Using outcomes-based contracting to tackle the climate crisis

A review of the evidence

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Research contribution statement

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About the Government Outcomes Lab

The Government Outcomes Lab (GO Lab) is a research and policy centre based in the Blavatnik School of Government, University of Oxford. It was created as a partnership between the School and the UK Government and is funded by a range of organisations. Using qualitative, quantitative and economic analysis, it investigates how governments partner with the private and social sectors to improve social outcomes.

The GO Lab team of multi- disciplinary researchers have published in a number of prestigious academic journals and policy-facing reports. In addition, the GO Lab hosts an online global knowledge hub and data collaborative, and has an expansive programme of engagement and capacity-building to disseminate insights and allow the wider community to share experiences with one another.

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Abbreviations

CSI	California Solar Initiative
DER	Distributed energy resource
DIB	Development impact bond
EIB	Environmental impact bond
EMaaS	Energy Management-as-a-Service
ESCO	Energy service company
ESPC	Energy saving performance contract
GO Lab	Government Outcomes Lab
M&V	Measurement and verification
NGO	Non-governmental organisation
OBC	Outcomes-based contracting/contract
P4P	Pay-for-performance
PBI	Performance-based incentive
PPP	Public-private partnership
RBF	Results-based financing
SDGs	Sustainable Development Goals

Executive summary

Outcomes-based contracting (OBC) has the potential to contribute towards meeting environmental objectives, and has been implemented in a range of environmental policy areas, including agriculture, waste management, and energy. Existing empirical evidence is fragmented, however, and has never been systematically collated and examined. This report offers an overview of the existing empirical literature on environmental OBC, and a summary of key findings from across the evidence, including the challenges and successes of project implementation and some indications of the environmental outcomes achieved.

RECOMMENDATIONS

1) To ensure that they are both ambitious *and* realistic, incentivised *targets* should be attuned to local context and based on an understanding of key environmental factors

Difficulties arise when targets are based on unrealistic predictions of what is possible. It is therefore important to consult with communities and experts, and to draw on existing data, to inform incentive design. If available, historical records of the environmental factors that will influence service performance should be examined. Proportional payments according to progress made may help avoid 'incentive-motivation mismatch' – but the balance between flexibility and discipline needs to be considered carefully.

2) Environmental *metrics* should be chosen with due consideration for broader ecological effects

Interventions into ecosystems should be informed by an understanding of their complexity, as unintended effects may occur when only one outcome is financially incentivised. People with knowledge of the ecosystem and associated communities should therefore be involved in the design of environmental OBCs, so the interests of the ecosystem as a whole can be represented in the contracting process.

3) Energy service company (ESCO) contracts should be explored for their application into other environmental policy areas

The evidence indicates ESCO contracts – wherein the energy service company is financially rewarded for reducing a client organisation's energy usage – are well established, operating at scale, and generally achieve the desired energy savings. Both researchers and practitioners should therefore explore the extent to which the 'ESCO model' can translate into other policy areas and economic contexts.

WHAT IS ENVIRONMENTAL OUTCOMES-BASED CONTRACTING?

Outcomes-based contracting is a funding structure for the provision of services. A provider is responsible for delivering contracted services on behalf of a commissioner. The commissioner pays the provider, with payment contingent upon the achievement of pre-specified, measurable outcomes. Environmental OBC is therefore a version of this funding arrangement where payment is made for *environmental* outcomes – better water quality, reduced energy usage, and so on.[1]

NATURE AND COVERAGE OF THE EVIDENCE ON ENVIRONMENTAL OUTCOMES-BASED CONTRACTING

The evidence for environmental OBC collated in this report consists of 18 published studies. Across those studies, the research team identified 71 individual outcomes contracts.[2]

The OBCs represented in the evidence cover a range of environmental policy areas: energy (51); pollution and waste management (8); water (8); agriculture (2); and sustainable infrastructure (2). The large majority of OBCs represented within the evidence are therefore energy programmes.

A wide variety of metrics were used to determine outcome payments across environmental policy areas, as the following sample demonstrates: reduced energy usage; increased crop yields; 'cleanliness' of stoves; improved water quality; reduced stormwater run-off; as well as various service delivery standards (such as health and safety). Social goals are included alongside environmental goals in some OBCs, either directly as payable outcomes, or indirectly as conceived within the broader aims of a project.

Geographically, the majority of the OBCs were implemented in the USA (52), followed by Taiwan (8), India (6), Peru (2), China (1), Indonesia (1), and the UK (1).

The use of OBC for environmental policy therefore appears to be quite well established, at least for achieving demand-side energy savings. The evidence suggests more diversity in both policy area and geographical location since the 2010s. While not conclusive (given the small sample size), this could suggest a growing appetite globally for environmental OBC. Nevertheless, the evidence remains clearly skewed towards energy programmes, and towards the USA, raising the

[1] For the purposes of this report, we have limited the definition of OBC to those that commission private or non-governmental organisations only. Alternative forms of OBC that pay public sector organisations, or individual people/households, are therefore *not* addressed in this report.
[2] It is apparent that many more individual OBCs have been implemented – these 71 are simply those that were discussed with sufficient detail in the available studies to allow for their data to be collated by the research team.

question of how far the lessons learned can be applied to other policy areas, economies, and geographies.

SYNTHESIS OF FINDINGS FROM THE REVIEWED STUDIES

Use case

The most frequently reported reasons for using an OBC were to incentivise achievement of the desired environmental end, and to allow the service provider flexibility and innovation towards that end. For the specific goal of reduced energy consumption, OBC is claimed to remove financial barriers to implementing energy saving measures, as well as to address the financial concerns of utilities companies for whom reduced energy usage would otherwise be against their interests.

Implementation challenges and successes

The challenges and successes reported in the included studies emphasise the importance of a well-designed incentive structure; namely, clearly-defined outcomes metrics and realistic targets. Projects that did not include such well-chosen metrics and targets reported a variety of challenges, including inability to verify a specified outcome, and 'incentive-motivation mismatches' whereby the potential benefit to the service provider is outweighed by the cost/difficulty of meeting contracted targets. Further factors reportedly contributing to successful implementation were stakeholder buy-in, and a legal/regulatory context that facilitates, rather than restricts, the kinds of innovative service partnership that OBCs are intended to produce.

Environmental outcomes achieved

From those studies that reported on outcomes achieved, two main findings arise: 1) Energy service company (ESCO) contracts designed to achieve energy savings largely achieved that aim; 2) Public-private partnerships for water quality and provision in India made minimal or no progress towards incentivised target.

A development impact bond (DIB) for cocoa production in Peru and a World Bank Clean Stoves Initiative were the only other projects with outcomes data reported in this review's included studies. Service users in the Clean Stove Initiative in China saved fuel and reported improved air quality. The Cocoa DIB met and exceeded two of its four targets, and made progress towards, but ultimately missed, the other two.

Influence of OBC on service delivery

The practice of monitoring and measuring progress inherent in the OBC model was reported to have positive influence on service delivery in energy projects, a waste management project, and the clean stoves initiative. The monitoring process prompted services to learn and improve their program design and delivery. By

contrast, however, in an Indian water PPP, the attempt to introduce monitoring was met with public opposition, stalling the project's implementation.

RESEARCH METHOD: SYSTEMATIC REVIEW

The method used in this report is a systematic review. A systematic review is a form of literature review that uses rigorous searching and screening in order to collate all existing published evidence on a particular topic. This establishes a clear understanding of the current state of an evidence base, and allows insights to be synthesised from across a comprehensive body of available research.

The environmental focus of this report is part of a wider systematic review of outcomes-based contracting in *all* policy areas, currently being conducted by the Government Outcomes Lab and Ecorys. The research team identified 18 studies of environmental outcomes contracts, which constitute the evidence for this report. Details of the studies and the OBC programmes they examine were summarised, and 'evidence maps' produced to represent the state and coverage of the available evidence (section 3). Key findings from across the studies were then extracted and synthesised, focusing on the reported rationale for using OBC, the challenges and successes of design and implementation, and the reported impacts and outcomes of environmental OBC (section 4).

The report's findings were discussed with a panel of experts in a roundtable discussion, which aided the research team's analysis and brought to light further implications for policy.

1. Introduction

The climate crisis is the greatest challenge facing humanity. Climate change is predicted to have widespread destabilising effects, including extreme weather events, food and water insecurity, and undermining international peace. Recognition of the severity of these issues has led to a variety of commitments from governments, multilateral organisations, non-governmental organisations (NGOs), and private enterprises. From achieving net-zero carbon emissions to restoring biodiversity, there is a desire to mitigate climate change, adapt to its unavoidable effects, and manage the environment more sustainably in future. While the good intentions are there, the question then becomes one of implementation. Tackling the climate crisis will require innovation, more investment and more efficient spending, greater partnership between the public and private sectors, and a commitment to environmental outcomes.

Outcomes-based contracting (OBC) has been proposed as a potentially effective mechanism for achieving such innovative partnerships. Some research suggests that OBC can facilitate cross-sector efforts around an agreed goal (Mason, 2015) but the evidence base is diffuse and emergent (Clist, 2019; Picker *et al.*, 2021). Outcomes-based approaches to environmental management and climate change mitigation/adaptation have been implemented in a variety of contexts, and their potential role in addressing the climate crisis could increase as policy developments like Biodiversity Net Gain create markets for buying outcomes. No one has yet collated the existing evidence on OBC in the pursuit of improved environmental outcomes, however, or systematically examined it. This is critical to ensure we do not reinvent the wheel, but rather build on the lessons learnt and replicate effective practice. Hence this systematic review, the purpose of which is to examine the potential role of OBC in environmental policy.

The Government Outcomes Lab (GO Lab) and Ecorys are currently conducting a systematic review of evidence on OBC across *all* policy sectors (Picker *et al.*, 2021). Our aim is to produce a series of thematic outputs summarising the findings from a range of policy areas. The first policy-focused research output informed by the review examined impact bonds in education (Elsby *et al.*, 2022); this environmental report is the second.

AIMS AND RESEARCH QUESTIONS

This study investigates the adoption of outcomes-based contracts in the pursuit of improved environmental outcomes. Governments, multilateral agencies, and philanthropists are increasingly adopting outcome-based funding arrangements in the pursuit of a range of benefits, including improved cost effectiveness, innovation, accountability, systems-level planning, and responsiveness, with risk shared with the private sector (Albertson *et al.*, 2018; NAO, 2015; Clist, 2019). While outcome-oriented contracts are lauded by some as being highly-effective and uniquely innovative, attempts to shift public spending focus from inputs to outcomes is challenging (Bovaird & Davies, 2011), and payment for outcomes is still seen as a relatively new model in overseas development assistance (Clist, 2019).

The compelling logic within outcomes-based contracting – that specifying and steering services on the basis of social or environmental outcomes will deliver better outcomes – is appetisingly straightforward and aligns comfortably with much of the literature underpinning performance measurement and management. At the same time, evidence supporting the effectiveness of schemes operating under such contracting arrangements is limited (Carter *et al.*, 2018; Fox & Morris, 2019; Fraser *et al.*, 2018; Lagarde *et al.*, 2013) and fragmented (Picker *et al.*, 2021). This report responds by collating and synthesising empirical studies which investigate the adoption of outcomes-based contracts to secure improvements in the natural environment (broadly conceived), including climate change mitigation and adaptation.

The report is informed by an ambitious, global systematic review of outcomes-based contracting arrangements across all policy domains. This overarching review aims to offer accessible and reliable empirical insights so that organisations responsible for funding social and environmental programmes can make evidence-informed decisions on the most appropriate form of outcome contract or financing model to adopt in different contexts. The full, multi-year study is described in Picker *et al.* (2021) and aims to examine the effects associated with different forms of OBC across low, middle, and high-income contexts. The present report therefore examines an environmental sub-theme within the larger project. It is a preliminary review of evidence and is guided by the following research question:

"What is the nature and coverage of the existing empirical literature focused on outcomes-based contracts for environmental improvement, and how does this differ by type of funding instrument, policy area and/or country"?

STRUCTURE OF THE REPORT

The structure of the report is as follows:

- Section 2 describes the review method, outlining the search strategy, the inclusion criteria by which studies were selected, and the process of data extraction for the purposes of evidence synthesis.
- Section 3 provides a series of evidence maps, which present an overview of the evidence for outcomes-based contracting in environmental programmes. A breakdown of the studies and the outcomes-contracts represented within them is provided, including details of the different environmental policy areas in which OBCs have been implemented, the types of organisations involved, and the outcomes metrics that have been used to determine payment.
- Section 4 provides a thematic synthesis of the evidence from across the included studies, integrating their findings to identify commonalities and differences. Thematic summaries are presented regarding the rationale for using OBCs, the design and implementation process, and the reported impacts and outcomes of environmental OBCs.
- Section 5 is an analytic discussion of the review's findings, and considers the policy implications.

DEFINING OUTCOMES-BASED CONTRACTING

The mechanism at the heart of this review is the use of outcomes-based contracting as a funding structure for programmes which pursue environmental (and possibly also social) outcomes. There are important grounding concepts and notes on scope that inform the analysis throughout the report. Clear definitions are particularly crucial in this research area as there is considerable ambiguity in terminology used in the field of results-based financing (RBF) and beneath the umbrella term of 'outcomes-based contracting'.

We have defined outcomes-based contracting arrangements as the provision of any service or programme on behalf of a commissioner (e.g., a government outcomes payer) by non-governmental service providers, where payment to providers is contingent (either in full or partly) on the achievement of pre-specified, measurable outcomes. Key components therefore include: independent, non-governmental delivery agents; contracted provision; and payment contingent on outcomes performance/results achieved (Figure 1, see the yellow-hatched area).

To be included in the review, a study must describe contracts with a 'unit of incentivisation' that accords with the above definition – namely, an independent private or non-profit organisation, or, in the case of impact bond type models, investment funds/special purpose vehicles. This therefore excludes any projects where the incentivised agent is a government (e.g., some forms of results-based financing) or an individual person or household (e.g. performance-related pay for teachers or conditional cash transfers). Studies of programmes that incentivise individual landowners to achieve environmental outcomes are therefore *excluded* from the current review. While studies of such interventions exist, the focus of the present review is OBC mechanisms as they are applied to contracts between organisations.

There is a considerable body of research and evaluation material on outcomes-based contracting. The review process (described further in the methods section below) identifies papers – either formal academic articles or independent research published outside peer-reviewed journals – that provide an empirical contribution. We include a diverse range of study designs, including both quantitative experimental designs, qualitative research, economic analysis, and original, independent synthesis.

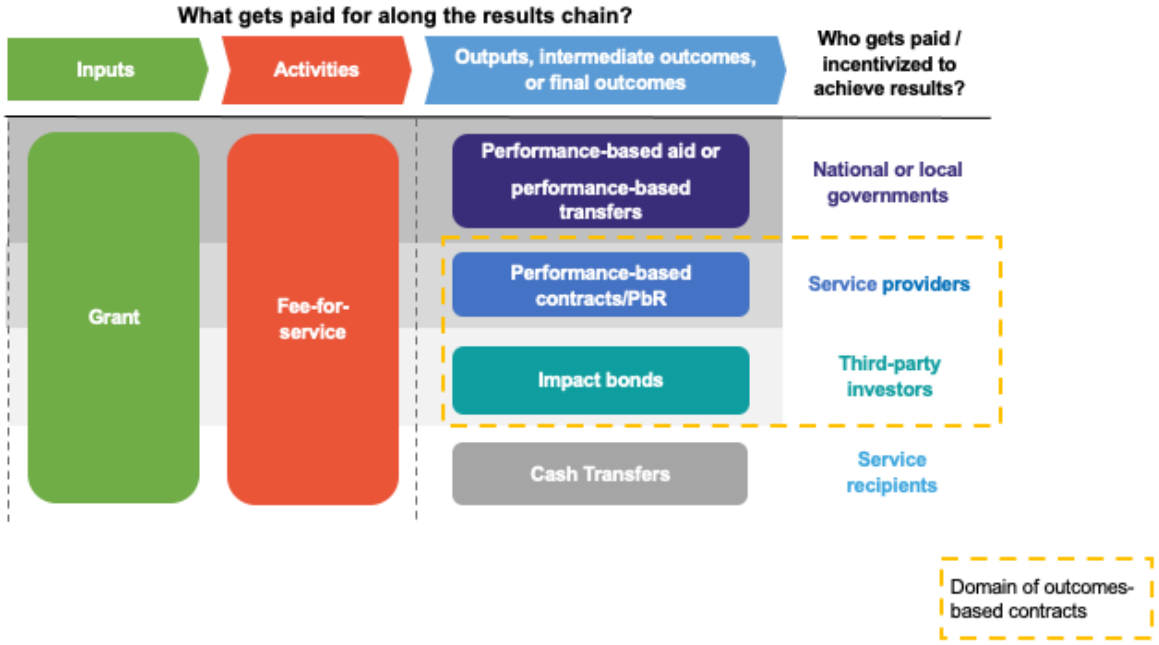


Figure 1 - Scope of outcomes-based contracting, informed by the 'Simplified Typology of RBF instruments' presented in GPOBA (2018, p.15)

2. Review method

The aim of the study is to identify and synthesise empirical research on outcomes-based contracts used in the broad context of climate change mitigation and environmental management. The systematic review, and the specific review of environment-related studies, involves several key stages (Figure 2): searching for literature; systematically screening studies to ascertain their relevance; quality appraising studies; extracting key study- and contract-level data; coding the findings; and analysing and synthesising the findings. These stages are summarised below, but more detail is in the Annex.

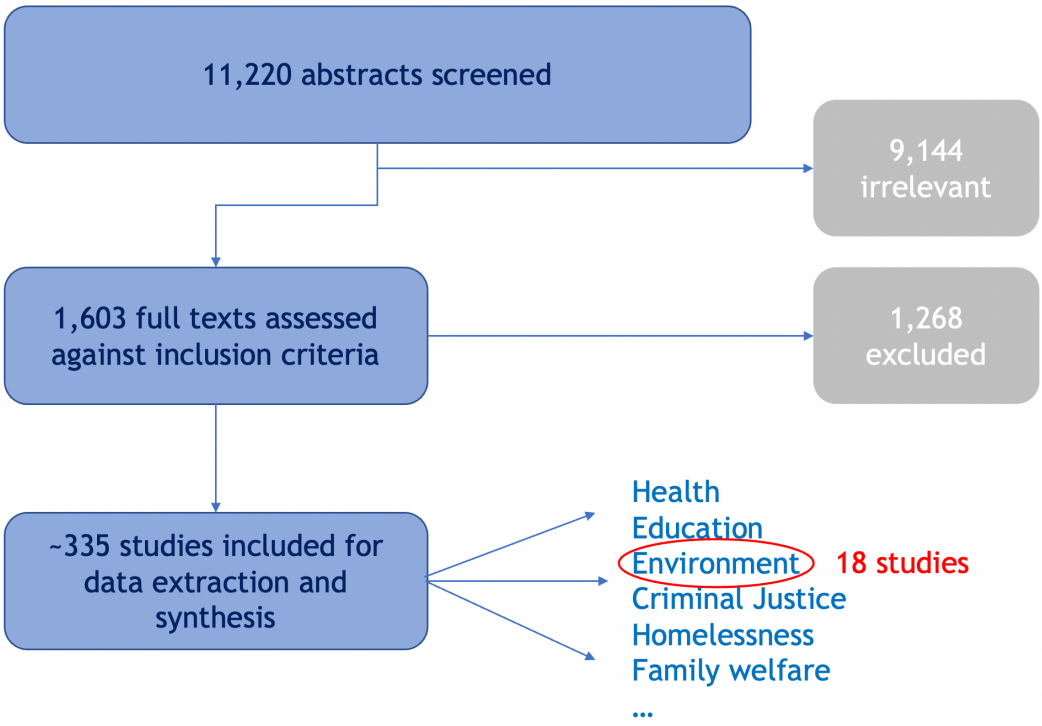


Figure 2 - Study screening and exclusion process

SEARCH STRATEGY

The search strategy for the broader systematic review involved a comprehensive search of academic literature and grey literature (i.e., research and evaluation of OBCs produced beyond a formal academic context). This included a search of 12 electronic bibliographic databases, internet search engines, a public call for evidence, and a targeted search of relevant websites, using a range of keyword terms relating to OBCs.[3] This comprehensive search identified 11,220 potentially relevant papers.

SCREENING OF ABSTRACTS AND FULL-TEXT STUDIES

Following the search process, the research team conducted an initial screen of study titles and abstracts, using eligibility criteria to remove unambiguously irrelevant studies. Two researchers reviewed each study title/abstract and only excluded studies if they clearly did not meet any of these criteria (see Annex). Where there was uncertainty as to whether an abstract met the inclusion criteria, these 'potentially relevant papers' were passed through to the full-text review stage. The research team then assessed full-text versions of the remaining, potentially relevant studies, for their eligibility against stringent inclusion and exclusion criteria (Table 1).

Papers were only included if they:

- **presented empirical evidence.** This could include primary research (e.g. interviews, focus groups, surveys), original analysis of secondary data sources, (e.g. quasi-experimental studies) and/or an independent synthesis of existing evidence, (e.g. detailed literature reviews);
- investigated an outcomes-based contract where the **contracted agent is at the organisational level** and is an organisation **from the not-for-profit or private sector**;
- investigated an outcomes contract with **financial implications for the non-achievement of social or environmental outcomes**. The financial incentive could take a range of forms including a payment linked to the achievement of outcomes, or negative financial implications (e.g. clawback) for poor performance against outcome indicators; and
- they provided a **specific, nameable example** of an outcome measure that is connected to the financial incentive.

[3] For search terms see: Appendix 1 of: Picker *et al*. (2021).

There were no restrictions on the type of OBC investigated (e.g., impact bonds, performance-based contracts, payment-by-results, etc., are all in scope) or the nature of the incentivised measure(s) (e.g., immediate 'outputs' such as the number of clean stoves delivered to rural villages, or longer-term 'outcomes' such reductions in storm-water run off).

IDENTIFICATION OF ENVIRONMENT-RELATED STUDIES

For the current study, the research team used a separate set of 89 environment-related search terms to identify papers from within the wider systematic review that are relevant to climate change mitigation and environmental management. These search terms were derived from suggestions of the environmental team at Ecorys, the systematic review research team, and a review of key resources (see Annex). An environmental specialist from Ecorys reviewed the initial set of search terms and suggested a further 25 terms. We applied blocks of environment-related search terms sequentially to the body of papers and the final 25 terms did not return any further studies, thus adding assurance that all relevant studies were identified. In total, 18 studies addressing environmental OBC were identified.

QUALITY APPRAISAL

The research team critically appraised the quality of the research methods of each of the 18 included studies. This assessment was informed by the widely-adopted 'Critical Appraisal Skills Programme' checklists,[4] and the team appraised each study according to the relevant CASP tool for the research design. For example, RCTs were assessed using the CASP RCT tool, qualitative studies using an updated form of the CASP qualitative tool (Long *et al.*, 2020), and quasi-experimental studies were assessed using an adapted form of the 'Case Control' CASP tool. The purpose of the quality appraisal was to aid the interpretation of evidence; no studies were excluded on the basis of their quality (provided they met the inclusion criteria detailed above).

[4] See: https://casp-uk.net/

Table 1 - Inclusion criteria of the systematic review, with examples

	Study design	***Contracted agent***	***Incentivised outcome measure***
Description	Studies must provide an **empirical** contribution	The study must describe a contract with an independent **organisation** from the **private or non-profit** sector responsible for service delivery	The contract(s) described in the study must attach a **financial incentive** to the achievement of a pre-agreed **outcome** measure
Examples of what is included	Original quantitative, qualitative, or economic research; original analysis of secondary data	Contracts that pay NGOs, private service providers, or private investors for the delivery of an intervention.	Contracts that include payment for the achievement of measured environmental outcomes, such as reduced energy usage or improved water quality
Examples of what is excluded	Theoretical papers; feasibility studies; ex ante predictive models	Contracts that pay governments, public institutions, or individual people/households for the delivery of services. This means that environmental projects paying individual landowners (e.g., farmers) are excluded. So are projects that pay governments, such as REDD+.	Contracts that pay *only* for activities or inputs. E.g., a rebate program that offers organisations a one-off upfront payment for installing solar panels.

DATA EXTRACTION AND CODING

The research team extracted detail on a uniform set of variables from all studies. These included key information of the studies themselves (publication details, study design, etc.), as well as of the individual contracts described within the studies (outcomes funders, delivery agents, etc.). Some studies addressed multiple OBCs. In such cases, data were collected for each of the individual contracts represented within a study, insofar as that was possible.[5] The review team then used a more detailed coding framework to extract qualitative and/or quantitative findings in relation to: the design, implementation and delivery of OBCs; observed effects of OBCs; sustainability of outcomes and OBC effects; and considerations for scaling and/or replication. Researchers also identified and noted themes from the studies that did not fit inside the coding framework (e.g., market-level analysis discussing trends in the adoption of different forms of OBC).

ANALYSIS AND SYNTHESIS

The analysis is presented in two parts. Firstly, evidence maps and descriptive statistics are used to analyse the standardised study- and OBC-level data. Secondly, the full content of included studies is synthesised thematically in relation to the coding framework's categories (e.g., design and implementation, outcomes or effects).

ROUNDTABLE

The research team held an online roundtable discussion with key policy makers and practitioners from across the world, all of whom work with outcomes-based contracting in the environmental context. The purpose of the roundtable was threefold:

- share key findings from the systematic review;
- gather feedback and critique from roundtable participants; and
- discuss the implications of the evidence for policy.

The findings of the roundtable are reflected in the discussion in section 5.

[5] It was not always possible to collect distinct data for each OBC – three studies did not provide sufficient contract detail to allow us to do so. For these three studies, therefore, information was gathered in aggregate, rather than by individual contract.

LIMITATIONS

There are several caveats to this study, which should be considered when reading the report:

- **The heterogenous nature of studies and projects:** The 18 studies included for review represent a range of types of projects, in different environmental areas (e.g. energy, water, agriculture), and geographical areas. This emphasises the broad potential of using OBCs for climate change mitigation and environmental management, but sometimes limits the ability to make meaningful comparisons. Considerations about comparability are noted where relevant throughout the report.
- **Qualitative evidence base and OBC 'effect':** Most of the included studies are qualitative designs, and generally lacked explicit comparison between OBC and non-OBC arrangements. Therefore, it is not possible to assess whether any 'effects' reported by papers are directly attributable to the OBC.
- **Limited scope on the contracted agent:** Given the breadth of the wider systematic review (in terms of type of OBC used, policy area, geography etc), strict inclusion criteria were introduced to provide clear parameters and ensure the review was practically feasible. In particular, the inclusion criterion related to the type of contracted agent (i.e., independent not-for-profit or private sector organisation) has implications for examining OBCs in the environmental context. It means that this report does not focus on contracted arrangements where individuals (e.g., farmers or private land owners) or public-sector organisations (e.g., local or national governments) are the contractually incentivised agent. Given that farmers and landowners are a key constituency in sustainable environmental management, their participation in 'green' outcomes programmes could and should be an area for future synthesis.[6]
- **Insufficient detail provided in papers:** Some studies were excluded from the review because they lacked sufficient detail about contractual arrangements. For example, papers were excluded where it was not possible to identify a specific nameable outcome measure. This requirement facilitates detailed analysis on the type of outcome measures used within OBCs, but means that the review works with a limited number of included papers. Ultimately, however, this requirement for specificity in the articulation of outcome

[6] The authors are grateful to participants in the roundtable for emphasising this point, and for drawing our attention to some ongoing examples of outcomes-based farming/land management programmes.

measures allows meaningful conclusions to be drawn in relation to the broader systematic review's research aims.

- **Language of included studies:** This review includes only English-language studies.
- **Risk of publication bias:** This study only reports on OBCs where there is empirical evidence available, and it is likely not representative of all environment-related OBCs that have been developed and implemented across the world. The roundtable with policymakers and practitioners (see above) validated the high-level findings, but also indicated that the prevalence of OBC for environment is not fully represented in the review.

3. Evidence maps

This section provides an overview of the studies included in the review. Where information is available, it also details the individual outcomes-based contracts that are described in each of these studies. In particular, it covers policy area (environmental and otherwise), the type of contracting arrangements used, contract start dates and duration, information on the principal (i.e., outcome funder), agent (i.e., delivery provider), and the measure(s) tied to payments. The section finishes by mapping the alignment between the individual OBC contracts and the United Nations Sustainable Development Goals (SDGs).

OVERVIEW OF INCLUDED STUDIES

Eighteen studies met all the necessary criteria for inclusion in the review. Figure 3 provides an overview of the specific environmental focus of each study.[7] It shows that 'Energy' was the most common theme, covered in seven of the studies. 'Pollution / Waste Management' and 'Water' were each identified as one of the main areas of focus for four studies. Three studies addressed 'Agriculture' and two addressed 'Sustainable Infrastructure'. Only one study was coded as covering multiple environmental areas ('Pollution / Waste Management', 'Sustainable Infrastructure', and 'Water').

Alongside the environment theme, nine studies were identified as covering one or more secondary policy areas: 'Poverty Reduction' and 'Health' were each noted as a secondary policy area for four studies, whilst 'Child and Family Welfare' was identified as a secondary policy area for three studies. Two studies also addressed 'Education'.

The majority of studies (n=16) included in the review had a qualitative research design, employing research methods such as interviews, focus groups, open-response surveys, and literature reviews. Two papers had a quantitative research design; one modelled the systematic differences between utilities that participated in a form of OBC and those that did not; and another used a quantitative survey of

[7] Categorisation of studies into different 'environment areas' was applied by the research team. We recognise that boundaries between these categories are not always clear-cut. Where studies might potentially have been placed in two different environment areas, we chose the category that we judged to be most appropriate or unambiguous. For example, a study that addressed clean-up of US Department of Energy facilities was categorised as 'pollution/waste management' rather than 'energy', despite the fact that it might also have been considered as part of the energy sector. The research team felt that a site clean-up programme had more in common with other waste management contracts than with contracts for energy efficiency.

individual contracts and an analysis of a project database. Only one of the papers provides a quantitative comparison of OBC to other forms of funding tool (Carley, 2012).

OVERVIEW OF INDIVIDUAL CONTRACTS WITHIN STUDIES

Across the 18 included studies, the review team identified a total of 71 relevant OBCs that were presented in sufficient detail to warrant their inclusion in the data extraction and analysis process (hereafter referred to as 'researched contracts'). The number of relevant OBCs included within each study varied considerably, from one contract (in seven studies) through to 22 contracts (in one study).

Three of the 18 included studies did not provide sufficient detail on the contracts that they discussed to facilitate data extraction and analysis at the contract-level. They did report at the aggregate-level on over 2000 environmental OBCs, however. (Larsen *et al.*, 2012). These OBCs were all in the United States and operating in the energy sector. Therefore, it is important to emphasise that the findings in this section are not representative of all environment-related OBCs where the contracted agent is a private or not-for-profit organisation. While the contracts in these three studies have not been included in the contract-level analysis, their findings are highlighted where relevant throughout the report.

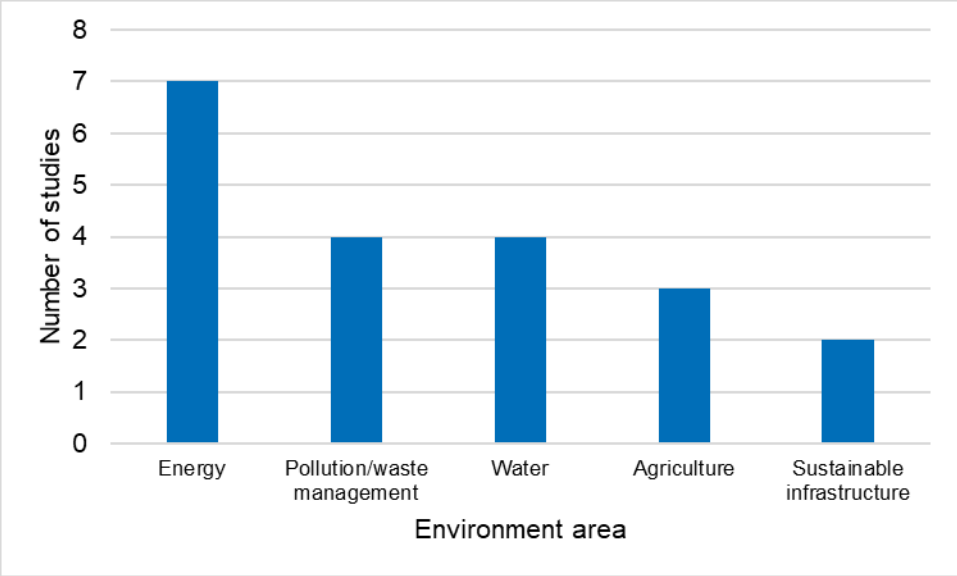


Figure 3 - Environmental areas covered in included studies (n=18 studies). Note, the total does not add up to 18 as one study covered multiple environment areas.

GEOGRAPHICAL AND POLICY DISTRIBUTION

Categorising the 71 OBCs according to geographical distribution reveals that the majority of researched contracts (n=52) operated within the USA. Eight contracts were in Taiwan, six in India, and two in Peru. China, Indonesia, and the UK were each home to one contract.

Figure 4 further disaggregates the geographical distribution of OBCs according to the main policy area of each contract. The majority of 'Energy' contracts (n=43) took place in the USA, with the remaining eight taking place in Taiwan. The majority of 'Pollution / Waste Management' contracts were also undertaken in the USA, with three exceptions taking place in Indonesia, India, and China. The eight 'Water' contracts were split evenly between the USA and India, whilst the two 'Agriculture' contracts were both in Peru. The two 'Sustainable Infrastructure' contracts were in Great Britain and India respectively.

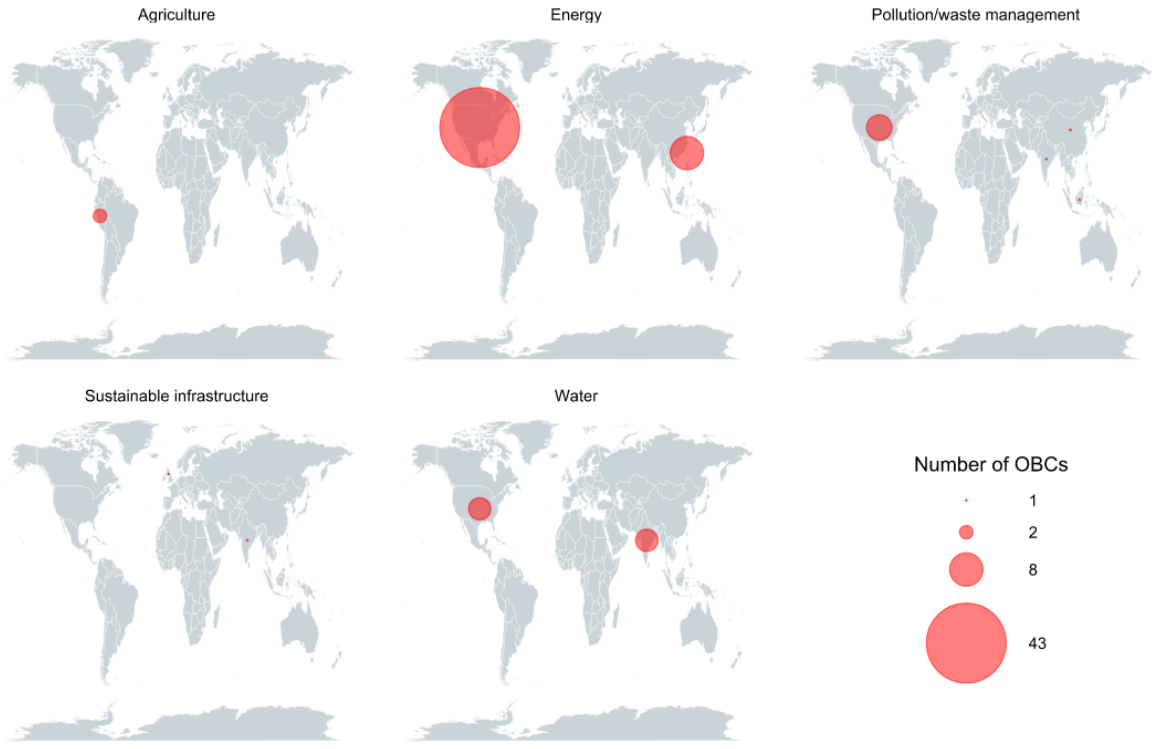


Figure 4 - Geographical distribution of researched OBCs, by environmental policy area. Source: Dataset of included environment studies. (n=71 OBCs). Circles are scaled according to the number of researched OBCs.

CONTRACT DURATION

Where specified, contract start dates (n=42) ranged from 1980 to 2018, whilst specified end dates (n=15) ranged from 1998 to 2021. The actual or expected length of contracts (n=45) ranged from less than a year to up to 30 years (in one case, 25 years with the possibility of a 25-year extension). As an informal benchmark, the mean contract duration for impact bond projects across all policy domains is just over five years (Correspondence with INDIGO data steward, March 2022).[8] Longer contract terms tended to be associated with energy efficiency contracts (where the agent would recoup their investment in retrofitting energy efficiency measures through the resulting energy savings (for example, see Bird *et al.*, 2012), or in large-scale water rehabilitation projects where the revenue model rested on agents collecting a fee per unit of water billed and collected from consumers (for example, see Water and Sanitation Program, 2014).

Analysis of contract start dates by geography (Figure 5 - *Researched environmental OBCs by contract start date. Source: Dataset of included environment studies. (n=42 OBCs) Circles are scaled according to the number of researched OBCs.*) highlighted that of the 19 contracts starting from the 1980s to 2000s, 18 were in the USA (one was in India in the 2000s). It was not until the 2010s that OBCs in other countries (e.g. Taiwan, Peru and China) started being reported in the evidence (n=23 contracts started in the 2010s).

TYPE OF OBC

A range of terms are used to describe the contracting arrangements across the OBCs included in the sample. Contracts with an incentive linked to performance (described as 'Performance-based contracts', 'Incentive programmes', 'Performance-based incentive programmes') were most common (used to describe 66 of the 71 contracts). There were three impact bonds (two 'development impact bonds' and one 'environmental impact bond'), and two examples of 'results-based financing'. While impact bonds typically imply the involvement of a third-party to provide upfront capital to pay for services, several studies describing 'performance-based contracts' also indicated that third party organisations took on the financial risk (for example, see Larsen *et al.*, 2012, Water and Sanitation Program, 2014 and Kushler *et al.*, 2006). Therefore, in the environment context, impact bonds are not the only mechanism in which investment is leveraged and risk is transferred (in theory) away from the service provider.

[8] The mean contract duration is 5.1 years and is calculated with a sample of 46 projects: 9 IBs have data on contract signature date and actual completion dates, and for 37 IBs the contract duration is calculated using anticipated completion dates.

Note that, in general, there is considerable variation in the terminology used to designate different forms of OBC. Consultation with a Policy Advisory Group at the start of our systematic review identified 35 different English language terms for outcomes contracts. Some of these are simply different names for the same or similar instruments. The above-described OBC 'types' should thus not be read as clearly defined, distinct, forms of contract design. They are rather summarised here only to indicate the terminology currently in use for environmental OBC.

The variation across the environmental OBCs is further analysed (below) through the 'Measure-Agent-Principal' (MAP) framework described by Clist (2016). The principal refers to the donor or funding body who commits to pay on achievement of a pre-agreed measure; the agent is the party being paid to deliver results by the principal; and the measure is the pre-agreed measure against which OBC payment is made (Duvendack, 2017).

Figure 5 - Researched environmental OBCs by contract start date. Source: Dataset of included environment studies. (n=42 OBCs) Circles are scaled according to the number of researched OBCs.

PRINCIPAL

The principal (or 'outcome payer') is the individual or organisation that commits to financing the contract on the basis of a pre-agreed set of measures. For this study, principals were categorised into the following types:

- Registered company, partnership or commercial organisation
- Government body
- Multilateral, bilateral or intergovernmental body.

It was possible to identify the principal type in 42 of the 71 researched contracts (Table 2). The majority of specified principals (n=23) fell within the first category – 'Registered company, partnership or commercial organisation'. These included companies such as Idaho Power Co in the US (Bird *et al.*, 2012) and Maharashtra Jeevan Pradhikaran (MJP) in India (Water and Sanitation Program, 2014). It is worth noting that 22 of the 23 principals in this category came from one study, which explored recent experience and best practices in distributed solar incentive programmes (Bird *et al.*, 2012).

Seventeen contracts involved a principal that was a government body. These included state-level or municipal government bodies, such as Prince George's County in the US (Alexandrovich, 2017), and national-level government bodies, such as the US Department of Energy (which funded four waste clean-up OBCs in the USA) (US General Accounting Office, 1998).

Two contracts involved principals which could be defined as a 'Multilateral, bilateral or intergovernmental body': the Common Fund for Commodities (in the Peru Sustainable Cocoa and Coffee Production Development Impact Bond (DIB) and the Multilateral Investment Fund (in the Peru Climate-Smart OBC). These were the only two agriculture OBCs in the sample of included studies.

Table 2 - Principal types across researched contracts. Source: Dataset of included environment studies (n=42 OBCs)

Principal type	**Number of researched OBCs**
Registered company, partnership or commercial organisation	23
Government body	17
Multilateral, bilateral or intergovernmental body	2

Figure 6 below provides an overview of the type of principals by environment area. It shows that registered companies generally funded energy OBCs, and government bodies funded OBCs in a range of different areas, including energy, pollution management, water, and sustainable infrastructure.

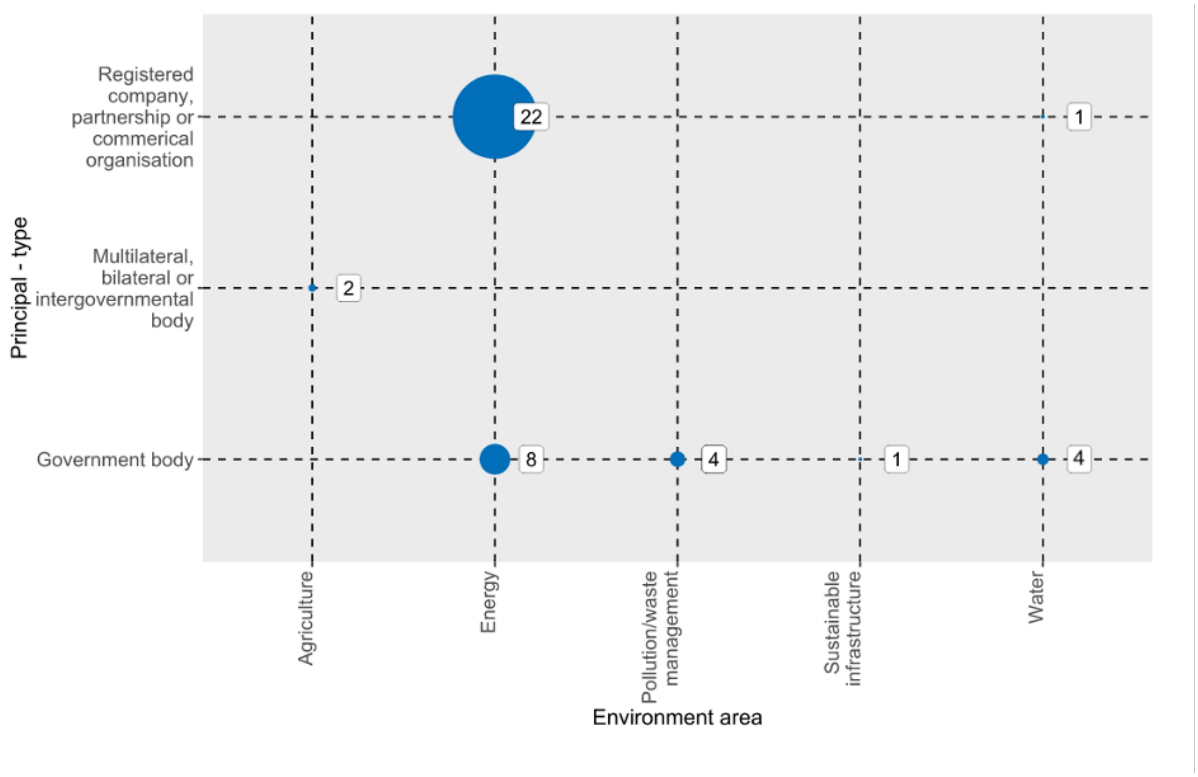


Figure 6 - Principal type by environmental policy area. Source: Dataset of included environment studies. (n=42 OBCs). Circles are scaled according to the number of researched OBCs.

AGENT

The agent refers to the service provider that is financially incentivised to deliver outcomes and where this incentive is conditioned on the achievement of a pre-agreed set of outcomes. The agent types identified in researched SOCs are:

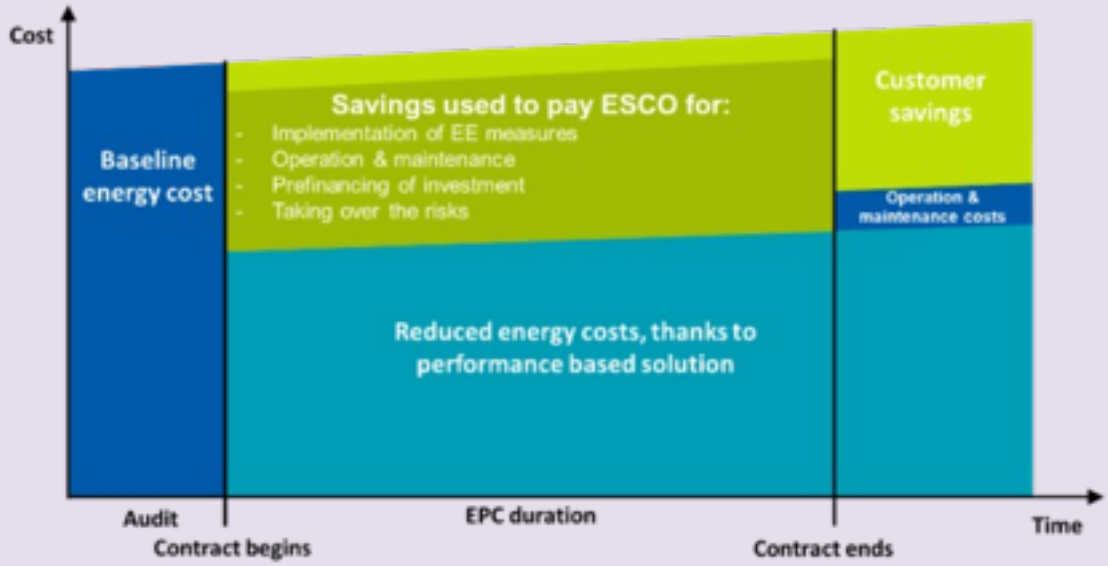
- Registered company, partnership or commercial organisation
- Registered non-profit organisation, charity or foundation.

It was possible to identify the agent type in 69 of the 71 researched OBCs. Almost all of the OBCs (n=67) involved an agent that could be defined as a 'Registered company, partnership or commercial organisation'. Many of these agents were individual companies, such as the Vermont Energy Investment Corporation (Kushler *et al.*, 2006) and The Bullitt Centre (Szinai *et al.*, 2017). An 'agent' type often recorded across multiple studies was 'energy service companies' (ESCOs - see Box 1).

BOX 1 – ENERGY SERVICE COMPANIES (ESCOs)

An 'agent' type often recorded across multiple studies was 'energy service companies' (ESCOs). ESCOs are performance contracts designed to create financial incentives for organisations to reduce energy emissions. They can take multiple forms, but typically an ESCO will guarantee energy and/or dollar savings for an organisation, and then work with that organisation to reduce their emissions (by, for example, making the building more energy efficient). If energy and cost savings are made, then the organisation benefits from some of these savings, and some savings go to the ESCO as payment (based on Larsen *et al.*, 2014: 8).

The diagram below provides a simplified version of an ESCO model:



Source: Laffont-Eloire, 2019

One study documented three contracts in which the agent was a consortium. These included the Veolia-Vishwaraj consortium and a consortium led by SPML Ltd, where both consortiums were contracted to replace water pipelines and service connections to increase water supply continuity in the Indian cities of Nagpur and Aurangabad, respectively (Water and Sanitation Program, 2014). For a small number of contracts, the author(s) provided little detail about the agent, beyond identifying them as a private company or organisation. For example, in the Anna Arundel

County Watershed Protection and Restoration Program (Alexandrovich, 2017), the agent was simply referred to as a 'Private contractor'.

There are only two researched contracts that involve an agent from the non-profit sector. Both of these contracts are described as development impact bonds and are funded by a 'multilateral, bilateral, or intergovernmental body' principal. These two contracts – the Peru Sustainable Cocoa and Coffee Production DIB and the Peru Climate-Smart DIB – both had their agent specified as The Rainforest Foundation UK (RFUK). In the former contract, the study author notes that RFUK acted as the agent in partnership with two local organisations – Central Asháninka del Rio Ene (CARE) and Kemito Ene (Rizzello and Kabli, 2020 – see Box 2 for details on the Cocoa and Coffee Production DIB).

BOX 2 – AN OBC OPERATING WITHIN THE AGRICULTURE CONTEXT

Name of OBC: Peru Sustainable Cocoa and Coffee Production Development Impact Bond (Peru)

Environment area: Agriculture

Principal: Common Fund for Commodities

Agent(s): Rainforest Foundation UK, Central Ashaninka del Rio Ene, Kemito Ene Cocoa Co-operative

Project aim: To improve the economic situation, and increase the cocoa and coffee crops, of the Asháninka farmers in the Peruvian Amazon.

Measure(s): 1) increase in the supply of Kemito Ene by 60%; 2) increase to 600 kg/ha or more in production by at least 60% of the members; 3) transfer of at least thirty-five tonnes of cocoa during the last year of the project; and 4) at the end of this project, forty farmers have an area of 0.5 hectares of new coffee plantations more resistant to leaf rust.

Source: Rizzello and Kabli, 2020

These two contracts were also the only two contracts that focused on 'Agriculture' as their main policy area. That means that all contracts that focused on 'Energy', 'Pollution/Waste Management', 'Sustainable Infrastructure', and 'Water' involved a registered company, partnership, or commercial organisation as the agent (Figure 7) and a government or registered commercial organisation as their principal.

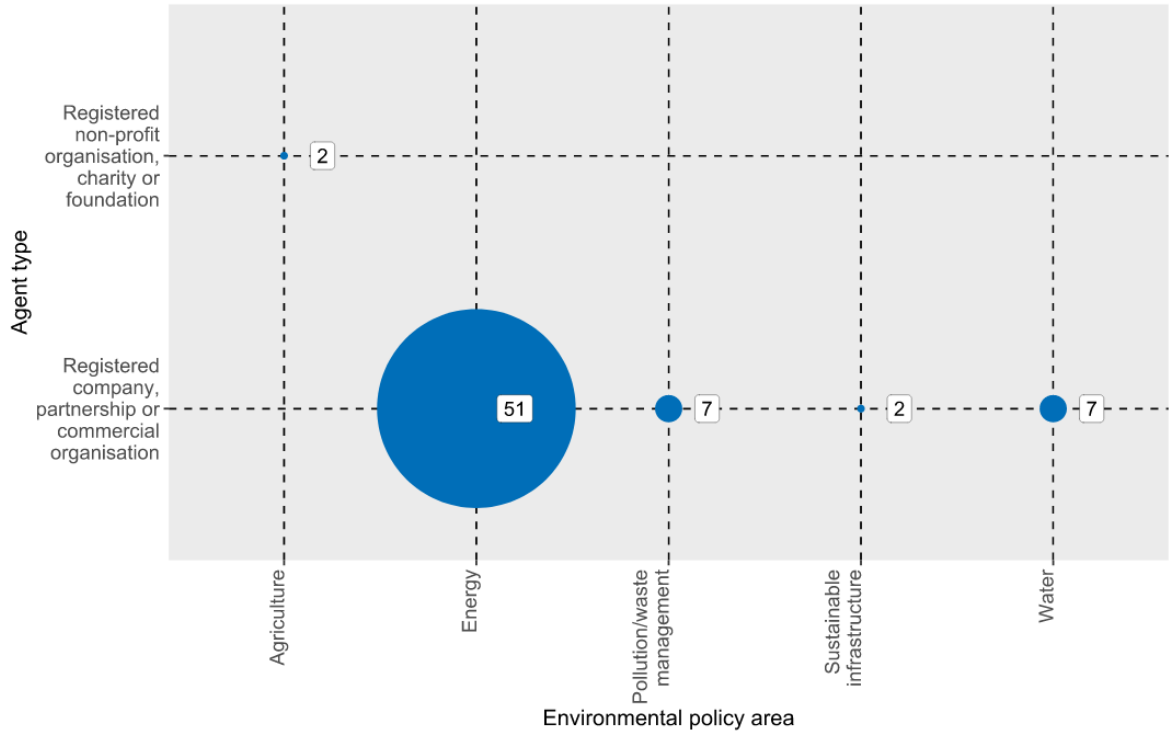


Figure 7 - Agent type by environmental policy area. Source: Dataset of included environment studies. (n=69 OBCs). Circles are scaled according to the number of researched OBCs.

MEASURE

In the context of outcomes-based contracting, a measure is the specific outcome metric or indicator against which success will be determined and outcome payments will be made (or incentive elements of contracts will be structured).

Incentive design

Contracting arrangements described in the 18 studies demonstrate variation in the contracts' *incentive design* - that is, the ways in which payments to the agent are structured and operationalised. Some arrangements take the form of a direct, explicit OBC with outcome measures being linked to financial incentives. See box 3 for an example.

BOX 3 – AN ENVIRONMENT OBC WHERE OUTCOME MEASURES ARE DIRECTLY LINKED TO FINANCIAL INCENTIVES

Name of OBC: D.C Water Environmental Impact Bond (USA)

Environment area: Water

Principal: DC Water and Sewer Authority

Agent(s): Private contractors

Project aim: To reduce the volume of polluting stormwater runoff in the Rock Creek Park corridor (Washington, D.C, USA) through the installation of green infrastructure (e.g. permeable pavement and bio-retention basins to capture and filter stormwater).

Measure(s): Payment is linked to three tiers of performance, relating to the percentage of runoff reduction (a higher percentage would lead to a higher return for investors).

Source: Alexandrovich, 2017; Andersen et al., 2017

In other cases, the contractual arrangements offer the mechanism of an OBC through an alternative formulation. As mentioned in the previous section (Agent, see Box 1), an example of this formulation is ESCOs. ESCOs are often paid a fixed, pre-agreed amount to provide energy. They then introduce energy reduction initiatives, thereby reducing the amount of energy required. ESCOs are incentivised to reduce energy consumption, and their ultimate payment is linked to the

achievement of energy reduction, where energy savings correspond in turn, to financial rewards for the ESCO.

Measures used in the researched OBCs

As noted in the Methodology, the systematic review took a broad view on the nature of measures. This means that across the included studies, incentivised measures range from shorter-term 'outputs' to longer-term 'outcomes'. The definitions used in this review are informed by Gertler *et al.*'s (2011) classification, which is as follows:

- **Outputs** are the tangible goods and services that are delivered by projects (e.g. percentage or unit change in energy efficiency, number of green infrastructure measures installed, production of an energy reduction plan)
- **Outcomes** build on outputs, and are realised as a result of the project outputs. These can be intended and/or unintended, and short- or long- term (e.g., cash savings from reduced energy bill following installation of energy efficiency measures, area of land/forest conserved, economic impact of improved crop yield)

Reflecting the potentially broad scope of the interventions in the included studies, we also categorised measures in relation to whether they were directly or indirectly environmental. For the purpose of this review, the definitions used to categorise measures were:

- **Directly environmental:** Measures which specifically aim to produce an environmental change.

  An example of a directly environmental outcomes metric from the evidence base is reduced stormwater run-off (Alexandrovich, 2017).

- **Indirectly environmental:** Measures where the link to the environment is less explicit, or where the environmental outcome of an intervention is a secondary effect of the chosen metric.

  An example of an indirectly environmental outcome from the evidence base is the delivery and use of 'clean' stoves (Zhang and Adams, 2015). This metric does not measure an environmental effect, but the use of clean stoves implies an improvement in air quality and reduced pollution.

Figure 8 provides an overview of the type of measures used across the 71 individual OBCs identified in this review. It shows that the majority of contracts (n=58) specified measures that were directly environmental. Over half of these (n=30) can be classed as 'outcomes'. Direct environmental outcome measures were most commonly used in energy contracts (n=24), where the outcome measure is often energy savings, with the provider (for example an ESCO or other type of utility or

energy company) receiving a proportion of the savings from reduced energy spending.

In the agriculture context, the Peru Climate-Smart Agriculture DIB (which, when reported on, was in the process of project development) aims to support implementation of agroforestry systems and a conservation strategy of the Asháninka communities in Peru. The DIB has multiple outcome measures, including forest conservation (in terms of the number of hectares of 'no deforestation') (Gustafsson-Wright *et al.*, 2017).

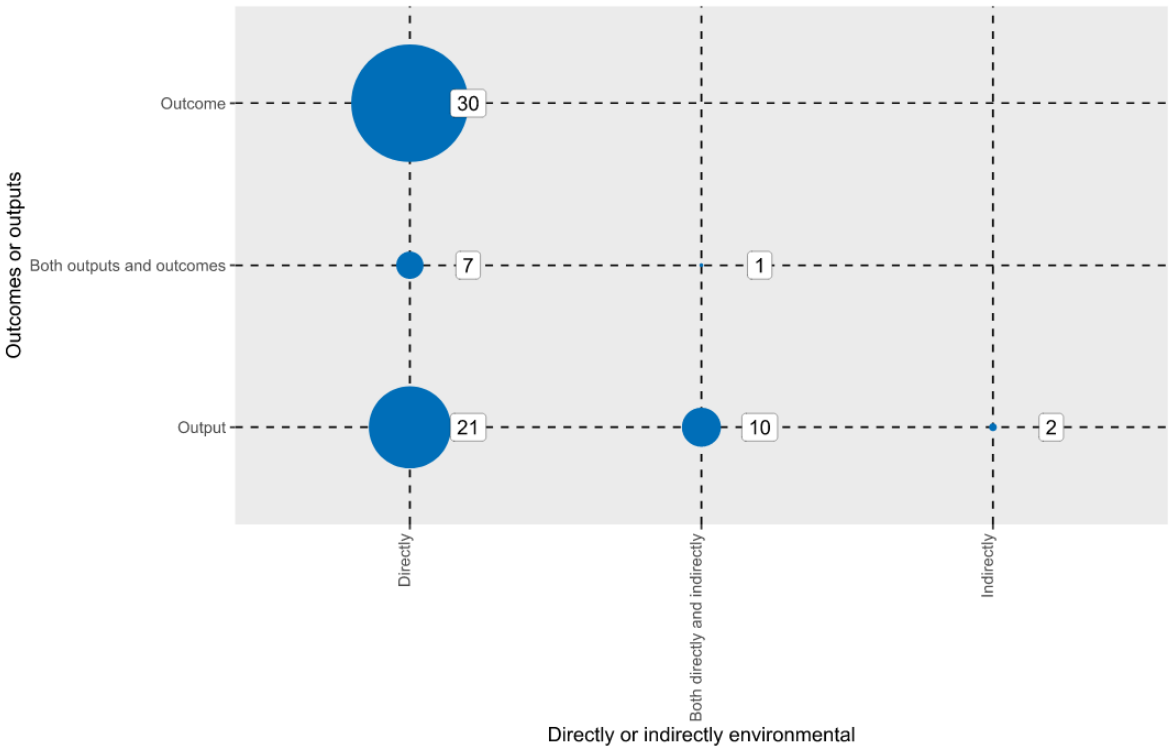


Figure 8 - Type of measures used in environmental OBCs. Source: Dataset of included environment studies. n = 71 OBCs. The outcome measures are analysed at the contract level (rather than the 'measures' level) so each observation in Figure 8 may represent one or more distinct measure. If an individual contract has multiple measures that are a mix of directly and indirectly environmental, or a mix of outputs and outcomes, it is categorised as 'both'. Circles are scaled according to the number of researched OBCs.

Eleven OBCs illustrate a mix of both directly and indirectly environmental measures, with most (n=10) having payment linked to the achievement of outputs. These

'mixed-measure' OBCs operate across a range of different environmental policy areas, such as pollution and waste reduction, energy, and agriculture. Box 4 details an example of a mixed-measure OBC for water provision in India. In this example, 'water quality' is a directly environmental metric, while '95% functional water meters' is indirectly environmental (because functioning water meters help customers and organisations to achieve more efficient water usage [Ornaghi and Tonin, 2021]).

BOX 4 – AN ENVIRONMENT OBC WITH A MIX OF INDIRECTLY AND DIRECTLY ENVIRONMENTAL INCENTIVISED MEASURES

Name of OBC: Aurangabad 20-Year Concession Contract (India)

Environment area: Water

Principal: Aurangabad Municipal Corporation (AMC)

Agent(s): Consortium led by SPML Ltd

Project aim: To operate and maintain the water system in the city to provide a 24/7 supply

Measure(s): 24/7 continuity of supply, water quality, at least 95% functional water meters, service standards (e.g. addressing complaints with in 24 hour period)

Source: Water and Sanitation Program, 2014

Two OBCs use only indirectly environmental measures. Both contracts aim to improve the provision of 'clean' stoves to households in the Liaoning and Hubei provinces in China and in the Indonesian areas of Yogyakarta, Central Java and Sumba Island (Zhang and Adams, 2015). The rationale for these programmes was that many households in the target areas use inefficient and poorly burning stoves to meet their cooking and heating needs. This results in high levels of household air pollution. The provision of 'clean' stoves would therefore help reduce pollution. The output measures linked to payment were not directly environmental (i.e., payment is linked to the number of stoves delivered and used; and the actual performance of stoves used); but if the incentivised outputs were achieved in these contracts, they would, in theory, lead to improved environmental outcomes (i.e.,

reduced pollution, reduced amount of coal burned per year) (Zhang and Adams, 2015).

MAPPING OF OBCS AGAINST SUSTAINABLE DEVELOPMENT GOALS

As part of the data extraction and coding process, the research team assessed which of the 17 United Nations Sustainable Development Goals (SDGs) each contract aligned with and/or contributed towards achieving. Researchers identified and coded as many of the SDGs as they felt were relevant to the contract. It is important to emphasise that this selection was based on researcher judgement alone, rather than on any explicit reference to the SDGs by the author(s) of each study.

Figure 9 shows how the OBCs in different environment policy areas map across the SDGs. Overall, it shows that OBCs operating in the 'Energy' context are typically mapped to 'SDG 7 - Affordable and Clean Energy' (n=49), 'SDG 9 - Industry, Innovation and Infrastructure', 'SDG 12 - Reliable Consumption and Production', and 'SDG13 - Climate Action' (all n=26 respectively). However, OBCs operating in the Agriculture and Sustainable Infrastructure themes are linked to the greatest number of SDGs (n=10 for 'Agriculture' and n=8 for 'Sustainable Infrastructure'.

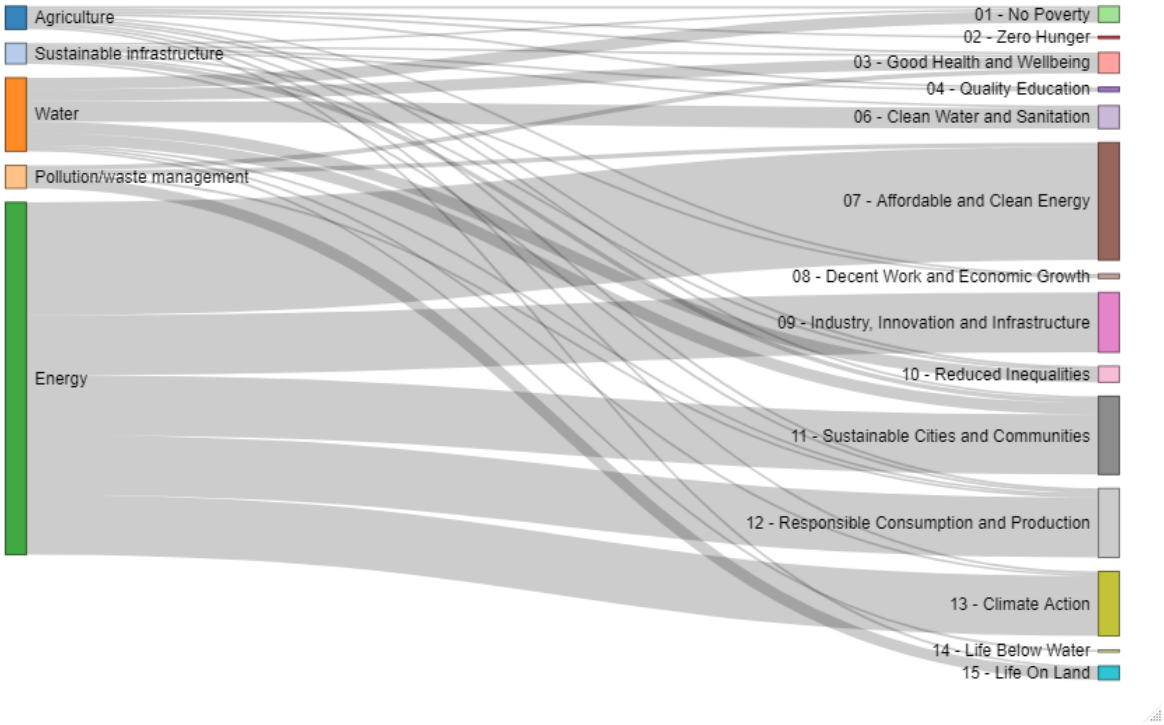


Figure 9 - Mapping of UN Sustainable Development Goals across included OBCs in different environment policy areas. Source: Dataset of included environment studies. n = 71 OBCs.

Based on these patterns, it appears that the researched environmental OBCs in our review were largely concerned with integrating clean and affordable energy into

cities and municipalities, with a relatively strong and concurrent focus on sustainable infrastructure, responsible communities, and climate action.

SECTION SUMMARY

- The majority of OBCs identified in the empirical research (and where sufficient evidence is available on individual contracts) were in the USA, in the energy sector. The principals and agents in these contracts tended to be private-sector, commercial organisations. This has implications for the applicability of the findings outlined in the next section and how easily contracting models developed in the USA can be applied to other contexts.
- Most agents are registered private/commercial organisations, with only two researched contracts with not-for-profit organisations (these were both DIBs).
- The 2010s saw a marked increase in the number of researched OBCs in multiple countries beyond the USA (prior to the 2010s, these were mainly in India). While not conclusive (given the small sample size), this could suggest a growing global appetite for OBCs for environmental management and climate change mitigation.
- The environmental OBCs appear to use a mix of outputs (i.e., measures of immediate change) and outcomes (i.e., measures of change beyond the immediate influence of implementation teams), sometimes used in conjunction in the same contract. The measures are generally directly linked to generating environmental change, but in some cases (e.g., the OBCs that aim to improve the provision of 'clean' stoves to households) indirect environmental outputs have served as a proxy for broader environmental outcomes.
- When mapping OBCs to the SDGs, the analysis suggests that researched OBCs in the sample focused on integrating clean and affordable energy into cities and municipalities, with a relatively strong focus on sustainable infrastructure, responsible communities, and climate action.

4. Evidence synthesis

This section synthesises key findings from the studies included in the review. Content from the studies, having been coded according to themes by the research team, was reviewed and summarised to produce the following synthesis. The themes are: use case; challenges and successes of implementation; outcomes achieved; and influence on service delivery.

USE CASE: WHAT WERE THE REPORTED REASONS FOR USING AN OUTCOMES-BASED APPROACH TO ENVIRONMENTAL PROGRAMMES?

All but two of the studies included in the review provided detail about the use case for OBC, either in general or for the specific form of OBC examined in the study. A range of justifications for the use of OBCs are reported, and are detailed below. In short, OBCs are used to:

- incentivise the desired environmental end;
- provide reliable long-term performance;
- allow a flexible and innovative service;
- transfer financial risk to the private sector;
- benefit from private sector involvement;
- remove financial barriers to implementing energy saving measures;
- address utility companies' financial concern with energy efficiency;
- and encourage energy savings to avoid infrastructure upgrade costs.

The most frequent reason reported for using an OBC was that the model **incentivises the desired environmental end**. For example, the US Department of Energy used performance-based incentives for the environmental clean-up of its sites to 'better link contractors' fees to the satisfactory accomplishment of specific tasks' (US General Accounting Office, 1998: 1). A report on Public-Private Partnership for the collection and segregation of household waste in Chennai, India, similarly justified the use of performance-linked fees: 'Performance contracts can play an important role in pushing for positive environmental outcomes associated with proper segregation' (Srinivasan, 2015: 23).

A further prominent reason reported was **reliable long-term performance**. One study noted that pay-for-performance (P4P) contracts for energy efficiency could offer more certainty that energy savings would persist over time. Unlike 'more

established rebate programs', which offer a one-off upfront payment, P4P continues to incentivise savings over the duration of a contract, which can be as much as 15 years or longer (Szinai *et al.*, 2017: 42).

Further studies emphasised the possibility of **service flexibility or innovation** in the use case for OBC. Connecting payments to outcomes in DC Water's Environmental Impact Bond, for example, allowed for 'innovative but unproven approaches to stormwater management' (Alexandrovich, 2017: 42), while the World Bank's results-based Clean Stove Initiative was reported to give stove suppliers 'the flexibility to innovate in how they design, produce, and sell the stoves, based on their familiarity with local conditions' (Zhang and Adams, 2015: 1).

Other aspects of the use case for OBCs focused on **sharing risk with the private sector**, something that was common to many of the OBCs represented in the studies, and was mentioned in multiple studies. Other benefits of collaborating with private partners were also highlighted. Two programmes for water supply and quality in India, for example, engaged private operators because the municipal corporations lacked sufficient technical capacity to rehabilitate and maintain the water distribution network (Water and Sanitation Program, 2014).

Studies that focused specifically on energy efficiency projects noted two further reasons for adopting an outcomes-based approach. First, to **remove the financial barriers** that prevent some organisations from implementing energy saving measures in their facilities (Yang and Chou, 2017). A study examining 'Energy Management-as-a-Service' in schools, for example, noted that '[t]he model shifts the burden of financing, owning, installing, operating, and maintaining energy assets from the customer [i.e., the schools] to the service provider' (Hawkins, 2020: 7).

Second, to **address the financial concerns that utilities companies may have with energy efficiency programmes**, which might otherwise be against their interests. Providing incentive payments to utilities for successful energy efficiency performance was reported as a way to make up for 'lost revenue' (Kushler *et al.*, 2006: 14) that results when customers use less energy. OBCs may therefore make investment in demand-side energy savings more attractive to utilities (Carley, 2012).

It is not universally the case that utilities companies are the incentivised party, however. In other examples represented in the studies, the utilities themselves offer incentive payments for demand-side energy savings, principally through contracting with energy service companies (ESCOs). In such cases, pay-for-performance models are used to encourage reduced energy consumption in order to 'avoid the construction of new power plants [and] reduce grid infrastructure costs' (Szinai *et al.*, 2017: 12). Consolidated Edison, for example, utilised a P4P programme in New York City because its distribution system was reaching capacity

and would have been 'very expensive to upgrade' (Szinai *et al.*, 2017: 46). Using an outcomes-based contract to reduce customer energy usage meant Con Edison avoided more expensive investments in upgrading the physical distribution infrastructure.

CHALLENGES: WHAT WERE THE REPORTED KEY CHALLENGES ENCOUNTERED DURING DESIGN AND IMPLEMENTATION OF ENVIRONMENTAL OBCS?

Eleven of the included studies discussed challenges encountered during the design or implementation of the OBCs they researched. The two most frequently reported challenges were problems with the **incentive structure** and **delays during negotiation and/or implementation**. Other challenges reported included: unanticipated variance in performance and/or cost from that predicted; difficulty developing good partnerships; and difficulty managing risks. One OBC faced severe public opposition, ultimately leading to contract termination.

Incentive structure – issues with appropriate target setting

Problems with incentive structure were reported for OBCs across policy areas, including pollution and waste management, water, sustainable infrastructure, and energy. Issues included payment metrics being **poorly defined, unrealistic, and badly chosen** (leading to perverse incentives, among other problems). A performance-based incentive for facility clean-up, for example, included a performance payment for every *filled* canister of 'immobilized high-level waste'. Yet, 'the incentive did not include criteria for what constituted an acceptably filled canister or specify the desired number of canisters to be filled' (US General Accounting Office, 1998: 4). A more precise definition of 'filled' was therefore introduced for the following year of the project. The same study notes one occasion of perverse incentive, whereby 'safety was compromised by the contractor in order to earn a fee' (US General Accounting Office, 1998: 3). No detail is given as to the nature of the incident, however.

The studies that focused on public-private partnerships in India reported multiple challenges with the incentive structure of the contracts. A water supply project in Mysore was reported to have unrealistic performance targets – namely, the target of 24/7 water supply to 100% of households (Water and Sanitation Program, 2014). In addition, the study reports that problems were caused by the fact that targets were inflexible; there was no means to adjust the targets in light of surveys, and there were no proportional payments for partial fulfilment of a performance requirement: 'If the operator is unable to achieve a performance target specified for a six-month period, the installment lapses and cannot be paid proportionately for partial performance or when the target is achieved at a later date' (Water and

Sanitation Program, 2014: 40). Reporting on the same contract, another paper notes the 'aggressive' and inflexible targets, suggesting that they 'create an incentive-motivation mismatch: when payments are not consistent with operating costs incurred by the provider and aggressive targets add to provider's financial woes, there is limited motivation to perform' (Srinivasan, 2015: 20).

Two further PPPs were similarly reported to have problems with their incentive structure. A waste management project in Chennai and a public toilet provision programme in Hyderabad both had payment indicators that were criticised as being **disconnected from the actual desired performance**. In Chennai, a measure on which payment was conditional included the 'number of vehicles/manpower' deployed to collect waste – a target that the report notes does not necessarily relate to the 'quality, timeliness or efficiency' of the service (Srinivasan, 2015: 24). The PPP for public toilets in Hyderabad similarly included some measures that were unrepresentative of quality and reliability, and, additionally, included targets that could not be verified – the non-use of phenyl or acid to disinfect the toilets, for example.

A final example of a challenge relating to incentive structure is provided by a study of P4P contracts for energy efficiency. A programme in New York aimed to procure energy savings from ESCOs (and build the ESCO market), but uptake was initially low because 'the incentives were too low to cover the proposed stringent and expensive [measurement and verification] of the program' (Szinai *et al.*, 2017: 44).

Inaccurate performance estimates

The studies reported challenges relating to inaccurate performance estimates. A utilities company offering P4P payments to ESCOs hoped to procure 150MW of energy savings, but secured 'commitments of only 40MW' in the first wave of contracts (Szinai *et al.*, 2017: 42). The Peru Sustainable Cocoa and Coffee Production DIB overestimated the potential increases in cocoa production. Here, the target outcome was to achieve an increase of cocoa production to 600kg per hectare for 60% of farmers in the intervention. Only 15% of the farmers achieved such an increase, however. A study notes that this 'was as much due to an optimistic estimate of yield as to the Mazorquero parasite that affected the harvest in 2015' (Rizzello and Kabli, 2020: 11).

By contrast, a programme that incentivised production of renewable energy with solar panels *under*estimated the performance of the intervention. The California Solar Initiative offers performance-based incentives (PBI), paying a fixed $/kWh rate for solar energy. Energy production was higher than predicted, however, and contributed to a 'a roughly $260 million budgetary shortfall' for the outcome payer (Bird *et al.*, 2012: 17).

Delays

Delays were reported for projects across policy areas, including pollution/waste management, sustainable infrastructure, and agriculture. In the OBCs for site clean-up, 'performance incentives at some of the sites were not approved until several months after the fiscal year had begun' (US General Accounting Office, 1998: 6). Meanwhile, a P4P energy efficiency programme's negotiation period 'took 10-18 months, instead of the expected 4 months' (Szinai *et al.*, 2017: 41). Such reasons for delay are not limited to OBC projects, and the reports were not explicit about whether it was the OBC mechanism itself that caused these delays. The launch of the Peru Sustainable Cocoa and Coffee Production DIB was also delayed, however, and this was reportedly due to the impact bond's **administrative processes that were new to all of the partners** on the project (Gustafsson-Wright *et al.*, 2017). In this case, delay posed a further risk to the project, because, as an agricultural intervention, the contract's viability is partly determined by the growing season: 'setbacks may mean waiting a full year before the project can move forward to coincide with the next harvest' (ibid., 64).

SUCCESS FACTORS: WHAT WERE THE REPORTED KEY FACTORS CRITICAL TO SUCCESSFUL IMPLEMENTATION OF ENVIRONMENTAL OBCS?

Eleven studies reported on factors that contribute to successful implementation of OBCs. The two most prominently reported factors were: clear, well-chosen incentives, and stakeholder 'buy-in'. Clear administrative procedures and an amenable legal/regulatory context were also reported as contributing to the implementation process.

Clear and well-chosen incentive measures

The clarity of the measures against which payment is to be made was reported across multiple studies as contributing to successful implementation. As a study of energy efficiency performance contracts put it: 'If objectives and rewards are not reasonably simple, transparent, and well-defined, it may be difficult to achieve desired program goals, and there may be possible conflicts and confusion' (Kushler *et al.*, 2006: 15). The benefits of clear and well-defined measures and incentives were also highlighted in the US Department of Energy's site clean-up projects. Learning from experience to improve its incentive structure year on year, the Department reduced the number of incentivised target measures to help focus the contractor's efforts on key-results. The project also changed the way it developed its incentives. Previous iterations of the contract had developed incentives in isolation from the site context, and the process was led by technical personnel. The resulting chosen incentives 'did not necessarily contribute to achieving DOE's goals for the site' (US General Accounting Office, 1998: 5). In response, the project began

developing incentives with an interdisciplinary team (i.e., including financial and contracting experts, as well as technical). The incentives were reviewed and approved by site-managers, to ensure they reflected 'the context of each site's activities' ibid., 5).

Stakeholder buy-in and relationships

The World Bank's clean stove initiative reported 'consulting all relevant stakeholders to ensure their buy-in' (Zhang and Adams, 2015: 6). Such stakeholder buy-in was also highlighted in a study of the DC Water EIB. The study attributed successful financing of the project to the existence of already good relations between outcomes funder (DC Water) and investors (Goldman Sachs and Calvert Foundation), and their willingness to innovate. The investors' confidence in the project was reportedly underpinned by 'the clarity and due diligence provided by external experts' (Andersen *et al.*, 2017: 50). The Peru Sustainable Cocoa and Coffee Production DIB likewise had partners who were 'brought together by their interest in testing the DIB concept and a commitment to putting this into practice' (Gustafsson-Wright *et al.*, 2017: 64).

With regard to energy efficiency programs, **buy-in from the utilities companies was particularly emphasised as a prerequisite to success**: 'If a utility's senior management is committed to supporting energy efficiency programs and sees the benefits they provide to customers *and* their company, energy efficiency programs are much more likely to be able to truly thrive, grow, and succeed' (Kushler *et al.*, 2006: 14).

Amenable legal/regulatory context

Multiple studies also highlighted the role of legal and regulatory frameworks for facilitating the implementation of OBCs.

The DC Water EIB was directly facilitated by a change in regulations: 'In 2015 […] D.C. Water modified its Consent Decree to allow for the use of green infrastructure to mitigate [combined sewer overflows]' (Alexandrovich, 2017: 39). The EIB in effect became a pilot for the effectiveness of the untested green infrastructure specified in the new decree.

In Taiwan, the Bureau of Energy took active measures to develop the ESCO sector and to promote the energy saving performance contracts (ESPCs) between ESCOS and public-sector institutions:

'In 2010, the [Bureau of Energy] promulgated a regulation to promote and support the ESPC approach and the ESCO industry with financial support for government agencies, public hospitals, public schools, and the service industry [...] an ESPC project can obtain a subsidy amount up to 166,667 USD [...] but the funding can be no more than one-third of total project cost.' (Yang and Chou, 2017: 484).

While Taiwan's government facilitated energy efficiency projects, California's government mandated them – a factor that was reported as contributing to the success of 'distributed energy resource' (DER) projects such as the EMaaS contracts used by schools: 'The success of DER projects in California largely reflects the state mandates for carbon emission reduction and renewable energy integration, as well as the growing need for energy reliability and resiliency' (Hawkins, 2020: 13).

IMPACTS: WHAT WERE THE REPORTED EFFECTS ON ENVIRONMENTAL OUTCOMES?

The evidence relating to the impact of OBC projects on their targeted environments is more limited. Eight out of the 18 included studies reported on outcome achievement or non-achievement and only one of the papers (Carley, 2012) formally compared the OBC to alternative contracting arrangements. Nevertheless, it is still possible to summarise the findings that were present. Two primary themes were identifiable:

- energy efficiency projects, in their various forms, reported energy savings; and
- public private partnerships for water supply implemented in India struggled to meet their performance targets.

These two findings were reported in more than one study. Other studies in the evidence base reported some positive progress towards desired environmental outcomes for the programmes they examined. These are reported below, but as the programmes are so different in design and context, it is not feasible to combine them into a synthesised cross-study finding.

Reported outcome achievement of energy efficiency OBCs

A variety of energy efficiency OBCs are represented in the review evidence base. In some, utilities companies are incentivised by performance payments from government bodies (Carley, 2012; Kushler *et al.*, 2006). In others, the utilities themselves offer pay-for-performance contracts to ESCOs (Szinai *et al.*, 2017). In yet another example, schools in California contract with independent service providers offering 'Energy Management as-a-Service' (EMaaS) (Hawkins, 2020). Across these various forms, **the studies all report the achievement of energy savings**. Seven out of the ten schools surveyed on their experience of EMaaS reported performance exceeding expectations, with the service delivering 'monthly savings increases of up to 30 percent' (Hawkins, 2020: 41). Even where expectations hadn't yet been met, interviewees were still seeing bill savings and felt confident about future savings. Elsewhere, a study of P4P energy efficiency contracts provided outcomes detail for eight separate programmes, all of which delivered

energy savings (Szinai *et al.*, 2017). Finally, a study that examined the use of performance payments by US state governments to incentivise utilities companies further emphasised the impact of the programmes by offering a comparison with states that did not offer such incentives: 'utilities in states with performance incentives experienced an average of 1,249,579 greater MWh savings than utilities in states without performance incentives' (Carley, 2012: 18-20).

Reported outcome achievement of PPPs in India

Two of the studies examined PPPs in India (Srinivasan, 2015; Water and Sanitation Program, 2014), covering six different contracts: water supply and quality (4); waste management (1); and public toilet provision (1). The water supply contracts were reported to have some limited progress, but **generally struggled to achieve incentivised outcomes**. No findings on outcome achievement or non-achievement were reported for the waste management and public toilet provision PPPs. A PPP for water supply in Latur is reported to have failed to make progress on its initial output target of 10,000 new metered water connections before the partnership ended. Only 450 meters had been installed in the first 12 months. The project furthermore **faced strong public opposition**, and this was cited as a key reason why the private operator declared their intent to withdraw from what was meant to be a 25-year PPP (Water and Sanitation Program, 2014). The partnership was therefore in effect over before longer-term performance targets, including water quality and managing water loss through leakage, could realistically be achieved. A similar PPP in Mysore made progress towards increasing the number of water connections in the city, but, having got to the final year of the 6-year contract, its broader performance targets, which included water quality, 'remain seriously challenged' (Water and Sanitation Program, 2014: 41). Reporting on the same PPP, another study noted that 'it seems unclear if this contract can effectively fulfill [*sic*] its universal service expansion mandate' (Srinivasan, 2015: 21). Reasons offered for this poor performance include: 'poor technical preparations leading to expansion in scope; poor PPP design, especially performance standards, revenue risk and contingency management; a hybrid contract that requires both construction and operation responsibilities; conflicting stakeholder interests; and aggressive bidding by the operator' (Water and Sanitation Program, 2014: 41). Two further water PPPs, in Nagpur and Aurangabad, are reported on, both of which were at the beginning of long-term contracts (25 and 20 years respectively) at the time of the study's publication. There is therefore limited detail on their performance targets.

Reported outcome achievement of other OBCs in the review

Beyond water and energy, studies examining projects for clean stoves and sustainable agriculture both reported **aspects of progress towards outcomes**. The

results-based financing clean stove initiative, piloted in two villages in China,[9] reported an annual household coal saving of 1.85 and 1.94 tons respectively (Zhang and Adams, 2015: Table 1, p. 6). Household survey results also saw 100% of respondents in both villages report better indoor air quality (ibid.). The Peru Sustainable Cocoa and Coffee Production DIB exceeded two of its outcome targets: 52 tonnes of cocoa were transferred to the producers' association in the final year of the project (exceeding the target of 35 tonnes), and 62 producers planted half a hectare of resistant coffee (exceeding the target of 40) (Rizzello and Kabli, 2020). The project made progress towards, but ultimately failed to meet, its two other outcomes targets: supply to the producer association increased by 45% (missing the target of 60%), and 15% of farmers increased their cocoa yield to 600kg per hectare (missing the target of 60%) (ibid.).

SERVICE DELIVERY: WHAT WERE THE REPORTED IMPLICATIONS OF OUTCOMES-BASED CONTRACTS ON SERVICE DELIVERY?

Seven of the studies reported on implications for service delivery when operating under an OBC. Positive influence was particularly associated with the practice of **monitoring progress and performance**, as well with **attaching incentives to performance goals**. As indicated in previous sections, studies examining PPPs in India reported less positively on the implications of OBC for service delivery.

For the Energy Management as-a-Service programmes in California schools, the practice of tracking progress and performance, inherent in an outcomes-based approach, reportedly led to improved 'peak shaving' (i.e., reducing/eliminating moments of 'peak' energy usage across the day). The software that was used to monitor the institutions' energy usage could 'learn' from the usage data, leading to improved peak shaving performance over time (Hawkins, 2020).

Tying payment to performance goals was judged an effective mechanism in energy efficiency projects and in the performance-based site clean-up programme. Utility company management reportedly became more supportive of energy efficiency investments in response to performance incentives, encouraging them to invest even more than the statutory requirement in efficiency programmes. Reporting on a performance-based scheme in Minnesota, Kushler (2006: 28) found that:

This incentive seems to be working well to encourage spending above statutory requirements (which is occurring). Utilities informally have indicated that their management is more supportive of energy efficiency investments because: (1)

[9] The clean stove initiative also implemented pilots in two regions in Indonesia. At the time of the study's publication, the Indonesian project had not completed, meaning no outcomes achievement/non-achievement was reported.

recovery of the conservation investment is guaranteed including a carrying charge on these investments, as well as an annual automatic adjustment to recover these investments, and (2) the performance incentive makes additional investments more attractive (beyond simply fulfilling statutory requirements for spending levels).

While the PBI for waste clean-up programme did have some problems with setting clear performance targets (see above), it was also reported that the programme administrators learned from these experiences. **Adjusting incentives in response to learning led to improved service delivery**; for example by specifying the number of cannisters to be filled with immobilized waste, and explicitly defining what constituted an acceptably filled cannister ('a minimum level of 96 inches' [US General Accounting Office, 1998: 4]).

Both the Peru Coffee and Cocoa DIB and the World Bank clean stove initiative reported some positive influence of OBC on service delivery, but with minimal explanatory detail. Regarding the Peru case, it was reported that the service provider utilised the flexibility that a DIB model allows. An interviewee stated: 'One of the lessons from this DIB was the importance of flexibility. The service provider was able to change their strategy on how they spent the resources' (Gustafsson-Wright *et al.*, 2017: 65). The DIB also reportedly 'influenced an improvement in performance management and monitoring systems' (ibid., 65). Monitoring and verification was similarly reported as having a positive influence on the World Bank clean stoves initiative: 'M&V improved program management and provided quantitative feedback to further improve program design and user satisfaction' (Zhang and Adams, 2015: 6). Furthermore, the results-based incentives in the program were associated with improved after-sales service (ibid.).

While the practice of monitoring and measurement was therefore associated with improved service in energy, agriculture, and clean stoves projects, in one of the Indian water supply PPPs (in Latur) an attempt to introduce metering was met with public protest. This public protest appears to have been a key factor in the operator withdrawing from the partnership: 'the operator appears to have concluded that the PPP arrangement is not enforceable on the ground' (Water and Sanitation Program, 2014: 27).

In another water PPP (Mysore), the service was stalled by a **breakdown in the relationship between the public commissioner and private operator**. The scope of water system rehabilitation that was defined in the contract turned out to underestimate the extent of work required, leading the operator to propose a doubling of investment in rehabilitation. The public Water Supply and Drainage Board did not want to invest more, or admit that its original estimate was inaccurate. 'This resulted in a stalemate in rehabilitation and also impacted the performance targets for the operator" (ibid., 38).

SECTION SUMMARY

- Examining the reported use case for environmental OBCs reveals how different projects have conceived the intended benefits of an outcomes-based approach. The most frequently reported reason for using an OBC was to incentivise achievement of the desired environmental end, and allow the service provider flexibility and innovation towards that end. For the specific goal of reduced energy consumption, OBCs are claimed to remove financial barriers to implementing energy saving measures, and address the financial concerns of utilities companies for whom reduced energy usage would otherwise be against their interests.
- The reported challenges and successes of OBC implementation both emphasise the importance of a well-designed incentive structure; namely, clearly-defined outcomes metrics and realistic targets. Projects that did not include such well-chosen metrics and targets reported a variety of challenges, including inability to verify a specified outcome, and 'incentive-motivation mismatches' whereby the benefit to the service provider is outweighed by the cost/difficulty of meeting contracted targets. Further factors reportedly contributing to successful implementation were stakeholder buy-in, and a legal/regulatory context that facilitates, rather than restricts, the kinds of innovative service partnership that OBCs are intended to produce.
- Only eight of the eighteen included reports provided detail on the achievement of contracted outcomes. Energy savings were reported across the variety of OBC forms with that aim. By contrast, the evidence on PPPs for water provision and quality in India indicates that they made minimal or no progress towards incentivised performance and environmental goals. The Peru Cocoa DIB and the World Bank Clean Stoves initiative are the only other projects with outcomes data reported in this review's included studies. Service users in the World Bank clean stove initiative in China saved fuel and reported improved air quality. The Cocoa DIB met and exceeded two of its four targets, and made progress towards, but ultimately missed, the other two.
- The practice of monitoring and measuring progress inherent in the OBC model was reported to have positive influence on service delivery in energy projects, a waste management project, and the clean stoves initiative. The monitoring process prompted services to learn and improve their program design and delivery. By contrast, however, in one of the Indian water PPPs, the attempt to introduce monitoring was met with public opposition, stalling the project's implementation.

5. Discussion

Outcomes based contracting has been implemented in a range of environmental projects. The state of the evidence base presented in section 3 demonstrates the diversity of contexts in which they have been utilised. Section 4 summarised findings from across the studies included in the review, highlighting the challenges and successes of the various OBCs, their reported outcomes achievements, and their influence on service delivery. Taking all this into account, this final section's discussion is guided by an overarching question: *are there potential benefits to the use of outcomes-based contracting for environmental policy?*

INITIAL OBSERVATIONS ON THE CURRENT STATE OF ENVIRONMENTAL OBC

Looking at the evidence maps presented in section 3 of this report, some initial observations are apparent about the current state of outcomes-based approaches to environmental management. Overall, OBC for environmental policy appears to have evolved and expanded over time. They have existed since at the least the 1980s, principally in the USA's energy sector, with the evidence showing more diversity in policy areas and geographies since the 2010s (Figure 4 and Figure 5 - *Researched environmental OBCs by contract start date. Source: Dataset of included environment studies. (n=42 OBCs) Circles are scaled according to the number of researched OBCs.*). Note again that this picture represents only those projects discussed in the studies that met this review's inclusion criteria. There will thus be even more cases of environmental OBC that are not captured here. Background reading for this review reveals that China, for example, has a well-developed ESCO market, larger even than the USA's.[10]

The OBCs represented in this evidence base cover a wide range of policy areas. They have different contracting structures, and they connect payment to a wide variety of environmental outputs and outcomes. This means that a range of models have been implemented and tested, providing a base of knowledge from which environmental OBCs could be expanded and replicated should they be deemed as having further potential to tackle the climate crisis.

Furthermore, the models of OBC implemented in environmental programmes are sometimes quite different from those that have been implemented for social programmes. Social impact bonds, for example, tend to have a duration of around

[10] See the International Energy Agency's graph of ESCO market size and distribution here: https://www.iea.org/reports/energy-service-companies-escos-2

5 years, and most have a government outcome payer.[11] By contrast, the environmental projects in this review include contracts of much longer duration (up to 30 years), and also include a greater proportion of registered companies/commercial organisations as outcomes payers, as well as government bodies and intergovernmental organisations. The environmental evidence therefore shows that a broad range of options for OBCs exist, and could offer inspiration/lessons to the design of socially oriented projects. Indeed, some of the *environmental* projects in this review already include *social* considerations, either directly as payable outcomes, or indirectly as conceived within the broader aims of a project. The question of how best to combine social and environmental aims together in outcomes-based service provision is a crucial one for the design of future OBCs.

Finally, it is important to note that the contracts represented here are heavily skewed towards the energy sector, and to the US context. Though we do not know the extent to which this is a skew only of the *evidence*, or if the actual real-world *presence* of OBCs is similarly skewed, it still raises a pertinent question – can the relative successes of the US energy management model be replicated in other policy areas, economies, and geographies? The next section therefore offers some further observations regarding the viability of environmental OBC more generally. The observations are particularly informed by the expert roundtable discussion conducted during the preparation of this report.

FURTHER CONSIDERATION OF THE VIABILITY OF OBC FOR ENVIRONMENTAL POLICY AND CLIMATE CHANGE MITIGATION

When considering both the challenges to implementation and the factors contributing to successful implementation, the **importance of the design of the incentive structure** emerges as perhaps the most crucial aspect. The findings for challenges and successes mirror each other on this point. That is, the most frequently reported challenge to OBC implementation was poorly defined, unrealistic, and/or unclear incentive targets; the most frequently reported factor contributing to success, conversely, was clear, well-chosen targets. What is typically meant, then, by a well-designed incentive structure? This has two components:

In relation to the *metrics,* there is an expectation that the outcome measures are clear, unambiguous, easily measurable, easily verifiable, and with the ability to align the incentives of multiple stakeholders. Studies also indicate the importance

[11] At the time of writing, the INDIGO Impact Bond Dataset lists 213 impact bonds with government outcome payers, and 23 with non-government outcome payers: https://golab.bsg.ox.ac.uk/knowledge-bank/indigo/impact-bond-dataset-v2/

of involving local stakeholders and potential beneficiaries/service participants in the development of outcome measures. Broader literature indicates that there may be tradeoffs between the clarity of narrow and specific outcome measures and broader – but potentially harder to measure – aspects of quality that may become overlooked.

In relation to *quantitative targets* or performance level, studies indicate that targets have worked well when they are achievable but ambitious (and therefore likely to change behaviour to strive towards the target). The level of financial incentive is seen to work well when this is of a sufficient magnitude to change behaviour (but needs to be calibrated so as to drive the *right* behaviours rather than perverse behaviours).

The studies reviewed included examples of projects that under-achieved relative to their contracted targets (e.g., the Peru Cocoa DIB failed to meet two of its four targets) and over-achieved (e.g., the California Solar Initiative [CSI] over-performed so much that it caused budgetary problems). But under- or over-achieving are not in themselves a problem. Indeed, they are inherent to the logic of OBC models. It is precisely the risk of under-performance that creates an incentive to adapt and improve, while the possibility to over-perform and make greater profits is likewise an incentive. The challenge, therefore, is not over- or under-performance *per se*, but the **difficulties that arise when the contracted targets/incentive design are based on unrealistic predictions**. Examples in this review included targets that were so unrealistic as to be unachievable, reportedly lowering morale on the part of the service provider. On over-performance, the problem in the CSI example was that no cap was set on an upper-limit of payment, and that the outcomes payer had not factored over-performance into their budget. This demonstrates the necessity of consulting technical experts when designing a programme's incentive structure, as well as those who understand the local operational context and delivery realities. Doing so can make sure performance estimates are as accurate as possible. For environmental OBCs, such technical input may involve an **understanding of the environmental factors that will determine what is possible in terms of performance**. The DC Water Environmental Impact Bond, for example, utilised historic rainfall data and knowledge of the infiltration rates of various soil-types in the target area when designing the project's performance payment tiers (Andersen *et al.*, 2017).

As noted in the previous section, the evidence indicates some successful achievement of outcomes in different environmental policy areas and in different economic contexts. Of these, the **success of the US energy programmes is the finding in which most confidence can be placed**. The studies report the achievement of energy savings across the different forms of energy contracts. It is particularly important to highlight the evidence of the replicability of such projects.

This review identified 43 individual performance-based energy projects in the USA, but we know that thousands of such performance contracts have been implemented over the past three decades. Larsen *et al*. (2012) note that the Lawrence Berkeley National Laboratory has collected data on at least 2,800 individual ESCO projects. While outcomes-based contracts in general are sometimes found to be expensive and difficult to replicate, the prevalence and reported success of energy saving performance contracts provides an example of OBC mechanisms being duplicated reliably and effectively.

The findings for the US energy OBCs contrast most notably with those for public-private partnerships in India. To reflect on the lessons that can be learned from this, it is useful to draw out some of the differences in the factors behind the success of US energy saving performance contracts and struggles of India's PPPs. A first point of comparison is the difference in the number of metrics being used to determine payment. The energy programmes generally used a **single metric, which can be reliably and accurately recorded** (megawatts/kilowatt-hours). Precise detail on all targets was not always reported for the Indian PPPs, but water supply projects in Mysore and Latur had at least eight performance targets each. At least some of these were judged as unrealistic – the target to achieve 24/7 water supply to 100% of households in Mysore, for example. Elsewhere, the Hyderabad PPP for public toilet provision included targets that could not be verified (the non-use of phenyl or acid to clean the toilets).

Furthermore, the energy saving interventions are based on a **sure understanding of which activities will lead to energy savings** – the installation of LED bulbs, for example, or upgrading a building's insulation. While the same confidence might apply to some of the activities needed to meet the PPPs targets (e.g., fixing leaks to reduce water loss), targets such as redressing 80% of complaints within 24 hours (Aurangabad water PPP) might not be so reliably linked to a specific activity (particularly since complaints could be varied and unpredictable).

As the 'use case' findings in the previous section demonstrate, one reason for adopting an OBC is their potential to allow for innovation in service provision and to try out untested solutions. The observation that energy management services' success is in part based on a sure understanding of what works therefore differs from the 'innovation' narrative. If we know what works, why not just pay directly for the required activities, rather than enter an OBC? At least two answers to this might be proposed. First, as indicated in the use case findings, there are other reasons cited, besides innovation, for using an OBC. For the energy saving services specifically, these include removing financial barriers that might otherwise prevent any actions being taken by some organisations. Schools, for example, might not have sufficient funds available to invest directly into building-efficiency upgrades, even if they do have a sure knowledge of what would be effective. Hence the appeal

of contracting with an ESCO, wherein the upfront cost is covered by an external company, and the school in effect repays the ESCO through the subsequent savings made. Second, the confidence that can be placed in activities that deliver energy savings might be indicative of a 'mature' model of OBC – one for which the drive for innovation has become less of a requirement. The fact that the ESCO model has existed since at least the 1980s, and that they now operate at scale, further supports an understanding of them as a mature form, as compared to the more recent, 'young' forms of environmental OBC, that are still in an experimental/innovative phase (like the DC Water environmental impact bond, for example). It may be that, as knowledge and understanding of what works in other policy areas becomes more certain through testing and innovation, they, too, will become more standardized in terms of activities and metrics. The use case for OBC may then begin to alter, as it becomes less about discovering new ways to reach a desired environmental end, and more about facilitating wider access to the service and taking operation to scale, as ESCOs have done for energy management services.

Beyond the targets in and of themselves, the strictness of the payment conditions was also highlighted as negatively effecting implementation of Indian PPPs – creating an 'incentive-motivation mismatch' (Srinivasan, 2015: 20). The implication of this reported observation is that a more flexible form of incentive structure would have been preferable – one that does not have such a strict cut-off point, or which offers **proportional payments according to progress made**, for example. Perhaps, in order to avoid the unexpected cost of over performance experienced by the California Solar Initiative (Bird *et al.*, 2012), a cap or taper should be put on the pay-performance scale. Yet the balance between flexibility and discipline needs to be considered carefully. Adjusting targets in light of their non-achievement may undermine other aspects of the OBC logic, for example, if the risk is thereby placed back onto the public sector, and/or the emphasis on achieving ambitious environmental outcomes is diluted.

IMPLICATIONS FOR POLICY

The review team convened a practitioner roundtable to present early findings and explore the policy implications for the review. This online workshop brought together eight representatives from a range of organisations including multilateral organisations, domestic government environment departments, and green finance advisors.

Roundtable participants see considerable potential for the broader adoption of OBCs in the environmental sector. A notable benefit that was identified by participants, but which was not present in the literature, is the potential for OBC to prevent 'greenwashing'. In this regard, the monitoring and verification of

outcomes at the heart of OBC was positioned as a key accountability tool. As 'green' and sustainable credentials have become increasingly salient for both governments and private organisations, OBC might therefore serve as a model for translating good intentions into transparent and verifiable effects 'on the ground'.

Three persistent challenges were highlighted in the discussion:

1. The challenge of setting ambitious but appropriate target levels in OBCs;
2. The challenge of identifying appropriate metrics that do not squeeze out important ecological considerations (e.g., CO_2 sequestration without regard for biodiversity – see below), and balancing flexibility/prescription in contracting arrangements;
3. Regulatory frictions that prevent 'payment for outcomes' contracting arrangements, particularly in highly regulated sectors, such as water and waste management.

Participants provided some suggestions of how to respond to these challenges. The endeavour to choose appropriate outcome targets, and metrics, could be informed by a culture of data sharing and transparency on project performance. This review's findings suggest that monitoring progress and performance of an OBC, and adapting incentives accordingly, led to improvement in service delivery. A culture of data sharing and transparency could ensure that such *internal* processes of learning and improvement could be replicated *externally*, as newly designed OBCs can draw on the insights provided by those which have been implemented in similar contexts. As for the challenge of regulatory frictions constraining the possibilities for OBC, participants advocated engagement with regulators to consider what adjustments might be necessary to enable OBC.

Further discussion during the roundtable emphasised that interventions into complex, biodiverse ecosystems need to be **informed by an understanding of that complexity, and of the potential for unintended negative effects**. There are reasonable calls for simplifying outcomes-based contracts, to make them more straightforward, and cheaper, to design and implement. But over-simplifying risks creating perverse incentives. For example, rapid carbon sequestration can be achieved by planting particularly fast-growing trees. But the narrow pursuit of carbon offsetting leads to widespread planting on one species of tree, creating monocultures that reduce biodiversity and deplete soil quality (this example was provided by a participant in the roundtable). It is therefore necessary that people with expert knowledge of ecosystems and communities in which interventions are proposed are involved in the design process. India case studies point to the importance of co-design, as did the US Department of Energy site clean-up example. **The interests of the ecosystem as a whole need to be represented in the contract.**

Can outcomes-based contracts be used to tackle the climate crisis? This review reveals emerging evidence that they can be effective in the right context. The use of energy saving performance contracts exemplifies a form of OBC that concentrates focus on the desired outcome, and provides correction to a market that that does not otherwise financially reward utilities for environmental outcomes. The evidence is currently confined to a certain geography and sector, however. Whether the 'US-energy model' can travel to other contexts and settings remains in question. Speculatively, it would seem reasonable to expect that it could be replicated for energy programmes in other high-income countries. One study did examine the ESCO market in Taiwan, for example (although that study did not report on the outcomes) (Yang, 2017), and China has a well-developed ESCO market (a fact not represented in the evidence base of this review). Applying the lessons of ESCOs to waste management, water quality and supply, and agriculture, however, requires more exploration.

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Annex: Screening, inclusion criteria, and search terms

INITIAL SCREENING ELIGIBILITY CRITERIA

The research team included studies if the abstracts indicated that the study investigated a form of outcomes-based contracting; provided an empirical contribution, [12] investigated an intervention that sought to incentivise the achievement of social and/or environmental outcomes; and was published on or after 1990.

HIERARCHICAL EXCLUSION CRITERIA TOOL

Following screening, the potentially relevant studies were reviewed in full, and assessed against three key inclusion criteria. The review team were given detailed guidance on how to assess the studies, and how to select a 'reason for exclusion' for those studies that did not meet the criteria. A summary of the hierarchical exclusion criteria tool used is as follows:[13]

1) STUDY DESIGN

*Does the paper provide an empirical contribution? An evidence contribution must describe the **primary research or secondary data analysis** (quantitative, qualitative or economic) or provide an **independent synthesis**.*

Reasons for exclusion:

- Absent empirics
- Wrong study design
- Misaligned systematic review

2) CONTRACTED AGENT

[12] This means that the study includes one or more of: primary data (qualitative and quantitative); analysis of secondary data; or an independent synthesis of existing research. It was a requirement specific to independent syntheses that they provide a formal description of the method. This additional requirement intentionally excluded informal 'think pieces', wherein it is unclear how the findings of a paper are established.

[13] This is just a summary. A full, detailed version of the hierarchical exclusion criteria tool was provided to the review team. A copy of the detailed version can be found in Appendix 2 of Picker *et al*. (2021)

*Is an **independent organisation** from the not-for-profit or private sector party to a **contract?***

Reasons for exclusion:

- Wrong intervention – contracted agent

3) OUTCOME MEASURE WITH FINANCIAL INCENTIVE

*Is a **financial incentive** attached to the achievement of a pre-agreed social or environmental **outcome measure**?*

Reasons for exclusion:

- Wrong intervention – broad SOC
- Wrong intervention – No financial incentive
- SOC unrelated to study's empirics

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If the study meets all of these criteria then it can be included.

ENVIRONMENTAL SEARCH TERMS

Resources consulted to develop a list of key search terms included:

- The World Bank Independent Evaluation Group's topic pages on: agriculture; climate change; energy and extractives
- The United Nations Sustainable Development Goals topic pages on: atmosphere; biodiversity and ecosystems; chemicals and waste; climate change; desertification, land degradation and drought; energy; food security and nutrition and sustainable agriculture; forests; green economy; mountains; oceans and seas; rural development; sustainable cities and human settlements; sustainable consumption and production
- The Oxford Martin School's 'Environment' pages
- The UK Foreign, Commonwealth, and Development Office's (FCDO) 'Outcome Delivery Plan 2021-22', and subsection on 'Tackling climate change and biodiversity loss' in FCDO's Integrated Review of Security, Defence, Development and Foreign Policy.

The specific environmental search terms used to identify relevant, included studies from the wider systematic review are in the table below.
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Broad topic terms	**Ecosystems and biodiversity**	**Resource management and solutions**
Climate	Biodiversity	(Conservation of) Protected areas
Nature	Terrestrial/ Aquatic Ecosystem (management)	Conservation
Environmental	Ecosystem services	Regenerative, reconstruction or restoration
Climate change Mitigation	Ecology	Green
Climate change Adaptation	Biological diversity (biodiversity)	Greening
Sustainability	Deforestation	Green economy
Energy	Vegetation	Green growth
Grid	Forests	Circular economy
Electrification	Trees	Climate finance
Electricity	Precipitation	Climate services
Heat	Ecological flows	Nature based solutions
Renewable energy	Flora	Sustainability
Energy	Fauna	Resource management
Solar power	Nutrients	Geoengineering
Wind power	Dryland	Meteorology
Energy transition	Desertification	Natural/environmental/water governance
Clean energy	Drought	Resilience
(Coal) Power plants	Ocean	Urban planning
Energy management	Marine	Bioremediation
	Watershed	Eco/environmental tourism (management)
	River basin	Transport
	Aquifer	Mobility
	Groundwater	Health, safety and environment (HSE)
	Surface water	Environmental modelling
	Seas	
	Coastal zones	

	Wildlife Mountains Wetland Biotechnology Natural hazards Hydrology Geology Microbiology Water Geographic information systems	Remote Sensing Water quality Environmental Economics Water resources management Environmental Impact Assessment (EIA) Environmental Law Environmental management Sustainable construction Sustainable buildings Infrastructure (green infrastructure) Marine resources (Fresh)water resources Natural resources
Carbon emissions/global warming Carbon emissions/global warming Carbon emissions or decarbonisation Carbon investment Post-carbon Net zero Nationally determined contributions Atmosphere Greenhouse Gas Emissions (GHG) Greenhouse effect	**Agriculture** Agriculture Food (Food security) Soil Farm Rural Land management Land degradation Livelihoods Smallholder Irrigation Pesticide (management) Pests Fertilizer	**Pollution** Pollution (Bio/biological/biobased) Plastic Resource degradation Air (quality)/pollution (control) Toxic chemicals Erosion Waste (hazardous; solid; radioactive) Contamination Wastewater (treatment) Regenerated water Toxicology

Anthropogenic (activities) Temperature rise Fossil fuels Natural gas Sea-level rise	Commodities Compost Crop (management) Manure Best-management practices (BMP) Yields Silage	Industrial Contamination/waste Atmospheric monitoring Faecal Sludge Activated Sludge Flood Stormwater

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