approach. ES approaches can build on previous environmental sustainability initiatives such as managing the use of fresh water, when there is an alignment of scope and an understanding of ES methods.

Our meta-analysis made it clear that the implementation of ES approaches in organisations needs improvement and supports our hypothesis that implementation deviates from the theory. Three key weaknesses include the following: (1) limited analysis and reporting of the dependencies (Stage 3) including dependency on biodiversity; (2) limited reporting of risks and opportunities (Stage 4); and (3) limited monitoring and evaluation (Stage 5) as part of the assessment.

Few case studies identify and report on the dependencies of the organisation on ecosystems and the services they provide, which suggests a lack of understanding that the environment underpins the organisation (see Tashman 2020). Recognising this dependency is crucial to shifting the perception that the organisation is distinct from the environment. An understanding of dependency is also necessary to understand that the health of the organisation is related to the health of the ecosystems it operates within. It is difficult to ascertain whether the lack of assessment of dependency is due to weak implementation and reporting of ES approaches or due to a lack of knowledge. It may be that highlighting the dependency of an organisation on ESs may involve commercial sensitivities; therefore, it limits the amount of information in the public domain. Organisations should undertake an ES dependency analysis as part of implementation, not only to improve methodological robustness but also to deepen knowledge on how the business is dependent on nature. This information may remain confidential; however, independent assurance and a public acknowledgement of the dependency analysis is required for the implementation process. This, in turn, should enable the management of potential business risk associated with declines in these ESs, as explained in Stage 5.

The scarcity of natural resources and decline of ESs has drawn attention in the management literature. Figge and Hahn (2021)

discuss the importance of understanding the scarcity and constraints of natural resources on firms. While these risks and opportunities should be assessed in Stage 5 (see Figure 1), we found little evidence of this in our meta-analysis. Understanding these risks and gathering more data on the implications of resource scarcity is an important issue to address, since weak implementation of Stage 4 (risks) can hinder decision making in corporate environmental sustainability practice. Some case studies indicated that managing risks was a key motivation for implementing an ES approach but provided no detail on the risks that were assessed. This has the potential to undermine corporate reports and subject them to criticism as greenwashing.

There was also limited analysis of the opportunities (Stage 4) associated with ES approaches. Switching from a negative to positive framing is important for engaging a broader audience as well as for understanding the symbiotic relationship at the organisation–ecosystem nexus. For example, restoration of peatland in upland areas of a water catchment by a water company may offer recreational opportunities for stakeholders and reduce water treatment costs, one well-known example being the Catskill watershed supplying water to New York City (see Daily 2000). This action by corporates seeking opportunities and multiple benefits through investing in nature-based solutions should not only be analysed but also shared as part of the reporting process to advance good practice and inspire others to take similar action.

Finally, we found little attention to monitoring or evaluation in the case studies. Monitoring is essential to verify whether the actions are successful in achieving the aims and objectives established at the scoping stage (e.g., no net harm to natural capital assets or for best practice ecosystem restoration). Evaluating the appraisal also helps reflect on the data and processes that worked well and those that did not, and to learn and improve on in the next iteration of the appraisal. Furthermore, given the urgency of ecosystem decline, it is important that the actions to restore and regenerate ESs are monitored for success to bridge the corporate-ecological disconnect. Considering that the ecosystem and business are both living systems evolving over time, it is important to iterate ES approaches to monitor change and progress over time horizons. Businesses should make a commitment to monitor and evaluate the success of any outcome, ideally through disclosed KPIs, as well as support this process with appropriate resources to monitor actions of an agreed time period. Furthermore, a cyclical process is crucial to the continuous improvement of corporate sustainability practice. The observed weakness may be due to weaknesses in industry guidance such as the natural capital protocol, which at the time of this study period omitted monitoring of the assessment. Our analysis suggests that the majority of ES assessments are conducted in a linear way and that the assessments are not cyclical.

Implementing theory can often be challenging, which makes empirical research particularly important for theories seeking to contribute to reversing the planetary crisis. We find that the implementation of ES approaches deviates from theory. It becomes weaker through the later stages of the theoretical framework: Stages 1–3 are better implemented than the second half of Stage 3 through to Stage 6. This may be because the latter stages are more time and data intensive, or because momentum

is lost following an initial level of enthusiasm about using ES approaches.

The circularity of the framework is crucial for effective implementation of ES approaches. The first iteration of the Natural Capital Protocol in 2016, an early dominant industry guidance with global application, was linear and did not formally include circularity and feedback in implementation, deviating practice from theory. This was a weakness entailing missed opportunities for assessments to track progress over time. The process and the assessments need evaluating to see what worked well and to identify what data would help strengthen the next iteration of the ES assessment. The linear model of the Protocol was updated in 2019 to four stages and introduced circularity into its application. [Of note the reporting years within our sample database are prior to this update.]

5.2 | Archetypes of Organisational Use of ES Approaches and Their Implications

To extract further findings from our qualitative meta-analysis of ES case studies, we adopted archetypal analysis to discern common patterns in global ES implementation in corporate reporting. These archetypes and their implications can inform future literature and practice.

Our analysis finds that MNCs use integrated profit and loss methods in ES approaches. MNCs have often an established reporting procedure that is independently assured (see Braam et al. 2016). The established method and culture of reporting may constrain the tools and methods that MNCs use in conjunction with the ES approaches, as the data that are gathered have to fit within the established reporting frameworks. To date, there are no certifiable standards against which to audit the ES approaches used in corporate reporting. The commitment of many MNCs to third-party audit and certification may play a role in the implementation of ES approaches at scale, so until standards are available, the ES approaches may stay on the periphery of corporate reporting.

In the light of the literature, this archetype suggests that to avoid misrepresentation (see Boiral and Henri 2017) it is imperative that a certifiable ES standard is adopted that may be independently verified to ensure the implementation of theory to practice of ES is improved. The finding of this archetype can also be triangulated with the thematic analysis, which finds that a high number of bespoke ES assessment methodologies (the third highest implementation method) are being used. Certification is essential to avoid ES approaches becoming another failed environmental management approach that does not successfully address the corporate-ecological disconnect.

The climate crisis is gaining attention among consumers, signalled by the emergence of global change makers such as Greta Thunberg. Hahn et al. (2017) note that climate change is receiving greater attention than the ES approaches. The same is evident in our empirical analysis. Consumer-facing organisations that obtain their social license to operate from a broad range of stakeholders prioritise the climate change agenda. While carbon sequestration is an ES relevant for ES approaches, it should form

part of a broader ES approach. It is promising that consumer-facing organisations are undertaking and reporting on climate change impacts and opportunities using ES approaches. However, a robust ES assessment should include all ESs material to the organisation, not just the ones that stakeholders wish to see reported. This finding again highlights the need for independent certification and robust, holistic standards for corporate reporting based on ES approaches, to avoid misrepresentation and greenwashing.

This archetype offers positive opportunities for cross-partnership working. The implication of this archetype is a potential sectoral shift in reporting on the climate change agenda across geographies. This archetype suggests that there is momentum in the consumer-facing organisations to address both mitigation of and adaptation to climate change, and an important finding of note for national government and global climate change organisations.

We found that resource-based industries implement ES approaches in their corporate reporting across the planet. For example, forestry and water companies have a high level of corporate ecological embeddedness (see Whiteman 2010). Organisations such as Sveaskog, a Swedish forestry company, are dependent on the health of forest ecosystems in producing timber and selling it to customers. The same is true of other organisations that involve human use of water, forests, fisheries and the production of food, for example, tea and coffee. This close relationship between the health of the ecosystem and the primary product may explain why there is such a global spread of case studies of ES approaches in highly resource-dependent organisations.

This archetype illustrates the potential of ES approaches to address the corporate-ecological disconnect at both a planetary and site scale. The finding of an archetype that demonstrates the strength of ES approaches at working across scales and geographies is also corroborated by the MNC use of ES approaches that typically operate across scales and geographies. The cumulative findings are that the ability to apply across multiple scales and geographies, combined with implementation identifying the opportunities to collaborate and share knowledge, demonstrates the real potential for business use of ES approaches to contribute to global scale ecosystem restoration. However, this potential to help improve planetary health will not be realised until the challenges in implementation from theory to practice are resolved.

Next, we consider the cumulative implications of the archetypes by discussing them in relation to the strengths and weaknesses of ES implementation we identified earlier. There are three points for further discussion. First, the use of ES approaches in corporate reporting for MNCs holds potential for standardisation and for independent voluntary certification. Second, consumer-facing organisations could establish best practices in how to consider climate change in ES approaches and similarly seek independent certifiable standards. Finally, resource-based industries offer great opportunities to advance both monitoring and evaluation practice and raise sectoral awareness of the organisational dependency on the environment. We provide further detail on each point below.

First, the use of ES approaches in corporate sustainability reporting for MNCs holds potential for standardisation and an opportunity for independent voluntary certification once standards have been developed. Given the current homogenous nature of the scope and methods currently used in each MNC case study, reaching a consensus across the archetype may be easier to obtain than a consensus across all organisations. This standardisation and independent verification would improve robustness and reduce the charges of green washing, particularly in these global organisations. This offers significant opportunities for further research, too.

Second, consumer-facing organisations may drive for a certifiable standard of ES implementation to facilitate their stakeholder license to operate, particularly in relation to climate change. Given climate change is consistently included in ES approaches by consumer-facing organisations, there is significant opportunity to establish best practice on how to incorporate climate change agendas within ES approaches, particularly when considering boundaries between different organisations or between levels such as national and organisation-level climate change agendas. This would advance ES implementation in corporate environmental sustainability and contribute to reversing the global climate and biodiversity crises. Given the ever-growing societal pressure on consumer-facing organisations to demonstrate action on climate change, developing best practice techniques embedding carbon accounting within ES approaches and then developing independent verification could maximise the opportunity of this consistently reported ES in this archetype.

Third, resource-based industries have the potential for advances in monitoring and evaluation, for example relating site NC applications to national, international and global level applications. Furthermore, there is a great opportunity for this sector to emphasise the dependencies of organisations on a healthy ecosystem. If widespread knowledge and data sharing occurred between organisations and their stakeholders, e.g., organisations with community groups or between similar organisations, a more comprehensive understanding of the impacts and dependencies of the sector could be shared across multiple organisations. This would address a fundamental weakness in the implementation of ES approaches. Cross-sectoral sharing and implementation of this approach offer a significant opportunity to shift organisational awareness of the dependency on the environment.

6 | Conclusion

Ecosystem health is declining at an unprecedented rate and further research is needed to understand the relationships between organisations and ecosystems to help humanity remain within the planetary boundaries. Corporate environmental reporting is one way in which organisations share their wider value with stakeholders. We analysed the implementation of the ES approaches in corporate sustainability reporting, conducting a meta-analysis of 125 case studies of ES approach implementation. Our aim was to analyse the implementation of the theory of ES approaches in practice to support improvements in it, as well as identify further areas of research that can have real impact to

help bridge the corporate-ecological disconnect. The key lesson for practitioners from the research is the importance of completing the full ES approach cycle, including focusing on the opportunities, responses, actions and a commitment to monitor the success of interventions.

A limitation of this research is that we use organisation's self-reporting as our material—it may not offer granular enough evidence to obtain a comprehensive picture on the implementation of the ES approaches. Future research using other materials such as interviews with representatives of the organisations would complement and triangulate the findings. Our sample included companies who had chosen to link with a body championing the use of ES approaches; they may be leaders, rather than laggards, in their corporate environmental sustainability practices. A longitudinal study of corporate reports could offer further insights building on the results presented here.

We provide new empirical evidence on corporate environmental sustainability practice and the use of ES approaches in it. We find that the greatest weakness in the implementation is the deviation of practice from theory, with momentum lost in implementation. Next in the implementation cycle: a lack of monitoring and evaluation means that assessments may not be learned from and improved. The greatest opportunity in ES approach implementation is the opportunity for collaboration and knowledge sharing across organisations, and with this the potential for scaling ESs restoration on a planetary scale. Future areas of research could focus on why organisations lose momentum in implementation and do not respond, monitor or evaluate.

We use innovative archetypal analysis to discern patterns in the use of ES approaches in corporate sustainability reporting. The archetypal analysis shows that (a) multinationals have a preference for methods that align with existing reporting methodologies and hold strong potential for implementation at scale (if certifiable); (b) the consistent inclusion of climate change in consumer-facing organisations suggests the importance of stakeholder values and maintaining a social license to operate in the process of implementing ES assessments; and (c) the global reach of implementation of ES approaches in resource-based industries, such as forestry and water utility companies, who have a high level of corporate ecological embeddedness and depend on the health of ecosystems in producing their products. It is recommended that policy makers and practitioners should encourage peer-to-peer knowledge sharing to raise awareness of the sectoral dependency on the ecosystem and the urgency and importance of advancing sustainable business practices.

We find great promise in the implementation of ES approaches to help business organisations contribute to reversing ecosystem decline to restoration and enhancements, but only if implementation is conducted robustly, comprehensively, in collaboration and context, and at scale.

Acknowledgements

This research was supported by the White Rose Doctoral Training Centre through the Economic and Social Research Council grant number ES/J500215/1 COHORT 6 awarded to Angela Naomi Small.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.