IEU LEARNING PAPER

07/2024

EVIDENCE REVIEW ON MARKET-BASED APPROACHES TO MITIGATION AND ADAPTATION

Andreas Beavor, Zephaniah Danaa, Leigh Dowsett, Fizza Fatima,
Samia Khan, Elangtlhoko Mokgano, Martin Prowse

GREEN CLIMATE FUND | Independent Evaluation Unit

TRUSTED **EVIDENCE**.
INFORMED **POLICIES**.
HIGH **IMPACT**.

Evidence review on market-based approaches to mitigation and adaptation

Andreas Beavor, Zephaniah Danaa, Leigh Dowsett, Fizza Fatima,
Samia Khan, Elangtlhoko Mokgano, Martin Prowse

07/2024

175, Art center-daero
Yeonsu-gu, Incheon 22004
Republic of Korea
Tel. (+82) 032-458-6450
Email: ieu@gcfund.org
https://ieu.greenclimate.fund

First Edition

This paper is a product of the Independent Evaluation Unit at the Green Climate Fund (GCF/IEU). It is part of a larger effort to provide open access to its research and work and to make a contribution to climate change discussions around the world.

While the IEU has undertaken every effort to ensure the data in this report is accurate, it is the reader's responsibility to determine if any and all information provided by the IEU is correct and verified. Neither the author(s) of this document nor anyone connected with the IEU or the GCF can be held responsible for how the information herein is used.

Citation
The suggested citation for this paper is:
Beavor, Andreas, and others (2024). Evidence review on market-based approaches to mitigation and adaptation. IEU learning paper (July). Songdo, South Korea: Independent Evaluation Unit, Green Climate Fund.

Credits
Head of the GCF Independent Evaluation Unit: Andreas Reumann
Task manager: Dr. Martin Prowse, Evaluation Specialist, Independent Evaluation Unit
Editing: Greg Clough
Layout and design: Giang Pham
Cover photo: A smallholder farmer in Kenya is watering a garden within the GCF-funded FP078 project, ©Little Big Films/Green Climate Fund

Completion
The report was completed in December 2023, reviewed up to June 2024 and published in July 2024.

A FREE PUBLICATION

Printed on eco-friendly paper

About the IEU

The Board of the Green Climate Fund (GCF) established the Independent Evaluation Unit (IEU) to objectively assess the Fund's results, including its funded activities, effectiveness and efficiency. The IEU fulfils this mandate through four main activities:

Evaluation: Undertakes independent evaluations to inform GCF's strategic result areas and ensure accountability.

Learning and communication: Ensures high-quality evidence and recommendations from independent evaluations are synthesized and incorporated into the GCF's functioning and processes.

Advisory and capacity support: Advises the GCF Board and its stakeholders of lessons learned from evaluations and high-quality evidence and provides guidance and capacity support to implementing entities of the GCF and their evaluation offices.

Engagement: Engages with the independent evaluation offices of accredited entities and other GCF stakeholders.

About the IEU's Learning Paper series

The IEU's Learning Paper series is part of a larger effort to provide open access to the IEU's work and contribute to global discussion on climate change. The series aims to contribute to learning and global knowledge on what works, for whom, why, how much, and under what circumstances in climate change action. The findings, interpretations and conclusions are entirely those of the authors. They do not necessarily reflect the views of the IEU, the GCF, its affiliated organizations or the governments associated with it. Comments are welcome and should be sent to ieu@gcfund.org.

About this IEU Learning Paper

This learning paper examines and synthesizes evidence in systematic reviews focused on four market-based approaches: index-based insurance, payments for ecosystem services, results-based payments and willingness to pay. As an evidence review, the learning paper summarises the key factors which moderate the effectiveness of each approach across different countries and contexts.

ACKNOWLEDGEMENTS

The learning paper's authors express their appreciation to Deborah Sun Kim for assisting with co-drafting the terms of reference for the evidence review. The authors also express their gratitude to Anna Koch and Naji Makarem for their support in compiling the systematic reviews.

LIST OF AUTHORS

The authors of the evidence review on market-based approaches to mitigation and adaptation are (in alphabetical order by last name):

FULL NAME	AFFILIATION
Andreas Beavor	Urban Emerge
Zephaniah Danaa	Formerly Independent Evaluation Unit, Green Climate Fund
Leigh Dowsett	IMA International
Fizza Fatima	Urban Emerge
Samia Khan	Urban Emerge
Elangtlhoko Mokgano	Independent Evaluation Unit, Green Climate Fund
Martin Prowse	Independent Evaluation Unit, Green Climate Fund

ABSTRACT

The Green Climate Fund (GCF) is well-positioned to lead the acceleration of private sector finance for climate mitigation and adaptation. This evidence review focuses on specific market-based approaches that have the potential to scale private sector financing for climate action. The approaches include index-based insurance, payments for ecosystem services, results-based payments, and willingness to pay assessments. It assembles evidence scattered across different actors, silos and sectors.

The review highlights commonalities across the four selected approaches to inform learning within the GCF and, more broadly, across the climate finance landscape. It does this by aggregating findings from existing systematic reviews. This report is limited to causal studies and focuses mainly on the second of these two questions:

- To what extent have the selected market-based approaches effectively achieved mitigation and adaptation outcomes in developing countries?
- What factors influence the effectiveness and efficiency of these market-based approaches in developing countries?

This evidence review examines the landscape of existing systematic reviews through an iterative search process. The review uses the Population, Intervention, Comparison, Outcomes model to guide its inclusion and exclusion criteria. A total of 79 systematic reviews met the strict inclusion criteria, selected from 39 academic and grey literature databases, including Scopus, Web of Science, JSTOR, and the Campbell Collaboration, in line with PRISMA standards.

The review found that the factors that influence the effectiveness and efficiency of these four interventions are wide ranging.

For **index-based insurance**, they include:

- *Challenges with adoption, uptake and use* – the customers' risk perception
- *Financial support* – access to credit
- *User knowledge and perception* – design and administration of insurance products
- *Basis risk* – minimization of mismatches between weather indices and real conditions
- *Technological support* - availability of digital solutions

For **payments for ecosystem services**, key factors that influence the effectiveness of schemes are predominantly at the local and institutional levels. For example:

- *Stakeholder and community participation* – local community engagement
- *Geographical* – transparent spatial targeting and land tenure arrangements
- *Governance and institutional capacity* – governance of PES schemes
- *Monitoring, reporting and verification* – results systems
- *Financial support* – transaction costs
- *Challenges with adoption, uptake and use* – financial and non-financial motivators

For **results-based payments**, the factors influencing success are mainly at the national and institutional levels, suggesting this approach is more suited to regional or national level interventions. They include:

- *Policy and regulatory frameworks* – for ensuring compliance with conditions
- *Governance and institutional capacity* – for implementing effective policy

- *Political support* – for mobilizing actors and investments
- *Monitoring, reporting and verification* – for tracking progress towards pre-agreed results
- *Stakeholder/community participation* – for promoting a sense of ownership
- *Financial and technical support* – for incentivizing and standardizing

Actors' **willingness to pay** applies to all three preceding approaches, especially index-based insurance and wider market-based approaches. WTP offers insights into the opportunities and constraints for private sector-financed climate action. Factors that moderate households' WTP for a wide range of goods and services can be grouped into:

- *Sociodemographic factors* – education, gender, age, marital status, household size
- *Financial support* – wealth status, subsidies, payment modalities, price
- *Policy and regulatory frameworks* – environmental policy and governance
- *Technological support* – design, durability, operational issues, access to information and communication technology
- *Norms and values* – subjective norms, beliefs and behaviours
- *Trust in the service provider* – confidence in the providers and their products
- *Geographical* – residency and distance
- *Quality and characteristics of products and services* – safety, quality, transparency

The Independent Evaluation Unit encourages the GCF to consider the evidence review's findings in terms of the viability and enabling environments for these market-based approaches in climate mitigation and adaptation interventions. In particular, the GCF may wish to consider the following findings.

First, that **enhancing the adoption, uptake and use of index-based insurance products** may require bundling the service with access to credit, and bespoke design and administration to address customers' risk perception.

Second, that GCF financial support for **RBP modalities could consider regions or countries demonstrating key attributes** such as solid policy and regulatory frameworks, governance and institutional capacity and broad political support.

Third, the GCF may wish to consider that the effectiveness of **PES schemes**, as a form of results-based finance, **can be enhanced through factors predominantly at the local and institutional levels**, including local community and stakeholder engagement, land tenure arrangements, transparent spatial targeting as well as monitoring and results systems.

Fourth and finally, when supporting the testing and scaling up of return-generating climate solutions, the GCF may wish to **consider the factors which influence households' willingness to pay for products and services** including sociodemographic aspects, social and cultural beliefs, behavioural aspects and geographical location as well as wealth. The GCF could carefully consider specific locations or segments of populations that are most likely to adopt and utilize pilot interventions, to support appropriate pricing to improve the uptake of solutions and services.

CONTENTS

Acknowledgements iv

List of authors v

Abstract vi

Abbreviations xi

A. Introduction 1

1. Description of the problem: the need to scale up climate finance 1
2. Objectives of the evidence review 1
3. Introduction to the selected market-based approaches 2
   a. Index-based insurance 2
   b. Payments for ecosystem services 2
   c. Results-based payments 3
   d. Willingness to pay 4
   e. Interlinkages between the market-based approaches 4
4. Considerations for GCF programming 4

B. Methods 5

1. Overview of the search process 5
2. Search terms 5
3. Screening of studies 6
4. Results of the search 6
5. Analysis and synthesis of selected studies 7

C. Results 8

1. Index-based insurance 8
   a. To what extent has index-based insurance been effective at achieving mitigation and adaptation outcomes? 8
   b. What factors influence the effectiveness of index-based insurance in developing countries? 10
   c. Conclusions on the evidence trends for index-based insurance 14
2. Payments for ecosystem services 15
   a. To what extent have payments for ecosystem services been effective at achieving mitigation and adaptation outcomes? 19
   b. What factors influence the effectiveness of payments for ecosystem services in developing countries? 22
   c. Conclusions on the evidence trends for payments for ecosystem services 31
3. Results-based payments 32
   a. Defining results-based payments and relevant sectors to which they are applied 32
   b. To what extent have results-based payments been effective at achieving mitigation and adaptation outcomes? 34
   c. What factors influence the effectiveness of results-based payments in developing countries? 37
   d. Conclusions on the evidence trends for results-based payment 40
4. Willingness to pay 41
   a. Health 41

b. Forest ecosystem conservation 42
c. Energy 43
d. Water and sanitation 44
e. Pro-environmental consumer goods and services 45
5. Conclusion 47
D. Discussion 47
1. Findings on the range of factors that influence effectiveness 48
2. Findings on interlinkages between the four market-based approaches 52
3. Implications for GCF programming 53
E. Conclusions 54

APPENDICES 57

Appendix 1. Search terms 58
Appendix 2. Additional sources and findings 61
Appendix 3. Summary of the key results-based payment intervention types 68
Appendix 4. List of targeted databases 71
Appendix 5. List of systematic reviews included in the synthesis 73

REFERENCES 79

TABLES

Table 1. Breakdown of topics covered by the studies selected for the synthetic review 7
Table 2. Socioeconomic and ecological impacts of weather index insurance 8
Table 3. Sample of PES impact indicators reviewed in the selected SRs 21
Table 4. Summary of land tenure types 24
Table 5. Examples of conditionalities for PES schemes 29
Table 6. Effect sizes extracted from the studies referenced 31
Table 7. Main factors affecting sustainable consumer behaviour in the Middle East and North Africa 45
Table 8. Summary and importance of factors for the effectiveness of index-based insurance 48
Table 9. Summary and importance of factors for the effectiveness of PES 49
Table 10. Summary and importance of factors for the effectiveness of RBPs 50
Table 11. Summary and importance of factors influencing the WTP 51
Table 12. Summary of factors influencing the selected approaches and degree of priority 52

Table A - 1. Summary WTP estimates 63
Table A - 2. Overview of key RBP interventions 68

FIGURES

Figure 1. PRISMA diagram 7
Figure 2. Conceptual framework of weather index insurance for mitigation of weather risks in agriculture 14
Figure 3. Broad categories of PES 17
Figure 4. Costa Rica introduced a Payments for Ecosystem Scheme (PES) in 1996 through a Forestry Law 18
Figure 5. Ladder of citizen participation 27
Figure 6. Four stages of the RBP model 32
Figure 7. Performance measurement and management framework 33
Figure 8. Factors influencing fruit and vegetable consumption and purchase behaviour 46

BOXES

Box 1. The Global Index Insurance Facility 11

ABBREVIATIONS

AEs	Accredited entities
Ci-Dev	Carbon Initiative for Development
CDM	Clean Development Mechanism
CBHI	Community-based health insurance scheme
FAIR	Findability, Accessibility, Interoperability, and Reusability
GM	Genetically modified
GIIF	Global Index Insurance Facility
GCF	Green Climate Fund
GHG	Greenhouse gas
GDP	Gross domestic product
IEU	Independent Evaluation Unit
IBI	Index-based insurance
MSMEs	Micro- small- and medium-sized enterprises
MRV	Monitoring, reporting and verification
NbS	Nature-based solutions
NGOs	Non-governmental organizations
PES	Payments for ecosystem services
PICO	Population, Intervention, Comparison, Outcomes model
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
REDD+	Reducing emissions from deforestation and forest degradation
RBP	Results-based payments
SMD	Standardized mean difference
SR	Systematic review
USD	United States dollar
WASH	Water, sanitation, and hygiene
WTP	Willingness to pay

A. INTRODUCTION

1. DESCRIPTION OF THE PROBLEM: THE NEED TO SCALE UP CLIMATE FINANCE

Global mitigation investment is considerably lower than needed to limit global warming to 1.5 degrees (Climate Policy Initiative, 2022). Estimates of global climate financing suggest a current range of USD 620 to 640 billion of tracked mitigation and adaptation domestic and international flows in 2019 and 2020. This is less than a fifth of what is required throughout this decade. Furthermore, 90-93 per cent of all tracked climate finance flows currently target mitigation purposes, with the remaining proportion split between adaptation and dual purposes.[1] Due to the urgency of the climate challenge, the considerable mitigation finance gap, and limited fiscal space in many Annex I countries, the balance between public and private finance will need to rapidly change in the coming years. For example, according to the Ehlers and others (2022), if global commitments are to be met, (i) private finance must be doubled by 2030, and (ii) low-carbon and adaptation-focused investments urgently need incentivization through private financing mechanisms in emerging markets.

As the world's largest climate fund, the Green Climate Fund (GCF) can be instrumental in overcoming these challenges. The GCF is strongly positioned to mobilize action through its Governing Instrument. The GCF houses a "private sector facility that enables it to directly and indirectly finance private sector mitigation and adaptation activities at the national, regional and international levels" (Green Climate Fund, 2011, para. 41).

A range of market-based approaches can contribute to meeting this challenge and accelerate private sector finance for mitigation and adaptation solutions. Yet global evidence on key market-based approaches is scattered across different actors, silos and sectors. The GCF's Independent Evaluation Unit (IEU) has identified four key market-based approaches for this evidence review that have potential to scale private sector financing for climate action:

- Index-based insurance (IBI)
- Payments for ecosystem services (PES)
- Results-based payments (RBP)
- Willingness to pay (WTP) assessments

2. OBJECTIVES OF THE EVIDENCE REVIEW

This evidence review highlights commonalities across the four selected market-based approaches to inform learning within the GCF and, more broadly, across the climate finance landscape. It aggregates findings from studies included within existing systematic reviews (SRs) and synthesizes these using qualitative methods. SRs mainly include causal studies and are the gold standard for aggregating effect sizes and findings from specific interventions on selected outcome areas in a rigorous and replicable manner.

The findings raise awareness on how to enhance the origination and programming of return-generating projects in the GCF and climate finance fields. The review synthesizes evidence from SRs to address two research questions:

[1] Just over half of current flows are from public actors, predominantly national and multilateral development finance institutions. Globally, the balance of public and private investment varies considerably, with private flows dominating in Annex I countries, especially the United States, and public flows dominating in non-Annex I parties (especially sub-Saharan Africa).

- To what extent have the selected market-based approaches relevant to mitigation and adaptation effectively achieved desired outcomes in developing countries?
- What factors influence the effectiveness and efficiency of these market-based approaches in developing countries?

As described in section B, the review has used clearly defined search criteria, following key protocols applied by leading global institutions in the field of evidence synthesis.

3. INTRODUCTION TO THE SELECTED MARKET-BASED APPROACHES

The four market-based approaches identified to accelerate financing and impact for mitigation and adaptation are briefly introduced below.

a. Index-based insurance

IBI is a financial tool that provides affordable protection for smallholder farmers against crop losses due to drought, thus protecting livelihoods after suboptimal growing seasons (International Labour Organization, 2017).[2] Unlike traditional indemnity-based insurance, which can be costly for small scale farmers, index insurance uses data from satellites or weather stations to determine payouts based on aggregated indices. These indices are designed to be easy to measure and independent of household losses. As a result, the assessment process is less costly, and compensation is paid sooner than traditional insurance (Appui au Développement Autonome, 2022).

When implemented responsibly, IBI can benefit smallholders, reduce reliance on transfers, preserve assets and avoid food shortages. It also encourages on-farm productive investment in good years and improves access to finance for low-collateral or previously deemed "high-risk" borrowers (Steinmetz, n.d.). However, several challenges hinder the widespread adoption and scalability of IBI initiatives, including affordability of insurance premiums for smallholders, limited access to information about insurance products as well as the potential mismatch between the index used for insurance payouts and the actual weather conditions experienced by farmers, termed basis risk (Carter and others, 2014).

Access to IBI is likely to improve adaptation in developing countries, particularly for households who can afford the premiums and have sufficient information on the products available and redress mechanisms. It also has an interesting role to play in the accelerated deployment of renewable energy. However, as discussed in this evidence review, many enabling factors and constraints must be understood to enable broader deployment.

b. Payments for ecosystem services

PES, also referred to as payments for ecosystem services, are based on a voluntary transaction where a buyer purchases a defined ecosystem service from a provider, contingent on the provision of the service (Fripp, 2014). PES incentivize environmental stewardship and protection of natural assets, often by changing the behaviour of key actors and local communities, reducing the prevalence of extractive livelihoods. Common PES drivers include carbon sequestration, biodiversity protection and protection of watersheds. PES initiatives can offer ecological and socioeconomic advantages by aligning financial incentives with environmental conservation efforts. These benefits should reach local communities, providing opportunities for sustainable livelihoods (Salzman and others, 2018).

[2] IBI is a form of parametric insurance. IBI can also be applied to a range of sectors beyond agriculture, such as forestry, renewable energy, water supply, and irrigation.

The Costa Rican PES scheme is one of the earliest and most well-known examples of forest protection measures implemented in a developing country (Hinojosa, n.d.). Another successful example is Uganda's Kibale PES scheme (Osewe and others, 2023).[3]

While PES schemes are most commonly applied in the forestry sector (Kaiser, Haas and Krueger, 2023), other key sectors include agriculture, land conservation, watershed services and blue carbon conservation. Encouraging environmentally beneficial land-use is also incentivized by some PES schemes. For example, farmers can be incentivized to use agroforestry practices that integrate trees and woody shrubs into crop and livestock production systems. Various public and private sector sources, including the voluntary carbon market, can finance PES. As such, PES has the potential to accelerate private sector finance contributions to mitigation and adaptation.

c. Results-based payments

RBP is a financial instrument that pays for achieved results, encouraging the accomplishment of pre-agreed milestones (Organisation for Economic and Co-operation Development, 2014). Payments are disbursed upon achieving agreed-upon targets and typically after verifying that outcomes are authentic and additional, meaning they would not have happened without the project's intervention (World Bank, 2022). RBP can incentivize improvements in domestic institutions, policies, and infrastructure, involving the private sector and other stakeholders. Given that it is tied to achieving predetermined outcomes, this financing modality can increase the likelihood of project success (Organisation for Economic and Co-operation Development, 2014).[4]

RBPs are applied in various sectors relevant to mitigation and adaptation, such as infrastructure development and energy, water and transport. They are also applied in approaches such as nature-based solutions (NbS). For example, in the energy sector, the Carbon Initiative for Development (Ci-Dev) offers results-based climate funding for initiatives that promote off-grid solar markets and improve energy access in developing countries.[5]

Independent verification is a crucial aspect of the RBP process, ensuring the credibility and integrity of emission reduction claims. There is a key debate within the evaluation literature regarding approaches to measuring RBP project outcomes. For example, Hevenstone and others (2023) examined five European social impact bonds, all of which used RBP financial instruments. They found project implementers usually shunned a gold standard approach for measuring impact that used experimental or quasi-experimental designs in favour of non-causal approaches due to, *inter alia*, the challenges of delivering and communicating causal designs to a wide range of stakeholders (Hevenstone and others, 2023).

[3] A further example comes from Kenya's Lake Naivasha Payment for Ecosystem Services scheme, where a PES scheme aimed to incentivize landowners and farmers in the basin to adopt sustainable land management practices, preserving ecosystem services like water quality and biodiversity. It operated through a collaboration between the government, conservation organizations and private sector stakeholders. An innovative aspect of the scheme was a system that allowed farmers to redeem vouchers for certified seeds at selected agro-input supplier shops (Osewe and others, 2023).

[4] The IEU recently completed a global evidence review examining RBPs across multiple sectors and regional patterns of RBP modalities up to 2020 in developing countries and in low-income contexts/settings (defined in relative terms) in Annex I countries (Meuth Alldredge and others, 2020). While the review found evidence in North America, East Asia and Pacific, sub-Saharan Africa, and Latin America and the Caribbean, it found limited evidence in the Middle East and North Africa. Furthermore, almost half of all available evidence was from the health sector, followed by agriculture and forestry, and education. RBP evidence related to the energy sector was limited. This evidence review builds on the IEU's 2020 study, with a sole focus on evidence in existing systematic reviews within developing countries.

[5] Ci-Dev has backed programmes that facilitated the installation of approximately 84,000 solar home systems in households in Kenya and the distribution of more than 700,000 solar lanterns in Ethiopia (World Bank, 2022; Ci-Dev, 2020).

d. Willingness to pay

WTP refers to the amount individuals or communities are willing to spend for a specific good or service. Factors influencing people's WTP for specific goods and services include income, awareness of the good or service, education, geographical location, gender and individual values and attitudes. WTP values can vary significantly across regions and economic sectors due to differences in socioeconomic characteristics and environmental concerns (Streimikiene and others, 2019). There are many methodological differences in WTP studies, including valuation techniques and survey designs, which can influence results.[6]

Understanding WTP is vital for informing policymakers and designers of programmes and initiatives about potential support for climate change mitigation and adaptation that rely on market-based systems. Such insights can support public and private sector entities develop appropriate approaches with reasonable and reliable price estimates to accelerate the uptake and scale of important climate action solutions.

e. Interlinkages between the market-based approaches

As is apparent from the above, interlinkages exist between these four market-based approaches. For example, WTP influences the uptake of both PES and IBI related solutions. In the case of PES, this includes the willingness of a household or smallholder farmer to cover the upfront costs required to change farming or other methods towards those based on environmental stewardship. In the case of IBI, consumers will compare costs versus competing forms of insurance, such as kinship- and community-based redistribution mechanisms in times of stress. They will also consider wider costs and priorities, such as food, fuel, farming inputs, household needs, and education and health costs. RBP frameworks also underpin many forms of PES, particularly REDD+[7]. These interlinkages are explored in the review and summarized in the discussion.

4. Considerations for GCF programming

The GCF is the world's largest dedicated climate fund serving developing countries. Since its inception, it has committed over USD 13.5 billion to more than 243 projects in over 128 developing countries and mobilized an additional USD 51.8 billion in public and private co-financing.

The Strategic Plan 2024-2027 aims to chart a course for delivering the highest possible levels of catalytic impact through its key assets. These include its financial resources, partnerships, convening power, people and knowledge. Within this context, and building on the Governing Instrument and GCF-1 programming targets, the GCF's programming priorities for 2024-2027 (Green Climate Fund, 2023a) include:

- **Private sector:** Promoting innovation and catalysing green financing while increasing the share of funding allocated through the Private Sector Facility compared to GCF-1. The GCF will seek to catalyse climate finance from the wider finance ecosystem, engaging key actors

[6] To estimate WTP, contingent valuation, choice experiments and hedonic pricing can be used. The contingent valuation method is widely used to estimate economic values for ecosystem and environmental services, including use and non-use values. It involves directly surveying individuals to determine how much they would be willing to pay for specific environmental services or how much compensation they would accept to give up these services, contingent on a hypothetical scenario (Ecosystem Valuation, n.d-a.). Despite its popularity, the contingent valuation method is the most controversial among non-market valuation methods. A choice experiment estimates the economic values for the various attributes of an environmental good or service, including its price, through a multidimensional, preference-based valuation surface that can be utilized in benefit-cost analysis and other non-market valuation applications (Holmes, Adamowicz and Carlsson, 2017). Hedonic pricing calculates economic values for ecosystem or environmental services that can directly impact market prices. Its most frequent application involves analysing changes in house prices, which reflect the value of local environmental attributes (Ecosystem Valuation, n.d-b.).

[7] REDD+ stands for reducing emissions from deforestation and forest degradation in developing countries, plus the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries.

such as local private sector early-stage ventures, micro- small- and medium-sized enterprises (MSMEs) and national and regional financial institutions.

In line with these programming priorities, the GCF is aiming to achieve the following targeted results within this programming period:

- Support for developing countries that results in 900 to 1,500 **local private sector early-stage ventures and MSMEs** provided with broad-based seed and early-stage capital for innovative climate solutions, business models and technologies, with a focus on adaptation, energy access and transport sectors, and removing barriers for home-grown innovation.
- Support for developing countries that results **in 90 to 180 national and regional financial institutions supported to access GCF resources** and other green finance, particularly for MSMEs.

Considering these priorities and targets, the evidence presented in this review highlights opportunities where GCF support can enhance the development of private sector-led innovation. The Strategic Plan 2024-2027 emphasizes the Fund will particularly focus on testing and scaling up financing for adaptation and resilience solutions. This heightened focus is especially relevant for PES and IBI as mechanisms for accelerating private investment. In addition, the GCF's focus on partnerships indicates there may be an enhanced role for RBP. For example, the Board at B.37 considered a draft proposal on financing RBP for REDD+, building on the outcomes of the pilot phase.[8]

Overall, the detailed evidence on the effectiveness of these approaches and the factors that determine their success will allow the GCF to consider how it can incorporate these approaches to support and guide accredited entities (AEs) in the project design.

B. METHODS

1. OVERVIEW OF THE SEARCH PROCESS

The review team used a robust search process to select relevant SRs to respond to the research questions. The Population, Intervention, Comparison, Outcomes (PICO) model provided the evidence review's inclusion and exclusion criteria. The PICO framework defined the search terms, synonyms, index terms, and combined search terms for the search (as described in section 3 and shown in Appendix 1).

The review team identified 42 bibliographic databases and sources of grey material.[9] [10] The following sections describe the key elements of the search process and review of identified studies.

2. SEARCH TERMS

Search terms were designed to include non-Annex 1 countries, SRs, with a focus on interventions to include the four market-based approaches and a general restriction to target sources relevant to climate adaptation and mitigation. Only studies completed in and after 2010 were included.

[8] See GCF/B.37/14 and GCF/B.37/14/ADD.01. In July 2024, the GCF Board approved the principles for mainstreaming REDD+ results-based payments into the regular project and programme activity cycle of the Fund, as well as, on an exceptional basis, extending the pilot programme on REDD+ results-based payments.
[9] The selection of 42 databases to include in the search process was guided by the IEU's knowledge of likely repositories for SRs and the range of subjects related to the selected market-based approaches, index-based insurance, payments for ecosystem services, results-based payments, and willingness to pay.
[10] It was not possible to access three of these databases due to a lack of suitable institutional credentials or an inability to get past a paywall. They comprise GREENR, Environment Complete, and the Agricultural and Environmental Science Database.

Where considered beneficial to the overall evidence review, research from wider areas, such as health, was also included under the WTP and RBP topics. The complete set of search terms is presented in Appendix 1.

3. SCREENING OF STUDIES

The review team searched the 39 accessible databases, selecting eligible studies for the synthesis stage. Results were screened in a two-stage process.

- **First stage screening**: Screened the title and abstract of the study to exclude irrelevant materials.
- **Second stage screening**: The selected studies were examined closely via a full-text review to assess if they complied with the inclusion criteria. The reasons for excluding studies are reported according to the PRISMA standards outlined in Figure 1. While the full-text review was conducted by a team of three, the team leader conducted spot checks of the review results to ensure a consistent approach.[11]

The review team used backward citation searches to search the selected studies at the full-text screening stage to find additional SRs. These additional reviews were then subjected to full-text screening, and the relevant studies were retained and added to the overall record of studies to be carried forward to the analysis stage. Zotero was used as the main management software. An online library was then used to capture and manage the bibliographic data and relevant research material.

4. RESULTS OF THE SEARCH

The search was conducted in August and September 2023. As the PRISMA diagram[12] shows, the search strategy returned 87,715 records, of which 555 were selected via title and abstract screening (see Figure 1). After removing duplicates, 433 records were left for the full-text screening process. Of these, 354 were excluded because they were not relevant.[13]

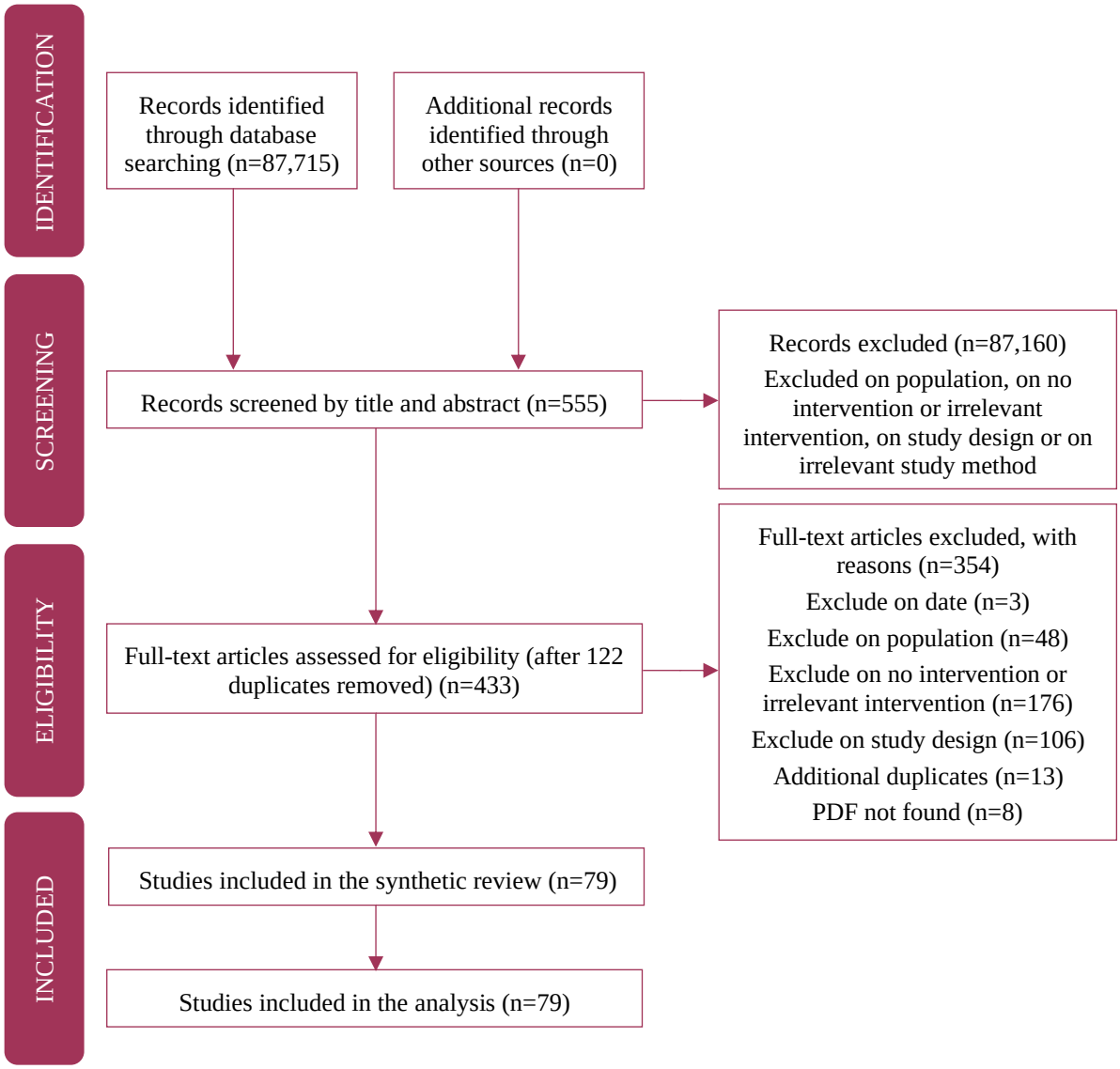
As noted above, the final set of studies selected for the evidence map comprised 79 studies focusing on the populations and interventions of interest. The breakdown of topics covered by the studies is shown in Table 1. It should be noted that some studies cover more than one topic, such as WTP in combination with IBI.

[11] Where the spot checks highlighted differing review outcomes, the team discussed the paper and decided whether it should be included.
[12] PRISMA refers to Preferred Reporting Items for Systematic Reviews and Meta-Analyses. Read more at http://prisma-statement.org/documents/PRISMA_2020_checklist.pdf.
[13] A total of 176 studies were excluded as they did not cover relevant interventions related to the four topics; 106 studies were excluded due to their study design, i.e. not an SR or meta-analysis; 48 were excluded due to population (where they are required to be non-Annex 1 countries), and a further 13 studies were identified as duplicates. Three studies were excluded based on their publishing date, i.e. before 2010, and eight full texts were not found.

Table 1. Breakdown of topics covered by the studies selected for the synthetic review

TOPIC	NO. OF SELECTED STUDIES
Index-based insurance	13
Payments for ecosystem services	28
Results-based payments	16
Willingness to pay	26
TOTAL	**79**

Figure 1. PRISMA diagram



5. ANALYSIS AND SYNTHESIS OF SELECTED STUDIES

Once the selected studies were identified, the review team conducted a more detailed full-text review, collating notes on relevant aspects of each SR in light of the research questions for this

synthetic review.[14] Overall, the findings for the four market-based approaches were grouped thematically to enable a practical understanding of their impact and the factors that contribute to their effectiveness in developing countries. The findings are presented in the following section.

C. RESULTS

The report now addresses the results of the evidence review, having examined its search and analysis methods.

1. INDEX-BASED INSURANCE

The first market-based approach explored in the evidence review is IBI. Thirteen SRs informed the review findings, which are set out in the following subsections.

a. To what extent has index-based insurance been effective at achieving mitigation and adaptation outcomes?

IBI is predominantly considered an approach to enhance adaptation, particularly in the agricultural sector. The approach can also be applied to renewable energy, such as wind and solar, supporting the stability of clean energy generation and contributing to mitigation (Xiao and others, 2019). The studies identified for this evidence review only focus on impacts related to adaptation.[15]

Regarding adaptation and resilience, there is evidence that IBI offers significant benefits. Goodwin and others (2022) reviewed 43 studies to compare key financial tools available to farmers in developing counties, including subsidies, indemnity insurance and IBI. IBI was reported as positively influencing adaptation outcomes of the interventions in almost all studies. IBI was also evaluated as better than traditional indemnity-based products regarding fairness and effectiveness. At the farm level, IBI was associated with adaptive behaviours and increased resilience.

Akinyi, Ng'Ang'A and Girvetz (2021) find that IBI accelerates farmers' payouts, enabling them to invest further in agricultural inputs, leading to higher outputs and income. Such payments also help smallholders maintain their productive capacity by minimizing the need to liquidate assets. Studies also highlight differences in impact due to poverty status. Lu and others (2022) review the recent literature on weather index insurance and microcredit for farmers. They find that both have positive economic impacts, but the benefits to the poorest households remain uncertain. Table 2 illustrates the socioeconomic and ecological impacts of weather index insurance as reported by Lu and others (2022).

Table 2. Socioeconomic and ecological impacts of weather index insurance

IMPACTS	POSITIVE	NEGATIVE	NO EFFECT OR UNCERTAIN EFFECT
Socioeconomic impacts	**86**	**3**	**2**
Household income	30	0	0
Agricultural investment	15	1	0
Asset protection	10	0	0

[14] For the review's PES section, which required more than two team members to review relevant studies, the team implemented a workshop approach that identified and discussed topics.
[15] While IBI can be applied to clean energy, there are a limited number of systematic reviews on the application of IBI to this sub sector.

IMPACTS	POSITIVE	NEGATIVE	NO EFFECT OR UNCERTAIN EFFECT
Adoption of new methods and technologies	17	2	2
Consumption	2	0	0
Production	10	0	0
Food security	1	0	0
Child health	1	0	0

Source: Lu and others (2022)

Xiao and others (2019) assert that weather index insurance is effective for coping with natural hazards in developing countries, citing the support offered by many governments and international organizations (see Box 1).

Yet, many types of weather index insurance exist for different natural hazards. The evidence base does not cover these hazards comprehensively. For example, most studies focus on rainfall-related phenomena, especially droughts. However, hazards such as extreme temperature variation, excessive rainfall and wildfires have a limited evidence base. For example, Adeyinka and others (2022) find that while research on agricultural IBI is increasing rapidly, the geographical spread is predominantly limited to Germany, China, India, the United States, Kenya and Ethiopia. Most of this research focuses on drought risk.[16] [17]

In terms of the geographical spread of authorship, Lu and others (2022) and Liu and others (2019) highlight how Chinese, Ethiopian and Indian authors are the most common contributors to work on weather index insurance in developing country contexts. However, a mismatch exists between research on IBI and the countries and regions where climate change impacts and risks are likely to be greatest, particularly regarding smallholder farmers. For example, Adeyinka and others (2022) show that when considering climate risk, food insecurity and dependence on agriculture, the need for evidence on IBI is also high for the Caribbean, Central American and Southeast Asian countries (e.g. Haiti, El Salvador, Myanmar) where limited evidence has been published to date. In addition, the need for evidence is also high for countries in southern Africa (e.g. Mozambique). The insurance industry in Africa accounts for only 0.5 per cent of the world's total, presenting a considerable opportunity to increase the uptake of this market-based approach in African countries (Akinyi, Ng'Ang'A and Girvetz, 2021). For example, Ouedraogo and others (2022), when assessing the key drivers of demand for Climate Information Systems for farmers in West Africa, find that agricultural index-based microinsurance is a viable option for farmers in Sahelian countries. In Niger, for instance, farmers are willing to pay for agricultural index-based microinsurance to protect themselves against climate shocks. Similar observations were made in Burkina Faso, Mali, Senegal and Côte d'Ivoire.

On the other hand, it may be too early to investigate welfare-related impacts from IBI as developing countries – and many developed countries – have rarely achieved high take-up of index insurance without substantial government subsidies (Adeyinka and others, 2022). Such analysis requires a large sample of farmers over a long period to build convincing evidence of impact and relevant factors for effectiveness. Adeyinka and others (2022) find that:

[16] Moreover, they found that over 60% (n = 135) of all agricultural climate IBI studies focused on cereals.
[17] An IEU evidence review by Ategeka and others (forthcoming) examined the effects of insurance for floods and drought on: (i) consumption and expenditure, (ii) crop yield, and (iii) income. Since Ategeka and others (forthcoming) was not included in the systematic search, the findings are summarized in Appendix 2.

> Academic research, which is lacking in some high-risk countries and crucial for wider uptake, is necessary for a better understanding (quantifying) of the risks and impacts, to, for example, examine the performance of the indices (e.g. income smoothing effects at different trigger rates), allowing for the building of the credibility and transparency of the agricultural IBI products/programme.

Goodwin and others (2022) highlight how such schemes may not support smallholder farmers more than informal community-based initiatives, as payments will not necessarily correlate closely with actual losses. In addition, they argue that subsided access may be a suboptimal choice for encouraging longer-term investments in risk management. Furthermore, most studies consider only single-hazard risk, and the limited number of multi-hazard risk studies assumed independence between hazards, neglecting the synergies between hazards (Benso and others, 2023). Moreover, Vyas and others (2021) argue that as a climate adaptation strategy, IBI favours developed countries. They argue that such insurance can be less affordable in developing countries, which are often exposed to greater risks.

b. What factors influence the effectiveness of index-based insurance in developing countries?

The evidence review identifies a range of factors that influence the effectiveness of IBI in developing countries. These are described below, with an indication of the strength of evidence for each factor and some tangible examples.

Minimizing basis risk

The key limitation of index insurance is basis risk – the mismatch between actual losses and predicted losses (Benso and others, 2023). For instance, "farmers who suffer from a heavy drought might not receive payments if the weather index fails to detect the actual rainfall on the territory of their farms" (Lu and others, 2022, p.8). Many studies find that basis risk has significantly limited farmers' interest in IBI, affecting its uptake and use (Lu and others, 2022; Singh and Agrawal, 2019).

Lu and others (2022) reviewed 360 studies on the socioeconomic and ecological impacts of weather index insurance. They found that the increasing availability of climate data and satellite technology will likely result in reduced basis risk and improved take-up rates. Emerging methodological and technological solutions that can help to improve accuracy and reduce basis risk include (Lu and others, 2022):

- Use of advanced indices such as the vegetation health index, forage production index, normalized difference vegetation index and a combination of various indices instead of a single index
- Development of statistical models and simulation models
- Machine learning and its application to better predict risks
- Remote sensing
- Integrating farmer information into insurance design

Adoption and willingness to pay for index-based insurance

Liu and others (2019) reviewed the demand for weather index insurance in India, where it has been available for many years. There, demand for weather index insurance is found to be highly price sensitive, with substantial subsidies required for uptake and use. Indeed, most studies note the need for subsidies to make IBI commercially viable in developing countries. Box 1 provides an example

of a global IBI initiative that draws on public sector funding to support the subsidization of IBI in developing countries.

Box 1. The Global Index Insurance Facility

The Global Index Insurance Facility (GIIF) facilitates access to finance for smallholder farmers, microentrepreneurs, and microfinance institutions through the provisions of catastrophic risk transfer solutions and agricultural climate IBI in developing countries as well as a forum for the collection of best practices and practical experiences. To date, GIIF's regional partners have facilitated nearly eight million contracts, covering approximately 40 million beneficiaries with an insured sum of USD 1.5 billion.

Source: World Bank Group (2020)

Basis risk affects farmers' WTP for index insurance (Singh and Agrawal, 2019). Liu and others (2019) find that farmers' education, wealth, level of risk aversion and familiarity with the insurance product are all important factors that moderate the decisions of small rural households in adopting IBI. They also found that trust and recent weather anomalies, such as damaging temperature and precipitation changes, influenced the WTP for an insurance product.

Indeed, Liu and others (2019) find that demand for crop insurance showed that adoption is positively correlated with recent experience of disasters, yield volatility, the level of subsidy and farmers' trust in government. Farmers who are more risk-averse or perceive greater yield risk were found to be more likely to participate in crop insurance. Farmers burdened with larger debts are also more likely to purchase crop insurance and are willing to pay higher premiums.

A relatively old review by Cole and others (2012) looked at 13 studies conducted from 1990 in Africa and Asia – specifically in Ethiopia, Kenya, Malawi, Morocco, Tanzania, China, India and Vietnam. The review was mostly concerned with assessing the WTP for IBI schemes. They found higher liquidity and income levels to be positively associated with take-up. Lower income diversification appears positively associated with insurance demand, which is unsurprising as specialization in agriculture would increase climate risks and demand for insurance. On the other hand, ad hoc disaster relief significantly undermined farmers' incentive to purchase crop insurance (Liu and others, 2019).

Access to credit to pay for index-based insurance

A significant barrier to the uptake of IBI is access to sufficient credit. For example, farmers in developing countries generally cannot afford the upfront premium for insurance (Lu and others, 2022). Credit can relax these liquidity constraints. In such cases, subsidies may play a role in making IBI more affordable. The role of subsidies is addressed by Singh and Agrawal (2019), who offer mixed evidence on effectiveness. Their review found that subsidies for smallholders greatly increased WTP and uptake, helped reduce poverty and increased social protection of farming households. Yet, several studies warned that subsidies distort markets and are not the best use of public funds.

In terms of liquidity, the review of 45 studies by Marr and others (2016) found that smallholders often cannot access credit from banks or rural credit institutions due to a lack of collateral. As a result, adopting IBI and high-return cropping activities that typically require significant upfront investments, such as enhanced seeds and fertilizers, may be hampered. Furthermore, they find the availability of insurance can encourage a greater supply of credit, enhance the use of agricultural inputs and could be provided in tandem, as a combined product.

Awareness and risk perception of potential index-based insurance customers

Awareness of IBI products and consumer risk perception are strong drivers of IBI uptake. Singh and Agrawal (2019) find that farmers need a few years of experience to learn about weather index insurance products. Low awareness levels and insurance illiteracy among farmers are cited as significant constraints on smallholder adoption.

An SR of 39 studies on natural hazard insurance by Mushonga and Mishi (2022) found that information regarding risk, uncertainty, and higher average age and income increased adoption due in part to older households' greater experience of disaster-related shocks. The study further showed that the salience of disasters attenuates within a relatively short period, reducing demand and market penetration. In other words, recent interactions with severe hazards increase demand. However, as the memory of the disaster fades rapidly, fewer households adopt insurance products.[18] The results show that understanding potential beneficiaries' risk preferences is important for enhancing uptake.

Index-based insurance scheme administration

Another factor for success is the management and administration of an IBI scheme. A particularly important challenge is aligning vulnerability to disasters with pricing. IBI is designed to be cost-effective, reducing the need for claimants and insurance companies to go through a detailed claim process, as indemnity insurance requires. However, there are still costs involved that can impact customers and insurance companies.

Goodwin and others (2022) reviewed 43 studies on financial assistance for drought-affected agriculture. They found the administration of IBI schemes was positively influenced by having standardized rules to declare droughts and issue compensation. Financial assistance was also improved by stakeholder collaboration. Overall, index insurance was easier to run than other schemes.

Several studies examined the constraints insurance companies encounter when providing IBI products. Vyas and others (2021) find that the pricing insurance schemes when data is scarce presents significant problems, especially in index and indemnity insurance. This finding correlates with Adeyinka and others (2022), who highlight how the lack of historical yield records or weather records to test whether an index is fit for purpose is a constraint in some developing countries.

In addition, insurers deal with complex dynamics related to the impacts of climate change, extreme events and the interlinkages between hazards. First, looking at climate risks, Benso and others (2023) find that the rising frequency of extreme climate events has forced insurers to increase premiums, threatening coverage availability. Loss and damage associated with extreme events have multiple drivers, implying losses have multiple thresholds and are associated with multiple variables. This highlights the importance of forms of redress and recourse for smallholders when firms claim force majeure (Act of God) and refuse to pay out. Vyas and others (2021) also find that insurers need to align pricing with increasing risks to address climate uncertainty (see Benso and others, 2023).

Several reviews suggest moving from single-hazard to multi-hazard mechanisms as disasters may be precipitated by independent, synergistic and cascade events.[19] To help address this gap, Benso and others (2023) propose a multi-hazard risk weather insurance framework.[20] The framework illustrates

[18] Surprisingly, political affiliation also had an impact on decisions to purchase insurance.
[19] Independent hazards are events that can happen simultaneously in a region without any causal dependence. Synergistic hazards refer to a situation when the occurrence of a particular hazard increases the probability of the occurrence of another. Cascade hazards represent a situation when an event triggers the occurrence of another event (e.g. excessive rainfall triggering landslides in a particular region).
[20] The degree to which such a multi-hazard framework can be simply communicated to smallholders is not fully explained by the authors.

the process of selecting and prioritizing hazards, defining index thresholds, modelling losses and optimizing insurance risk premiums.

Second, the insurance market could consider a layered insurance scheme, including private and public sectors, to cope with extreme losses. This means that when a defined loss threshold is reached, a second partner will pay the difference in the indemnities (Benso and others, 2023). Layered insurance may be an area for consideration.

Availability of related digital solutions

Finally, an increasingly important factor in the effectiveness of IBI in developing countries is the availability of and access to digital solutions. Ouedraogo and others (2022), who analysed 52 papers on farmer demand for climate information services, found that uptake of climate-smart agricultural technologies remains low in the West African countries covered in their review. Some of the studies in their review suggested bundling climate information services, index insurance and even extension services, as a package to enhance uptake.

Singh and Agrawal (2019) anticipate that innovative and advanced techniques will improve farmers' willingness to adopt index insurance products. This is largely related to reducing basis risk due to greater accuracy in predicting weather-related risks and refined indicators.

Related to this point, Adeyinka and others (2022) find that around three-quarters of the studies in their review (n = 144) utilized weather station data. Satellite and other data sources were the next most frequent, accounting for 10 and 12 per cent of agricultural IBI studies, respectively. Using satellite data could be particularly advantageous for agricultural climate IBI in developing countries, which often lack extensive and long-term station data. Adeyinka and others (2022) point to the example of the African Risk Capacity project, which uses Africa Risk View, an advanced satellite weather surveillance and software system developed by the United Nations World Food Programme.

The SR by Benso and others (2023) looks at the role of machine learning in improving IBI products and its effectiveness in helping insurers understand the interlinkages underpinning multi-hazard assessments. However, it points out that while machine learning has potential, applying it to model loss and damage in the insurance sector may face bottlenecks in developing countries lacking qualified personnel and the ability to communicate the approach clearly to potential consumers.

Abdi and others (2022) highlighted several potential avenues for further researching frontier technologies to improve IBI products, particularly using satellite data and coupled hydrological-crop modelling to address data scarcity and temporal and spatial basis risks.[21]

However, there are potential downsides to consider in using technologically advanced techniques in IBI. First, technically complex and less well-known indices may render contracts less transparent and complicate the marketing of the schemes to intended buyers. This may mean that simple precipitation and temperature-based indices may continue to dominate. Second, the use of methods such as quantile regression and generalized additive regression model, as well as machine learning approaches, in IBI contracts, may be hindered by the lack of understanding among users, beneficiaries, insurance companies and farmers of their conceptual complexities (Abdi and others, 2022). Supporting the capacity development of relevant stakeholders in pilots may assist the move towards more advanced and accurate IBI products.

[21] Among other things they suggest: (i) placing greater emphasis on drought indices, especially on hydrological data that can account for the role of reservoirs, water allocated for irrigation and streamflow in regions with irrigated crops; (ii) generating more scientific evidence on the use of evaporative stress-based, soil moisture-based, and El Niño–Southern Oscillation based indices in contract design, (iii) focusing on indices during critical crop growth periods using observations where available or growing degree day based models where not, and (iv) conducting more extensive local assessment of satellite observations of meteorological and vegetation for deriving indices especially in data scarce developing countries.

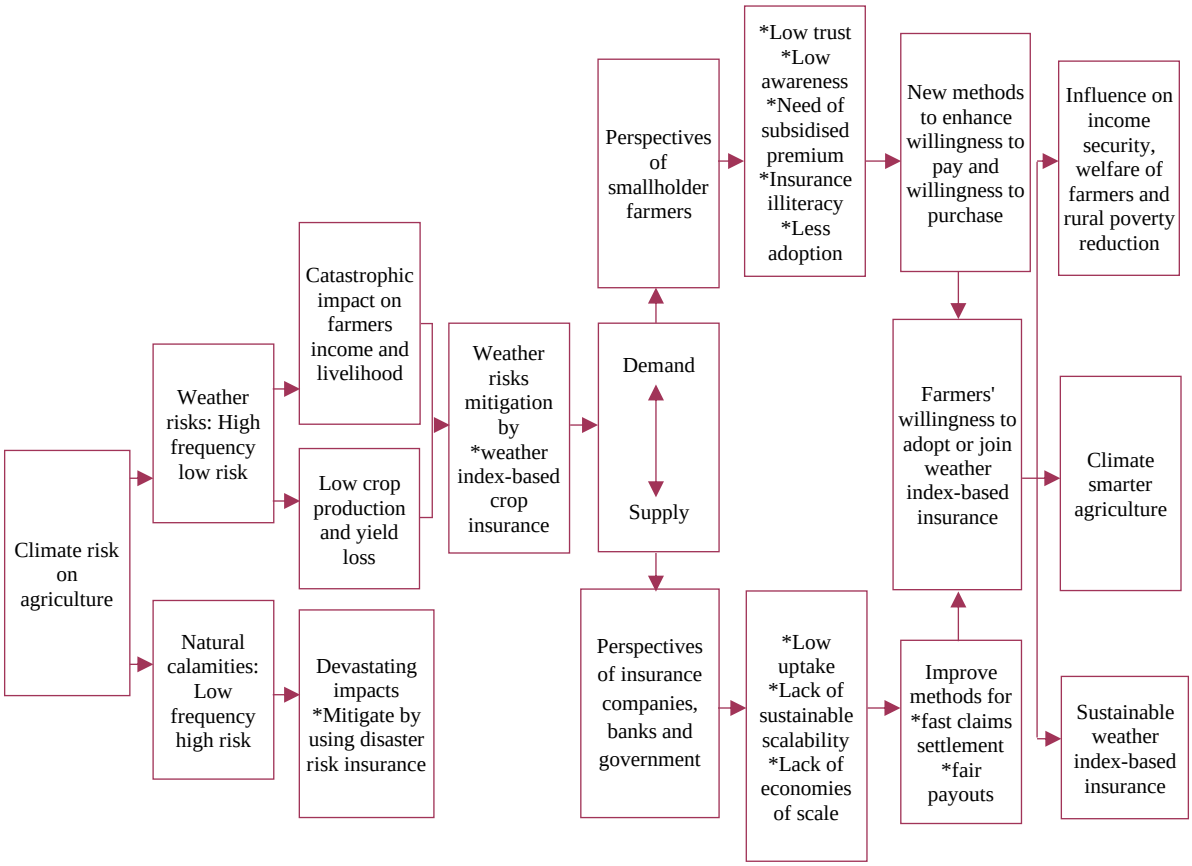
c. Conclusions on the evidence trends for index-based insurance

Unlike traditional insurance schemes, payments for IBI are triggered by a predetermined index, such as the amount of rainfall over a specified period or a typhoon's power and impact. While IBI is becoming increasingly widely adopted by farmers in developing countries, governments or international organizations subsidize the majority of IBI.

Factors that affect the uptake, scale and effectiveness of IBI are broadly consistent among the studies reviewed.[22] The factors that influence effectiveness include the potential customer's awareness of the product and understanding of its value. WTP and access to credit to pay premiums are important, closely linked factors that greatly influence uptake. The wider range of factors that affect the uptake and effectiveness of IBI in developing countries is summarized well by Singh and Agrawal (2019) and reflect the findings of many of the studies reviewed (see Figure 2). They conclude that the demand for weather index insurance is highly contingent on aspects such as appropriate pricing and WTP in light of other financial pressures. Demand will likely increase with access to finance, such as credit and a stronger understanding of IBI's role and value.

On the supply-side, the scale of IBI can be constrained by poor cost efficiency and lack of economies of scale, as well as challenges to product design, which are often caused by data scarcity in the context of many developing countries. The demand and supply-side constraints and possible measures to overcome those barriers are summarized in Figure 2.

Figure 2. Conceptual framework of weather index insurance for mitigation of weather risks in agriculture



Source: Adapted from Singh and Agrawal (2019)

[22] It should be noted that empirical effect sizes were not available in many of the SRs reviewed, highlighting the importance for more empirical research to be conducted in this topic to allow meta-analysis to be completed.

Using innovative and advanced techniques to overcome challenges relating to the demand and supply of index insurance is likely to improve adoption. Technology such as satellite data and machine learning can help improve product quality and cost-effectiveness. However, the role of technology is tempered by local constraints related to IBI research, technology, as well as the lack of trust in results by insurers and beneficiaries, such as farmers (Abdi and others, 2022).

As such, even though index insurance has gained attention in the past few years, important areas still require further attention and investigation in future studies, as demonstrated in the following examples:

- Providing a clear definition and analysis of multiple hazards instead of assuming single-hazard risk
- Testing interaction between hazards, especially for coupled moisture–thermal events
- Evaluating how the multi-hazard risk selection affects basis risk
- Analysing the trade-offs between the loss in model accuracy and the policyholders' WTP (Benso and others, 2023)

Further gaps identified by the synthesis of evidence include the extent to which non-subsidized index insurance products are marketable and sustainable and how to promote public-private partnership modes for index insurance.[23]

Moreover, it is important to consider what forms of redress smallholder farmers have when contracts with insurance providers are not fulfilled. This review highlights that IBI initiatives that benefit firms and smallholders equally require good contractual design and an appropriate choice of insurance model and third parties to arbitrate policy disputes and ensure mutual goodwill is not replaced by mutual distrust. In this respect, third-party providers of credit within IBI contracts can reduce the likelihood of firm holdup or breach of contract by insurers. This reduced likelihood is due more to the firm's concern about reputational loss among other firms than among rural smallholders.

Finally, Adeyinka and others (2022) highlight the importance of matching countries with high climate risks to IBI research and uptake to build the credibility and transparency of IBI products. The FAIR[24] guiding principles for scientific data and stewardship could play an important role in making research on IBI that is currently largely inaccessible more widely available.

2. PAYMENTS FOR ECOSYSTEM SERVICES

The evidence review analysed 28 selected studies to inform the findings on PES, which are defined in a range of ways.[25] Kaiser, Haase and Krueger (2023), who reviewed 27 publications on the potentials and challenges of community-based and collective PES, argue that PES schemes are best defined by their three key design characteristics: (i) creating positive incentives (monetary or in-kind), (ii) conditionality, and (iii) voluntary participation.

First, PES creates positive monetary or in-kind incentives to reward providers or stewards of ecosystem services for their protection efforts and the resulting reduction in environmentally

[23] Many of the SRs find that the majority of index-based insurance articles are quantitative and empirical studies. For example, of the 158 reviewed articles reviewed by (Singh and Agrawal, 2019), 130 are empirical studies. They suggest that a greater qualitative research focus could address some of these research gaps.
[24] FAIR: Findability, Accessibility, Interoperability, and Reusability
[25] An example of a PES scheme is when private landowners receive financial incentives from a fund financed by the government, private and international public donors, in exchange for ecosystem services in the form of forest protection, commercial reforestation, agroforestry, sustainable forest management or regeneration of degraded areas.

harmful behaviours.[26] In this respect, PES is defined as a market-based approach where users of ecosystem or environmental services pay owners or managers of those services, contingent on changes in behaviours that impact the provision of services (Snilstveit and others, 2019).

Second, conditionality is a central PES characteristic and includes regular monitoring practices that are linked to the state of ecosystem services (Kaiser, Haase and Krueger, 2023). In other words, PES introduces conditionality into conservation agreements to potentially attract non-traditional funding sources for conservation (Jones and others, 2020).

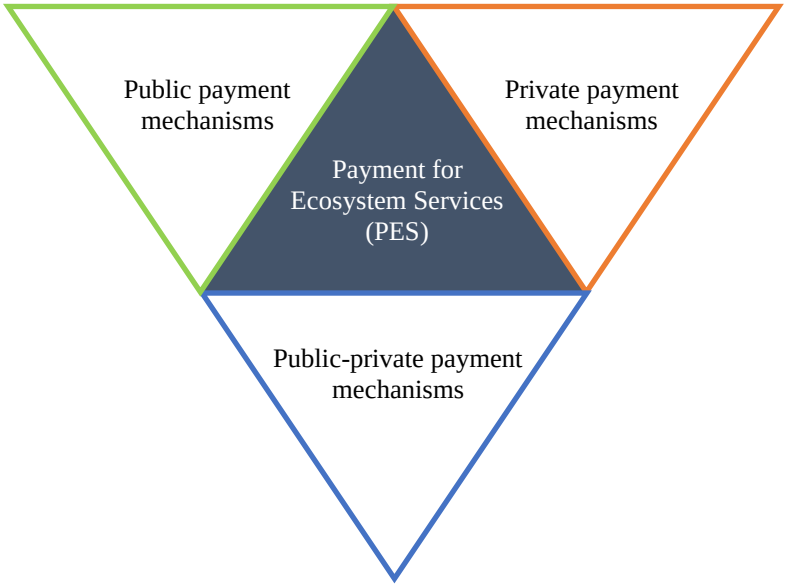
Third, ecosystem service providers can voluntarily join the PES contract (Kaiser, Hasse and Krueger, 2023). Snilstveit and others (2019) also highlight that PES typically involves voluntary transactions between government or non-governmental organizations (NGOs) (representing beneficiaries) and individuals, households, or community organizations managing land or forests, with agreed-upon rules for natural resource management to generate off-site environmental benefits such as water supply and carbon sequestration.[27]

The classification of PES schemes is often based on the type of actors involved. In this regard, three broad types of PES schemes are identified: (i) public payment mechanisms, (ii) private payment mechanisms, and (iii) public-private payment mechanisms. This approach is summarized in Figure 3.

In public payment mechanisms, the government pays land or resource managers to enhance the condition of an ecosystem and the services it provides on behalf of the wider public. These payments can be based on fiscal instruments, such as taxes or subsidies, or can rely on user fees. In these schemes, a state body allocates funding to compensate service providers through revenues derived from earmarked tax revenues or a general budget, and the public body may be involved in the administration and management of the PES contract. End user participation may not always be voluntary, as all citizens are taxed regardless of whether or not they use the service(s) provided. Such schemes are generally large in scope, often provide legitimacy, and offer scale economies in transactions (Forest Europe, n.d.; Pirard and others, 2019).

[26] PES goes beyond forest conservation and is used to help hydrological and biodiversity conservation as well as to combat global ecosystem service deterioration (Perevochtchikova and others, 2021; Aronson and others, 2010) and incorporate poverty alleviation goals (Zhang and others, 2010; Snilstveit and others, 2019).
[27] Similarly, Jones and others (2020) define PES as voluntary conservation incentive programmes and participation is determined by eligibility, willingness and ability to participate.

Figure 3. Broad categories of PES



Private payment mechanisms involve beneficiaries of ecosystem services contracting directly with service providers. These schemes represent direct private payments by service beneficiaries to service providers. The government participates as an intermediary only, and the buyers are usually the end users of the services. The schemes usually operate at a small scale and offer no more than a few services (Forest Europe, n.d.).

In public-private payment mechanisms, government and/or private funds pay land or other resource managers to deliver ecosystem services. The buyer is often a public utility that provides funds to the PES schemes in the role of a service buyer, just as a private buyer would do. When doing so, the public utility is not usually involved in the administration and management of the PES contract, as in public schemes, but participates as a contracting party of service buyers (Forest Europe, n.d.). This model includes community-based or collective payments for ecosystem service programmes that provide direct payments to communities or individuals to increase ecosystem service provisioning rather than investing in development projects (Kaiser, Haase and Krueger, 2023).

Sectors in which PES can be applied

Depending on the underlying PES definition, current estimates assume that up to 550 PES programmes are in operation worldwide, mostly in the forestry sector (Kaiser, Haase and Krueger, 2023).[28] In forestry, PES simulates a market through which stakeholders interested in a particular service pay service providers with the means to adopt land-use practices that ensure conservation. Broader than forestry, PES schemes often promote mixed land uses. For example, agroforestry, which integrates trees and woody shrubs in crop and livestock production systems, is widely promoted. Governments have invested in various PES programmes to spur agroforestry adoption, including farmer capacity development and market development (Miller and others, 2020). Furthermore, a number of agri-environmental schemes have been implemented as a collection of policies to tackle biodiversity loss, water pollution, and land degradation linked to farmland management (Nguyen and others, 2022). In the agriculture sector, PES is often tied to practices

[28] Other key environmental sectors that can benefit from PES include agriculture, land conservation and soil erosion, watershed services and blue carbon conservation.

associated with reduced greenhouse gas (GHG) emissions and increased carbon sequestration (Snilstveit and others, 2019).[29]

Some PES schemes focus on services in the water sector. Payments for Watershed Services are voluntary transactions between ecosystem service users and providers within a particular watershed. Such schemes are conditional on upstream management actions that generate downstream watershed services (Jones and others, 2023). According to Martin-Ortega and others (2019), who analysed 38 forest watershed schemes, Latin America is one of the pioneer regions in their implementation. PES is also used to conserve and sustainably manage coastal environments, also called blue carbon ecosystems, for their vital role in climate change mitigation and adaptation. It includes payments for protecting and conserving coastal vegetation and its processes (Quevedo, Uchiyama and Kohsaka, 2023).[30]

Finally, Brandt and Buckley (2018) reviewed 111 studies on the effectiveness of ecotourism on forest conservation. From a forest conservation perspective, ecotourism is an incentive-based forest governance intervention. It may interact with institutional interventions such as protected areas or other incentive-based strategies such as PES.

Figure 4. Costa Rica introduced a Payments for Ecosystem Scheme (PES) in 1996 through a Forestry Law

Credit: @ Jan Bartel

[29] Since the late 1990s, China has implemented some of the world's largest PES programmes according to Yang and Lu (2018), who reviewed 105 papers on China's PES programmes. One example is the Green for Grain programme, implemented by the Chinese government since 1999 to reduce soil erosion by converting sloping croplands into forests and grasslands. The scheme provides grain and cash subsidies to farmers in exchange for afforestation efforts. Additionally, China's Sloping Land Conversion Programme aims to incentivize the conversion of cropland back to forests or grassland through cash and in-kind payments to participating households or to reverse or prevent soil erosion and desertification (Snilstveit and others, 2019).

[30] This reviewed 1,179 papers on blue carbon and highlighted that PES schemes can also conserve and sustainably manage blue carbon ecosystems for their vital role in climate change mitigation via substantial carbon sequestration and strengthen coastal resilience. These schemes include payments for protecting and conserving coastal vegetation.

a. To what extent have payments for ecosystem services been effective at achieving mitigation and adaptation outcomes?

Effectiveness of PES in supporting mitigation outcomes

There is limited evidence from the selected studies on the direct link of PES in supporting mitigation. However, many studies highlight the link between PES and positive outcomes in terms of the conservation and regeneration of environmental assets. A study by Min-Venditti, Moore and Fleischman (2017, p. 21) that reviews 159 studies on the impact of public policy on deforestation and reforestation in Central America and Mexico finds that:

> Nearly all studies of payment for ecosystem services indicate an association between payments and improvements in forest cover (88% of cases), however, this evidence derives from only two countries (Mexico and Costa Rica), both clearly defined property rights and stronger governmental institutions than other countries in the region, raising questions about generalizability.

Perevochtchikova and others (2021), who reviewed 72 studies on the effects of PES schemes in Latin America, reiterate that the effectiveness of PES is generally presented with weak supportive evidence. In addition, they highlight that reducing deforestation is the only outcome area with observed marginal positive impacts. This finding supports Morgan and others (2022) conclusion that the evidence gap makes it difficult to extrapolate the effectiveness of PES through time as potential indicators (such as the value of carbon) are lagged and are likely to increase over time.[31]

A review by Samii and others (2014) of 11 studies on the effects of PES schemes on deforestation and poverty found that while PES reduces deforestation rates, the effectiveness is modest and highly inefficient. Studies that focus purely on reducing deforestation suggest that PES programmes have, on average, tended to reduce the annual rate of deforestation by 0.21 percentage points. Effect sizes are slightly larger for studies examining forest cover change by measuring forest loss and gain. Estimated effects on annual forest cover change rates ranged from 0.50 percentage points for a study in Costa Rica to 1.6 percentage points for a study in Mexico.[32]

Snilstveit and others (2019), who examined evidence from 18 economic incentives-based PES programmes, found that on average, PES led to an improvement in forest cover of 0.32 percentage points and a reduction in deforestation of 0.12 percentage points.

In terms of overall effectiveness, a study by Kaiser, Hasse and Krueger (2023, p. 13) argues that PES has achieved higher efficiency when compared to other regulatory environmental policies due to its flexibility to internalize environmental externalities into the market sphere through more precise spatial targeting of endangered ecosystems. This view contrasts with the public sector or international development-led approach to site selection.

Castle and others (2021) argue that some environmental benefits are being achieved in line with the broader literature on agroforestry practices. In their review of studies on agroforestry interventions. They used a random-effects model to report effect size estimates (using Hedge's g).[33] The effects of agroforestry interventions on yields and income were calculated. The effect of these interventions on

[31] In an earlier review, Aronson and others (2010) discussed the effectiveness of PES in terms of direct benefits for watershed protection, carbon sequestration and waste treatment. A SR of 1,582 peer-reviewed papers finds a lack of evidence linking ecosystem services to beneficiaries. It concluded that high-level research to recognize the value of ecosystem restoration to society is nascent in mainstream academic literature.
[32] Some studies reviewed environmental trends and additionalities such as ecological restoration and ecosystem flux within forestry resource systems. These indicators are not covered in this paper.
[33] Hedge's g is preferred to Cohen's D (difference in means / pooled standard deviation of outcome measure) due to the small sample size of five studies.

yields is 1.16 SMD[34], indicating agroforestry interventions are generally likely to cause a large, positive impact on yields.[35] Moreover, the average effect of agroforestry interventions on income is 0.12, suggesting a small, positive impact on income.[36]

Turning to ecotourism, Brandt and Buckley (2018), who reviewed 111 studies on the effectiveness of ecotourism on forest conservation, find insufficient evidence to evaluate its effectiveness. Of the 17 studies that used empirical evidence, most suggested ecotourism is associated with negative impacts on forests. However, when accompanied by an explicit conservation mechanism, a local economic benefit, and strong monitoring and enforcement, they find that ecotourism can lead to forest protection and re-growth.[37]

Effectiveness of PES in supporting adaptation outcomes

Regarding adaptation outcomes, the effectiveness of PES is assessed by Aronson and others (2010), who identify the urgent need for a rigorous and scientific process for how conservation and ecosystem management decisions integrate adaptation programming, including measuring adaptation outcomes.[38]

The influence of PES schemes on poverty reduction is discussed in several studies. Poverty reduction is considered both an enabler of more robust and sustainable PES and an outcome.[39] Looking at the effects of PES in Latin America, Perevochtchikova and others (2021) found evidence of increases in household income, social capital and improved local governance. A study by Blundo-Canto and others (2018), which reviewed 46 studies on PES's livelihood impacts, found that most studies reported positive livelihood outcomes, ranging from a 60 per cent decrease to a 400 per cent increase. Furthermore, Castle and others (2021) calculated a small, positive impact (SMD 0.12) on smallholder incomes from implementing PES schemes.

Yet, the study by Samii and others (2014) found extremely limited evidence on the effects of PES on welfare, and in particular, poverty. They identify two relevant studies, from China and Mozambique, which estimate that the PES initiatives, on average, boosted participating households' incomes by about 14 and 4 per cent, respectively. However, the subgroup analysis suggested that for PES to contribute to poverty reduction, poorer households must be able to participate with high adoption rates. Yet, participation in PES programmes is typically more difficult for poorer households.

In some cases, high poverty rates can limit PES success. For example, Samii and others (2014) argue that there is a trade-off between conservation effectiveness and poverty reduction (as behavioural change by poorer households has less potential to promote conservation than that of wealthier households or commercial entities).[40]

Jones and others (2020) argue that participation in PES programmes in developing countries is limited to those households and communities with, *ex ante*, higher levels of capital assets, limiting poverty reduction outcomes and affecting equity. In this respect, Jones and others also highlight the trade-off between poverty co-benefits in PES schemes.

[34] SMD means standardized mean difference.
[35] However, the I-squared illustrated high heterogeneity ($I^2 = 98.99\%$, $\tau^2 = 2.94$, Q(df = 4) = 370.7). Here the I-squared shows the proportion of variability across the studies not due to sampling error, while the Tau indicates the stability of effect sizes.
[36] Again, the I-squared illustrated high heterogeneity at 75% ($I^2 = 75.29\%$, $\tau^2 = 0.04$, Q(df = 6) = 19.16).
[37] However, deforestation can accompany forest re-growth if the remaining high-value forests are unprotected.
[38] This may eventually lead to a method for assessing the effectiveness of PES in adaptation through agroforestry where PES programmes are observed to be developing (Miller and others, 2020).
[39] When viewed as an outcome, poverty reduction is closely linked to climate adaptation.
[40] Wealthier households and commercial entities tend to have more land, and more secure access to land, so working with wealthier households and commercial entities means a greater provision of ecosystem services.

Lack of consistent indicators to assess the effectiveness of payments for ecosystem services

Due to the context-specificity and diverse institutional settings of PES programmes, it is difficult to define and measure outcomes for mitigation and adaptation. Moreover, a lack of consistent indicators raises challenges for comparability and synthesis. Table 3 illustrates the diverse range of impact indicators included in a sample of the SRs.

Table 3. Sample of PES impact indicators reviewed in the selected SRs

INDICATORS FOR PES	SOURCE (SYSTEMATIC REVIEW)
Water quality. Deforestation rate. Forest gain	Kindu and others (2022)
Forest cover	Min-Venditti, Moore and Fleischman (2017)
Organic carbon sequestered and stored by coastal vegetation	Montero-de-Oliveira, Blundo-Canto and Ezzine-de-Blas (2023)
Emissions below decreasing cap over time. Certifications	Shen, Gatto and Pagliacci (2023)
Nature reserve	Yang and Lu (2018)
Additional tons of carbon stored. Forest cover. Water quality. Deforestation rate. Increase in grassland area. Reduced in livestock density. Reduced purchase of agricultural chemicals	Börner and others (2017)
Forest cover. Deforestation rate. Forest gain	Samii and others (2014)
Forest cover change, from satellite data	Brandt and Buckley (2018)
Carbon sequestration. Number of trees planted on crop fields. Certified crops	Miller and others (2020)
Protected forests	Zhang and others (2010)
Reduced forest loss. Coverage area	Hänggli and others (2023)
Forestry and wetland management	Aronson and others (2010)
Reduced deforestation. Improved forest	Snilstveit and others (2019)
Reduced deforestation. Reduced pressure on primary forests. Improved market access and income for land stewards	Morgan and others (2022)
Deforestation rate. Forest cover. Forest loss and forest gain	Samii and others (2014)
Reduced deforestation	Yang and Lu (2018)
Water flows in a designated area. Soil porosity and density	Mota and others (2023)

The study by Kaiser, Hasse and Krueger (2023) further asserts that the lack of consistent indicators to assess effectiveness means most assessments are based on pre-defined programme aims, such as assessing the ecological benefits a PES programme may produce. These may not be direct measures of effectiveness for mitigation and adaptation but can, in some instances, be considered as proxies. This is also discussed in another study by Saeed, McDermott and Boyd (2017), who examined 15 studies of REDD+ in the context of public and community-managed forests to suggest that most studies use different indicators for measuring progress (making comparison difficult).

Indeed, Mota and others (2023), who reviewed 58 studies on PES concepts and practice in Brazil, found the terms 'environment' and 'ecosystem' play an important role. No PES initiative in Brazil pays directly for providing a final "ecosystem" service but rather for human actions or activities defined as environmental services under the law. Mota and others (2023) also find that one of the main limiting factors for compliance is the absence of effective indicators that show a realistic connection between service provision and payments. They conclude that standardizing terms used in the literature and PES schemes is critical. The Common International Classification of Ecosystem Services as a reference is recommended to ensure clarity, objectivity and, more importantly, the expected ecosystem-related outcomes.

The risks of negative and unexpected effects of PES

The evidence review has identified a number of negative and unexpected effects of PES schemes. The most notable are leakage, reduced household income due to loss of productive activities, insufficient income from PES schemes, and the rebound effect, as discussed below.

Leakage or substitution effects occur when deforestation shifts from within a PES scheme area to another location nearby rather than being halted or reversed. If households or communities do not enrol all their land in a programme, resource exploitation pressures may simply move to non-enrolled areas (Snilstveit and others, 2019). This study highlights how the limited information and low quality evidence on PES from a handful of countries effectively reducing deforestation and improving forest cover may be influenced by leakage. In terms of reduced household income due to the loss of productive activities, Perevochtchikova and others (2021) highlight that such negative outcomes occur mainly when PES participants abandon traditional productive activities.

Insufficient income has been reported as one of the economic dimensions of PES. PES programmes are designed to give communities or landowners financial incentives in exchange for preserving or improving environmental services. But occasionally, for various reasons, the income generated from these schemes may be insufficient to compensate for the loss of use rights and activities that have sustained livelihoods. The reasons for such negative and unexpected effects include low or fluctuating market prices, resistance to or limited participation in PES, and trade-offs (Perevochtchikova and others, 2021).

Rebound effects occur when increased revenue generated from PES results in altered household expenditure behaviours, which can affect land-use (Börner and others, 2017). For example, there may be an increase in land degradation or conversion for more intensive agricultural activities if households spend the extra income on resource-intensive activities. However, if households invest their increased revenue in sustainable practices, such as agroforestry or conservation, it could positively affect land-use patterns.

Overall, there is limited evidence across the available SRs to assess the extent to which PES has consistently achieved mitigation and adaptation outcomes across contexts. Greater volumes of evidence are likely to become available as PES schemes mature and longer-term impacts are observed. There is more evidence available on the factors that influence the effectiveness of PES.

b. What factors influence the effectiveness of payments for ecosystem services in developing countries?

The evidence review identifies a range of factors that influence the effectiveness of PES in developing countries. These are described below, with an indication of the strength of evidence for each factor and some tangible examples.

Transparent spatial targeting

The choice of location for where a PES scheme should be implemented influences effectiveness. Ideally, PES are implemented in locations that result from a robust process of determining the likely

impact on carbon sequestration or climate adaptation. However, several risks are evident during the design stage that could reduce effectiveness if not addressed.

A study by Montero-de-Oliveira, Blundo-Canto and Ezzine-de-Blas (2023) that reviewed 13 studies on PES schemes in the Amazon found that discretional targeting and adverse self-selection, among other factors, lead to negative forest conservation outcomes. Adverse self-selection refers to when PES enrols individuals who would have the programme outcomes whether or not they participated in the programme. They note that PES in the Amazon is often based on discretional targeting in areas where the threat of deforestation is low.

The role of auctions is considered in the SR by Nguyen and others (2022), who analysed 55 papers on novel incentive mechanisms designed to boost spatial coordination of conservation efforts. Auctions have long been advocated as an alternative allocation mechanism to avoid the problem of adverse selection and improve the cost-effectiveness of conservation programmes by fostering competition between landholders.

Conservation auctions are used in PES schemes as they can be efficient way to identify participants. Auctions can help overcome challenges related to information asymmetry and a lack of trust between potential buyers and sellers of ecosystem services. This can create fair foundations for the implementation process of a PES scheme. In an SR on auctions for ecosystem services, reviewing 115 studies, Kindu and others (2022) explain that auctions can be grouped as reverse or forward. In a reverse auction, providers bid the minimum compensation they would be willing to accept to sign a contract obligating them to provide a product or service. Generally, buyers are government agencies or NGOs seeking to procure ecosystem services on behalf of the public. Forward auctions refer to demand-side mechanisms where beneficiaries bid amounts they would be willing to pay to secure the provision of an environmental or ecosystem service. In summary, a forward auction bid is an offer to buy; a reverse auction bid is an offer to sell.

Poor targeting of PES locations is often due to imperfect information on the location of environmental assets and the potential for carbon sequestration. For example, looking at evidence from PES in China, Yang and Lu (2018) find that spatial and ecosystem distributions of existing studies are uneven, with most schemes poorly designed, rarely quantified and evaluated without sophisticated methods. The authors argue for matching PES with high-impact ecosystems, maximizing potential for carbon sequestration and resilience. When looking at PES via agri-environmental schemes, Nguyen and others (2022) find that an absence of spatial coordination of conservation efforts results in mismatches between the spatial scale of environmental management and ecological processes, leading to failures in realizing the full potential of PES for environmental conservation.

Nguyen and others (2022) have found considerable variation across studies regarding the effectiveness of spatial coordination incentives for PES.[41] Furthermore, PES programmes are typically voluntary and as highlighted above, there is a risk that households who already meet conditions self-select into the programme. Such risks, if realized across a broad enough proportion of participants, can render a PES scheme much less effective as conservation practices are already taking place and are not being catalysed by the initiative. In this case, PES may lead to ongoing environmental management practices that can be sustained over a longer time. However, effectiveness will likely be low (Montero-de-Oliveira, Blundo-Canto and Ezzine-de-Blas, 2023).

[41] For example, bonus sizes relative to land value can be 2% to 100% of the opportunity costs of using the land for other purposes or 167% to 500% of standard payments. Moreover, smaller agglomeration bonuses did not show any impact on participation rates and environmental benefits.

Land tenure

Key SRs (Kaiser, Hasse and Krueger, 2023; Shen, Gatto and Pagliacci, 2023) highlight the importance of clear and secure land tenure structures when implementing PES programmes. As summarized in Table 4, land tenure systems include privately owned (freehold and leasehold), state-owned, open access, communal, or customary ownership, with a number of subcategories and differing terms found across the literature.

Table 4. Summary of land tenure types

LAND TENURE TYPES	DESCRIPTION
Privately owned (freehold)	A system of land ownership in which individuals own land outright, without any time limit. This means the freeholder has exclusive ownership rights over the land, including the right to use, develop and sell.
Privately owned (leasehold)	The land is owned by one party, but another party has the right to occupy and use the land for a set period, typically under the terms of a lease agreement. The landowner is known as the freeholder, and the leaseholder has the right to exclusive possession of the land for the duration of the lease.
State-owned	The rights to land are appointed to a public sector authority. For instance, some countries have forest lands that fall under the state mandate at a central or decentralized government level.
Communal ownership	A group of people hold collective rights to own, manage and use land and natural resources, typically common pool resources. In some cases, communal ownership systems are formally recognized by the state. In other cases, these systems are not formally recognized, and members may face challenges asserting their rights.
Customary ownership	The use rights to land are distributed to users through vernacular processes of inheritance and marriage within communities and societies and are formalized to varying extents. These are individual rights, not communal rights. Secondary vernacular land markets may vary, but these are outside formalized land tenure systems.

Kaiser, Hasse and Krueger (2023, p.15), drawing on reviewed studies, state that

> An estimated 65% of the global land area is under customary (and communal) land tenure systems, particularly held by local communities and indigenous people in developing countries, although only a fraction is formally recognized by governments.

It is important to note that incentives to change environmental management via land management practices may depend on land tenure status and challenges associated with specific tenure regimes (Snilstveit and others, 2019). For example, there is a lack of separation between forest or natural asset tenure, land tenure and carbon rights. Saeed, McDermott and Boyd (2017) highlight how Indonesia's regulatory tenure framework that guides local PES projects does not separate these three categories. Carbon rights refer to a mechanism separating the right to carbon from broader rights to forest and land, including the right to sequester carbon into the future ('carbon sequestration rights', see REDD Net, 2010). Carbon rights legislation and policy frameworks are bespoke, and many countries have yet to formalize these in legislation. Indeed, very few countries have fully developed frameworks for carbon rights, which could complement limited land tenure frameworks in some developing countries (Saeed, McDermott and Boyd, 2017).

Several studies found that external, upfront support from public authorities, including local and/or provincial or state governments, or from international organizations, is usually necessary to address tenure challenges through community mapping, spatial planning, and clarifying legal ownership of forest carbon and recognizing community forest rights (Shen, Gatto and Pagliacci, 2023).

It is important to note that SRs revealed cases where PES can have a real or perceived detrimental impact on land ownership rights. Some PES schemes implement conditions and consequences of non-compliance by local landowners, such as withdrawable land rights. Consequently, PES participants may feel less secure regarding their land tenure security, particularly where information regarding redress and dispute resolution is limited. The lack of trust was reinforced by the instability of funding sources that affected payments (Montero-de-Oliveira, Blundo-Canto and Ezzine-de-Blas, 2023). This shows the importance of implementing robust PES designs that align with international standards on land tenure rights and Indigenous Peoples' rights, as well as providing accurate information to PES participants on rights related to land tenure.

Willingness to participate: Gaining meaningful revenue from payments for ecosystem services

Another important factor is achieving appropriate pricing for PES, such that the revenue received by land stewards is sufficient to incentivize improved land management. For example, in a review of studies on PES and forest conservation focusing on Indigenous Peoples, Scullion and others (2019) found payments are often marginal compared to land users' income and may not compete with higher returns from agriculture.

Snilstveit and others (2019, p. 5) also find that:

> The size of payments may influence take-up and the extent to which programme participants change their behaviour: If the cost of lost rents from restrictions on land or resource use from participating in the programme are greater than the payments received, a landowner is unlikely to choose to enrol. This requires a payment that is large enough to overcome the opportunity costs for households to decide to participate in the programme and then to stick to conditions. However, because of missing markets the payment size that will induce people to participate in the programme is not observed.

Setting a viable financial model for PES schemes, in close collaboration with landowners and land stewards, is vital for ensuring PES revenue will enable meaningful shifts in land-use and conservation practices.[42] However, it is important to remember that greater PES scheme uptake does not necessarily mean improved environmental outcomes.[43]

Willingness to participate: Non-financial factors

The willingness of landowners and stewards of natural resources to participate in PES schemes is also influenced by non-financial factors. An SR by Jones and others (2020) investigated the role of such non-financial motivations, grouped into pro-social, pro-environmental and risk reduction categories. They review a growing body of PES research, which shows that the motivations to participate in voluntary, incentive-based programmes are complex.[44] Pro-social motivations arise from social norms, the need for social approval, reputational concerns and social benchmarking that encourage a particular behaviour. Pro-social motivations are also driven by the value one derives from contributing to the well-being of others (altruism). The study finds that peer pressure, or

[42] Nguyen and others (2022) suggest that the mechanism of threshold payments can increase scheme uptake.
[43] The question of in-kind benefits and subsidies is an important consideration for the viability of PES. Jones and others (2020) find that many PES programmes in developing countries offer in-kind benefits, such as fencing materials or fertilizer, or investing in collective rural development projects, such as schools. Additionally, many PES programmes are financed through the government as a subsidy.
[44] Financial motivations include in-kind or cash payments in exchange for environmental stewardship actions and are covered in the section above on the importance of revenue from PES.

participating because others are, constitute significant motivators in PES schemes: 27 per cent of studies covered in their SR included at least one measurement of social capital as a determinant of participation.[45] Trust in local leaders and other landowners was also positively associated with participation. More widely, Blundo-Canto and others (2018) found that more than 50 per cent of participants in Costa Rica's PES programmes attributed their willingness to participate to environmental protection rather than financial benefits.[46]

Pro-environmental motivations are intrinsic conservation values or the value of natural assets for their environmental values (rather than economic or social values). Pro-environmental motivations were the most included non-financial factor in studies of PES participation reviewed by Jones and others (2020). Risk reduction occurs when individuals are motivated to sign up for PES programmes because they perceive it could secure their land rights or by receiving resources to demarcate property boundaries. The evidence offered by Jones and others (2020) on this topic highlighted that the underlying rationale for PES investments needs to be revisited and consider an increased number of variables and motivations as well as more complex behavioural changes that can be associated with these interventions.

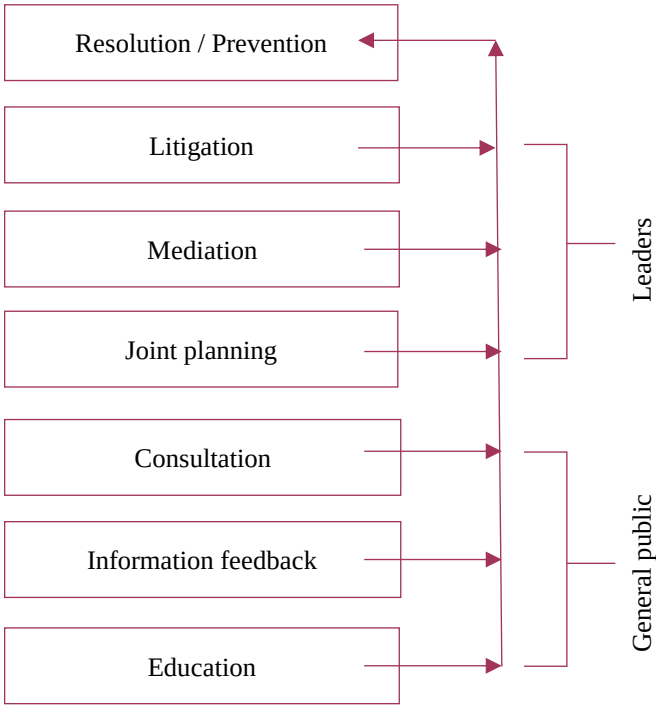
The study concluded with the recommendation that pro-social and pro-environmental factors are strong determinants of participation in PES schemes and should be considered more widely.

Local community and stakeholder engagement

Perhaps the most widely cited factor for the effectiveness of PES in the studies selected was the importance of community and stakeholder participation, engagement and consultation. The ladder of citizen participation by Connor (1988) is a framework that shows seven levels of citizen participation in decision-making, from lowest to highest (see Figure 5). This framework is particularly relevant in the context of complex and challenging issues, such as forest conservation, where effective solutions require the participation of a broad range of stakeholders. Furthermore, in terms of PES, it can be a useful tool to understand the various ways citizens can be involved in decisions and the different levels of power and influence they can have.

[45] Of these studies. 65% considered household participation in PES programmes, 20% were on collective decisions to enrol in PES, and 15% of studies were looking at both household and collective PES programmes in a combined way.
[46] This scheme is known as *Pago por Servicios Ambientales*.

Figure 5. Ladder of citizen participation



Source: Connor (1988)

Stakeholder engagement is especially important during the initial feasibility and design stages, as well as throughout implementation, in terms of:

- Current livelihood portfolios
- Current risks to ecosystems
- Effective and viable conservation methods
- Existing tenure regimes
- Willingness to participate in PES schemes and contribute to upfront investments
- Gender dynamics

Community participation also effectively reduces elite capture of land and benefits (Saeed, McDermott and Boyd, 2017; Duchelle and others, 2018). For example, in a review of studies focused on the Amazon biome, Montero-de-Oliveira, Blundo-Canto and Ezzine-de-Blas (2023) found local community empowerment, equitable cost-sharing and impacts of conservation underpin positive livelihood and environmental outcomes from many forms of PES. Nguyen and others (2022) cite collaborative governance as an important factor for success and effectiveness, which they define as institutional arrangements where landholders, together with other stakeholders such as advisers and government officials, engage in the design and implementation of inclusive decision-making.

Engaging socially and ethnically diverse stakeholders through equitable and inclusive approaches is particularly important to ensure all relevant voices and opinions are heard and considered by the actor coordinating design and implementation. Many studies also cited the importance of free, prior and informed consent.

Many examples exist of community and stakeholder engagement increasing the likelihood of PES achieving its intended results. For example, an SR by Saeed, McDermott and Boyd (2017) of 15 studies on REDD+ projects revealed that limited sharing of information and decision-making authority with communities, a general absence of free, prior and informed consent, and a lack of

defined benefit-sharing and conflict resolution arrangements all resulted in a weaker conservation outcome. In addition, Duchelle and others (2018) found that participatory monitoring enabled greater local participation in REDD+ and highlighted how community participation could extend beyond typical data-gathering activity.

Project ownership and trust between parties are closely linked to local community and stakeholder engagement, which can strengthen social capital and collective action. Montero-de-Oliveira, Blundo-Canto and Ezzine-de-Blas (2023) find that when pre-existing pro-environmental attitudes exist, capacity-building, network creation, and inclusive stakeholder engagement reinforce positive attitudes, supporting a sense of ownership, resulting in positive forest conservation outcomes.

Low transaction costs

The transaction costs related to the feasibility, design and implementation of PES projects have been repeatedly identified as a major impediment to uptake and efficiency, especially those based on auctions (Aronson and others, 2010). PES programmes are structured according to the context and initial administrative infrastructure. Typically, this is not transferrable to another location. This contributes to the complexity of transaction costs (Kindu and others, 2022).

Villamayor-Tomas and others (2022) argue that the transaction costs associated with PES programmes do not always promote sufficient participation by providers or consider local preferences or context. The authors suggest that understanding local legitimacy is important, especially in collaborating with community organizations and ensuring a participatory approach.

For example, from a farmer's perspective, community organizations can rebalance the power relations between the PES entity and farms. Moreover, collective bargaining can help reduce farmer risks, and community organizations can provide a forum for farmer dissatisfaction. From an entity's perspective, community organizations can reduce transaction costs per unit and address information and communication blockages. They also foster trust and good farmer relations. This approach can increase local communities' agency and ownership and enhance PES's effectiveness.[47]

Several studies highlighted the relationship between the level of transaction costs and the type of PES scheme. For example, Kaiser, Hasse and Krueger (2023, p. 7) confirm that community-based PES schemes tend to have lower transaction costs due to lower costs per participant contract, less negotiation time and better monitoring and enforcement of rules. Similarly, Martin-Ortega and others (2019) highlight how low transaction costs in PES for watershed services can be attributed to pre-existing institutions, such as water user groups, that have established mechanisms for collecting fees from beneficiaries. It also highlights how the benefits of working with community organizations may have thresholds in terms of scale (with support from government, NGOs or international organizations).

Governance of payments for ecosystem services systems

An important factor in establishing PES is local government and stakeholder competence. Generally, successful PES schemes have relied on the role of independent third parties, such as NGOs and development organizations. To achieve scale, however, PES systems need to be set up without the support of international entities such as a development partner. Yet, home-grown PES schemes are constrained by the limited experience of local entities such as governments, community groups and local NGOs. For example, Morgan and others (2022) found that participation of such agencies is constrained by limited capacity, including the ability to engage with formal processes through technical, financial and language skills. It found that few schemes include financial support or enhance capacity and governance on the ground.

[47] In another study, Li and others (2023) suggest that PES policies with low transaction costs and high benefits are sustainable in the long-term due to greater economic efficiency.

Certain governance mechanisms, such as community engagement and a sense of ownership, can enable the success of PES schemes. Bruzzese and others (2023) reviewed 52 studies on international markets for forest ecosystem services, finding that the governance of ecosystem services at the local level can enhance cost-effectiveness, environmental outcomes, consensus in decisions, and support from local communities.

Nguyen and others (2022) found that participatory institutional arrangements are a key governance aspect. They note the importance of collaborative governance, such as advisers and government officials engaging in the design and implementation of schemes, allowing more inclusive decision-making.

Perevochtchikova and others (2021, p. 9) found that an important factor for PES success is engagement and coordination between multiple parties in different sectors, including government departments, private sector actors and civil society. The review results by Villamayor-Tomas and others (2022) show a strong role for co-managing PES schemes, recognizing that some governance functions are better carried out jointly by governments and local communities.

A systematic comparison of deforestation drivers and policy effectiveness across the Amazon biome (Hänggli and others, 2023) shows the importance of understanding local context and regional differences to devise appropriate governance options better. The SR by Fischer and others (2020) also revealed that challenges related to governance were higher in African contexts and lower in studies relating to the Asian context.

However, PES governance is fraught with risks (Morgan and others, 2022). Some governance aspects of PES schemes can reduce trust between participants. For example, highly bureaucratic, long formal processes, penalties for non-compliance and suspension of payments due to financial instability can trigger feelings of distrust towards PES implementers. In addition, sanctions on participants for non-compliance can lead to conflict and distrust. Starting payments soon after community agreements are established and plans are certified appears to be a successful strategy. Putting pressure on donors to support longer-term investments has also been proposed (Montero-de-Oliveira, Blundo-Canto and Ezzine-de-Blas, 2023).

Some selected studies find that PES schemes can achieve conservation and regeneration objectives more effectively in jurisdictions with weak governance than in a top-down government-led approach. A study assessing payments for watershed services in Latin America (Martin-Ortega and others, 2019) described PES as more efficient and appropriate than command-and-control measures in weak governance settings. While governance is an important aspect of PES, the impact of PES itself on local and regional governance mechanisms is an interesting topic for further consideration and research, as advocated by Perevochtchikova and others (2021).

Monitoring and results systems

An important aspect of PES governance is measuring the impact of schemes. The perceived scheme rules and the formality of implementation are key factors. Second, conditionality, whereby payments are based on agreed environmental management measures, is a central PES characteristic and includes regular monitoring practices related to the state of the ecosystem or environmental asset, such as an area of tropical forest or mangrove forest. Examples of these conditions across various selected SRs are included in Table 5.

Table 5. Examples of conditionalities for PES schemes

PES CONDITIONALITY IDENTIFIED IN THE REVIEW	SOURCE (SYSTEMATIC REVIEW)
Change management practices. Plant trees. Afforestation	Kindu and others (2022)

PES CONDITIONALITY IDENTIFIED IN THE REVIEW	SOURCE (SYSTEMATIC REVIEW)
Community-based management. Afforestation of agricultural land. Plant grass	Min-Venditti, Moore and Fleischman (2017)
Conservation. Sustainable management	Montero-de-Oliveira, Blundo-Canto and Ezzine-de-Blas (2023)
Decreasing emissions cap. Standards and certifications	Shen, Gatto and Pagliacci (2023)
Nature reserves	Yang and Lu (2018)
Not clearing forests. Reduce cultivated area. Reduce agro-chemical use. Adopt silvopastoral practices. Adopt conservation practices	Börner and others (2017)
Not specified: Presumably not cutting down trees causing deforestation	Samii and others (2014)
Planting trees on crop fields. Improved or rational fallow. Certified agricultural produce (e.g. shade-grown organic coffee)	Miller and others (2020)
No deforestation	Hänggli and others (2023)
Maximum emissions limit	Bruzzese and others (2023)
Restoring degraded, abandoned agricultural lands, also known as old fields. Reintroduce an original or different nature-based land-use option	Aronson and others (2010)
Improved forest management. Sustainable approaches in degraded forests	Morgan and others (2022)
No deforestation	Samii and others (2014)
No deforestation	Yang and Lu (2018)

Saeed, McDermott and Boyd (2017) found in their review of REDD+ projects that most studies have adopted different indicators for measuring progress, making it difficult to compare impact across initiatives. It also makes it hard to assess the effectiveness of different monitoring, results and verification systems.

There is mixed evidence from across the reviews on the effectiveness of monitoring, reporting and verification (MRV) for PES schemes worldwide. Many studies make it clear that there is significant room for improvement. For example, the SR by Blundo-Canto and others (2018) that analysed 46 studies evaluating PES's livelihood impacts demonstrates that sound monitoring and evaluation systems are urgently needed.

Snilsveit and others (2019) conclude that to address this evidence gap, funders and implementing agencies should collaborate to develop rigorous methods for impact evaluation. They should also invest in collecting and analysing qualitative data that examines diverse research participants and follows change over longer periods. Reviewing evidence from payments for watershed services programmes in Mexico, Jones and others (2023) find that investments in monitoring and reporting on actual watershed metrics are likely to be important to the long-term success of payments for watershed services programmes.

Saeed, McDermott and Boyd (2017) report that MRV issues and establishing baseline scenarios are often given preference in the initial stages, with little attention paid to social co-benefits or community rights.

c. Conclusions on the evidence trends for payments for ecosystem services

One of the most recent studies, by Bruzzese and others (2023), concludes that future research on PES should be directed towards a better understanding of the process leading to the creation, implementation, effectiveness, and governance, and the level of satisfaction in economic terms of the actors involved. Much of the evidence is still based on the short-term implementation of PES projects. There are knowledge gaps in terms of land management measures on long-term timescales. Several SRs included effect sizes of various indicators, which quantify the PES-related impacts. The effect sizes mentioned in the previous sections are summarized in Table 6.

Table 6. Effect sizes extracted from the studies referenced

TOPIC / INDICATOR	EFFECT SIZE DATA	SOURCE (SYSTEMATIC REVIEW)
Deforestation rates	0.21 percentage points	Samii and others (2014)
	0.21 percentage points	Snilstveit and others (2019)
Forest cover change rates	0.50 (Costa Rica) 1.6 (Mexico) percentage points	Samii and others (2014)
	0.32 percentage points	Snilstveit and others (2019)
Agroforestry intervention yields	1.16 percentage points	Castle and others (2021)
Agroforestry interventions on income	0.12 percentage points	Castle and others (2021)
Household incomes	4% to 14% on average	Samii and others (2014)
	60% decrease to 400% increase	Blundo-Canto and others (2018)

Overall, there is a significant body of evidence on the factors that moderate the effectiveness of PES schemes. As a body of evidence, the selected studies provide findings that can guide the design and implementation of PES initiatives. The findings from the study by Montero-de-Oliveira, Blundo-Canto and Ezzine-de-Blas (2023) show that PES in the Amazon can generate positive environmental and social outcomes when they:

- Combine cash and in-kind incentives
- Raise environmental awareness through capacity-building
- Engage socially and ethnically diverse stakeholders through equitable and inclusive approaches
- Apply transparent spatial targeting
- Guarantee strong conditionality through robust monitoring of compliance
- Ensure stable delivery of payments

Such considerations appear to be appropriate for wider geographical contexts. There are a number of long-term sustainability considerations for PES schemes. Snilstveit and others (2019) find that the permanent benefits of PES schemes often depend on continuous programme funding, which may be particularly difficult in government-run PES schemes. Local community empowerment and equitable sharing of costs and conservation impacts also appear to underlie PES positive longer-term livelihood and environmental outcomes (Montero-de-Oliveira, Blundo-Canto and Ezzine-de-Blas, 2023). Yang and Lu (2018) suggest that if a PES programme is to be sustainable in the long run, it needs to be ecologically effective, economically efficient and socially equal. Effective implementation of all these factors should maximize the chances of success.

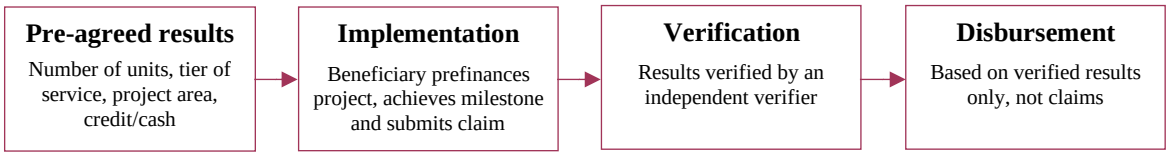
3. RESULTS-BASED PAYMENTS

Sixteen SRs were identified to synthesize evidence in relation to RBP. Nine were focused on health, six on NbS primarily within forestry and land-use, and one on clean cooking.

a. Defining results-based payments and relevant sectors to which they are applied

RBP is an umbrella term for financial mechanisms that link incentives to outputs or outcomes by ensuring that payment is conditional on achieving measurable actions or predetermined performance targets.[48] According to Stritzke and others (2021), results-based finance (RBF) typically includes four stages (see Figure 6). These include selecting pre-agreed results, implementing strategies, verifying results independently and disbursing funds by the contracting partner.

Figure 6. Four stages of the RBP model



Source: Adapted from Stritzke and others (2021)

In RBP models, the SRs showed that the principal or provider of the funding is mainly a central or local government, an international agency such as a development financing organization, an NGO or a private sector entity. The agent is the implementing entity, which can be a national or local government, NGO, or local service provider such as a health facility or household (Duvendack, 2017).

Duvendack (2017) employs a Measure-Agent-Principal framework in their SR to assess the success and failure of RBP as part of international development initiatives. With this financing approach, risks associated with project delivery and execution are shifted from the funder to the project implementer, making it an appealing approach for donor agencies, particularly in developing countries.[49]

In some contexts, RBP are used as a singular specific instrument. In other cases, it is implemented as part of blended approaches involving upfront and results-based grant payments. For example, Sieleunou and others (2021), who reviewed 35 articles to explore the scope and development of strategic health purchasing in Cameroon, posit that performance-based financing often coexists with broader systems, such as national health insurance, private health insurance, mutual health organizations and voucher schemes.

In summary, RBP contracts allow multiple actors to achieve specified outcomes through aligning agent incentives, increasing accountability by linking financing to desired outcomes rather than inputs or outputs (reducing some risks for funding agencies), and facilitating greater autonomy by agents to select inputs and processes (see Meuth Alldredge and others, 2020). A wide range of RBP financial structures exist (see Appendix 3 for a summary of these approaches).

Sectors to which RBP are applied

[48] RBP is used interchangeably with other terms, depending on the sector and geographical location, such as 'performance-based financing', 'performance-based funding', 'payment by results', 'results-based aid', 'results-based financing or funding', or 'performance incentives'.

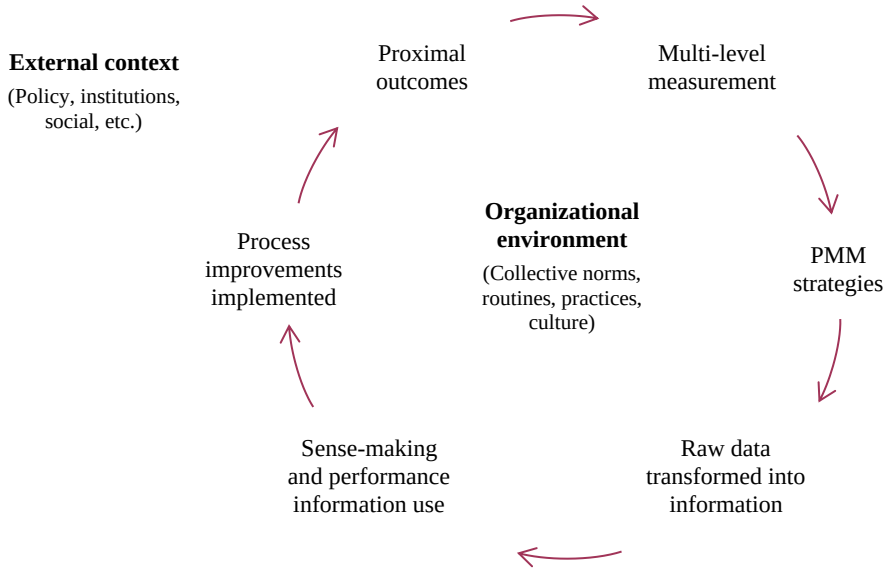
[49] Since October 2017, GCF has started a pilot programme for REDD+ results-based payments following the verification of emission reductions. This five-year pilot is part of the Fund's support of REDD+ for countries that have already completed the first two phases of the REDD+ programme.

Meuth Alldredge and others (2020) highlight in their review of the RBP literature that around half of the studies were in the health sector, with the rest of the evidence base spread across agriculture, forestry, education and other sectors.[50] Interestingly, a very limited number of studies have been found in the energy sector. Specific types of RBP modalities are linked to specific sectors, with PES schemes focused on agriculture and forestry. In contrast, pay for performance modalities are mainly found in the health sector. Conditionalities tied to vouchers are commonly found in the health and education sectors. In the health sector, the RBP model is typically used to fund healthcare facilities based on the extent to which providers meet pre-defined quantity- and quality-related performance targets, following independent verification. It is used across a wide range of health practices.

In their SR, Das, Gopalan and Chandramohan (2016) reviewed eight articles to understand the effect of RBP on maternal and childcare in developing countries.[51] They outline that the supply-side of RBP incentives involves strictly monitoring results in a stipulated time frame, typically measured through health outcomes, utilization of services and quality of care.[52] Munar and others (2019) reviewed 137 impact evaluations and 18 SRs and defined performance measurement and management for the health sector as a series of iterative cycles with interrelated components, as illustrated in Figure 7.

Based on the policy and organizational context in which the health system is embedded, this is a useful framework broadly representative of a range of RBP models in the health sector. In terms of forestry and agriculture, PES schemes, including REDD+ modalities, are covered in detail in section 2.

Figure 7. Performance measurement and management framework



Source: Adapted from Munar and others (2019)

[50] It should be noted that Meuth Alldredge and others (2020) included studies that assess the effectiveness of an RBP intervention in (i) non-Annex I countries (ii) low-income contexts/settings (defined in relative terms) in Annex I countries and (iii) non-Annex I and Annex I countries (jointly) if associated analyses distinguish effects and report results separately across the two samples.
[51] The study by Das, Gopalan and Chandramohan (2016) focused specifically on low- and middle-income countries.
[52] These authors refer to pay for performance initiatives.

b. To what extent have results-based payments been effective at achieving mitigation and adaptation outcomes?

The remainder of this section explores how effectively RBP has achieved mitigation and adaptation outcomes. More than half of the studies for this evidence review were related to the health sector. Health contributes to adaptation outcomes due to its role in increasing the resilience of the most vulnerable people and communities and promoting health and well-being.

Results-based payments and mitigation outcomes

There is mixed evidence of the effectiveness of RBP in achieving mitigation outcomes. Most SRs relevant to mitigation examine the role of RBP outcomes in the context of REDD+. The reviewed studies highlight that it is difficult to assess RBP effectiveness due to a lack of direct evidence. The analysis of metrics other than greenhouse gas (GHG) emissions remains mixed and sometimes contradictory. For example, Schulte and others (2022) identified 211 studies. Despite quantifying biophysical and carbon benefits, they found these estimates hold large uncertainties, and few capture direct socioeconomic outcomes.

Duchelle and others (2018) reviewed 45 articles to understand the outcomes of REDD+ interventions in terms of local participation and its carbon and non-carbon (e.g. tenure, well-being, biodiversity) goals. As of early 2018, over 50 countries had initiated national REDD+ strategies, and more than 350 localized REDD+ projects were being implemented. Studies based on remotely sensed and biomass measurements highlighted relatively positive impacts of REDD+ interventions on carbon/land-use. However, this evidence is primarily from South and Central America. Some examples focused on carbon/land-use outcomes show moderately encouraging results. Only 12 studies examined the supposed main goal of REDD+, changes in forest carbon/land-use outcomes, compared to 26 that assessed non-carbon outcomes (which tended to show small or insignificant results). Furthermore, while most REDD+ projects intended to sell credits to the voluntary carbon market, only one-third had done so as of early 2018.

Snilstveit and others (2019) found that the effects of PES on environmental outcomes were promising, with an improvement in forest cover and a reduction in deforestation rates, with substantial effects in some contexts. However, they also found that the effects on environmental (and socioeconomic) outcomes are of low or very low quality and that the evidence base is characterized by small studies. Snilstveit and others (2019) found that most studies do not have baseline data, often fail to use rigorous methods to establish a counterfactual and do not control for the well-known risk of spillover effects to neighbouring areas. [53]

In terms of energy, Stritzke and others (2021) addressed an important research gap by reviewing previous and ongoing RBP programmes regarding clean cooking solutions.[54] They present findings from RBP clean cooking initiatives implemented in Kenya, Mozambique and other locations. They argue the RBP model has the potential to be more effective than traditional aid programmes as the latter tend to conform to pre-planned interventions and strategies, with limited room for course

[53] Snilstveit and others (2019) also highlight that overall effects may be influenced by outcome reporting bias.
[54] One example of a clean cooking solution is the Modern Energy Cooking Services programme, a coordinated effort between leading United Kingdom research partners, the World Bank's Energy Sector Management Assistance Program and private and public sector organizations and businesses. The programme aims to leverage investments in both on-grid and off-grid renewable energies to promote clean cooking solutions through modern energy cooking services. The SR's authors claim their research is the first to express WTP estimates as a percentage of GDP or national net income per capita. More recently, clean cooking solutions have garnered support from development finance institutions applying RBP approaches rather than direct grants or investments in clean cookstove companies. Some notable initiatives include the World Bank's Clean Cooking Fund and the Energising Development Partnership (EnDev), a flagship European multi-donor initiative implemented by the *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ) that aims to promote sustainable access to modern energy services in 24 developing countries across Africa, Asia and Latin America (Stritzke and others, 2021).

correction and negotiation. On the other hand, as RBF initiatives tie payments to outcomes, they allow agents to implement the right combination of strategies and can utilize local knowledge and political dynamics (Stritzke and others, 2021). This "made-to-order" instead of "one-size-fits-all" approach increases the chances of success. In their review, they argue that RBP has proven effective in incentivizing companies to enter new markets including low-income, rural and displacement settings.

Muthee and others (2022) reviewed 65 studies for their in-depth qualitative synthesis of the Clean Development Mechanism's (CDM) effectiveness. They found mixed views on the effectiveness of CDM. While it generated benefits associated with emissions reductions and sustainable development, with co-benefits such as employment creation and improved air quality in the project area, this evidence is tempered by the complexities related to regulations and methodologies employed to assess CDM projects and inadequate monitoring modalities and verification procedures for co-benefits (Muthee and others, 2022).[55]

There are limited indications that RBP does lead to positive mitigation outcomes, including emission reductions, forest conservation and cleaner cooking solutions.

Results-based payments and achieving adaptation outcomes

There is also limited evidence available on the effectiveness of RBP in achieving adaptation outcomes, as much of the evidence is mixed. RBP outcomes in terms of adaptation are primarily found in the health sphere.

As part of this review, nine papers related to health were reviewed, presenting a wide range of results on RBP's effectiveness in fulfilling adaptation outcomes.

Witter and others (2021) argue that the evidence for the effectiveness of RBP in improving health outcomes is mixed, and the quality of evidence assessed in general is low. According to the authors, there is sufficient evidence that the RBP model positively influences quality of care, resource availability and patient satisfaction, with some minor exceptions. On the other hand, there is limited evidence on outcome areas such as facility governance, user fee payments, improved equity of utilization and staff-related indicators.[56]

Across a review of 13 studies, Patel (2018) further delineates that RBP can effectively improve the coverage and quality of targeted maternal and child health services. However, it should be noted that there is considerable variation, and improvements achieved are not uniform, as can be seen in the coverage of preventive services in some programmes and for some conditions but not others.

Das, Gopalan and Chandramohan (2016) reviewed evidence on the effects of RBP on the quality of maternal and child health in developing countries. In general, evidence was low because (i) programme evaluations did not adequately explore the quality of care, (ii) evaluations were mostly underpowered, and (iii) RBP could not affect the quality of care to a large extent. The authors found that RBP programmes could only improve the availability of skilled staff and provider's clinical knowledge. In addition, RBP led to some negative outcomes on quality, such as reduced availability of equipment and vaccines.

James, Lawson and Acharya (2020) paint a more positive picture, finding that RBP approaches have demonstrated a significant increase in coverage and utilization of maternal, newborn and child

[55] Central to the CDM's project-based system was the concept of additionality, which refers to the requirement that the greenhouse gas emissions after implementation of a CDM project activity should be lower than those that would have occurred in the most plausible alternative scenario to the implementation of the CDM project activity. In other words, CDM projects have to reduce emissions, which would not have been reduced without CDM financing. The CDM has been criticized for the questionable additionality of certain projects, potentially leading to so-called windfall profits by marginally 'tweaking' existing technologies and processes and excluding many categories of potentially important mitigation technologies.

[56] For example, staff satisfaction, motivation and absenteeism.

health services. Presenting evidence from Argentina, Zambia, and Nigeria, the authors suggest that RBF yields better investment returns than traditional input-based financing strategies. However, further evidence is needed on cost-effectiveness.

Waithaka, Cashin and Barasa (2022) explore RBP in the context of sub-Saharan Africa and find that it can positively impact governance and institutional arrangements in the health sector in some settings. It does this by defining clearer accountability frameworks, separating some key health financing functions, and clarifying roles and relationships among different actors, particularly where governance arrangements are weak, such as in post-conflict settings. They find evidence that RBP can be instrumental in introducing positive forms of provider autonomy into purchasing arrangements. However, they find that RBP's effects are often constrained in scope as they are frequently limited to pilot projects that run parallel to the rest of the health system. This results in limited integration with the mainstream health financing system, increasing fragmentation in governance and institutional arrangements. Ultimately, performance-based funding has not systematically transformed health purchasing in countries in sub-Saharan Africa.

Witter and others (2012) find the impact of RBP on service delivery to be highly uncertain, with limited effects and high costs. While there is evidence of improvements in institutional delivery, the findings vary in the direction of change and magnitude across settings. The authors argue it is not possible to draw any general conclusions. In addition, the quality of evidence was graded as low or very low, with limited numbers of studies reporting on specific indicators, a high-risk of bias in most studies, and inconsistent findings.

Turcotte-Tremblay and others (2016) find limited evidence that RBP increases value for money in developing countries. None of the studies in the SR were full economic evaluations that could attribute improvements in health services and/or health to the RBP modality. Furthermore, little is known about how RBP modalities and outcomes evolve over the long-term, including unintended consequences. The authors argue that greater transparency could facilitate better economic valuations of RBP.

Finally, this evidence review found that the literature lacks a meaningful assessment of the sustainability of RBPs, particularly in the health sector. James, Lawson and Acharya (2020) find that the dependency of recipient countries on donors compromises the sustainability of RBP programmes. They argue that for RBP to achieve long-lasting impacts in developing countries, an appetite for reform needs to be created within the country. Simultaneously, the capacity to mobilize domestic resources for RBP must be enhanced. While political factors may be important in institutionalizing initiatives such as RBP in any country, the evidence on RBP's effectiveness and effects is insufficient. This is also corroborated by Waithaka, Cashin and Barasa (2022), who highlight that achieving strategic health purchasing for better health outcomes means reforms need to be embedded in and aligned with existing financing systems and the context of the country.

While there are encouraging signs from some SRs, evidence is limited by the lack of research into the cost-effectiveness of RBP models. There are also reservations about the sustainability of services incentivized by RBP once the funding ends and concerns that RBP models can disincentivize the development of necessary regulatory and institutional frameworks for sustained services and impact to be delivered.

Overall, the evidence review indicates a limited number of SRs on RBP and a lack of evidence on its effectiveness for mitigation and adaptation outcomes. This observation is also reflected by Duvendack (2017), who highlights that RBP mechanisms and impacts are not well understood outside of health and education.

c. What factors influence the effectiveness of results-based payments in developing countries?

The evidence review identified a range of factors that influence the effectiveness of RBP in developing countries. These factors vary slightly for mitigation and adaptation and are heavily interrelated. They include political support, governance and institutional capacity, policy and regulatory frameworks, community participation, financial and technical support, and MRV systems. This section provides an overview of these factors influencing mitigation and adaptation outcomes in developing countries.

Political support

Political support for RBP is discussed throughout the literature, mainly in the context of REDD+ and is an important enabling factor for the success of interventions. Snilstveit and others (2019) describe how political collaboration and coordination are necessary, with strong frameworks to support implementation. Any new institutional arrangements must be consistent with existing laws or embedded into current legislation. Furthermore, too many institutions could risk overlaps and conflicting government priorities. Sieleunou and others (2021), in their SR on health financing schemes, posit that political contestation and fragmented authority have blocked policy change around health financing reforms in South Africa.

These findings are corroborated by Muthee and others (2022), who describe how inadequate political support from host countries and disinterest within political circles hinder the success of interventions. In a review of 211 studies exploring factors that influence the implementation of NbS, Schulte and others (2022) found REDD+ implementation limited when decisions were made with short-term objectives. When technical expertise needed to participate fully in the REDD+ process was lacking (but the process continued for political reasons), implementation tended to be limited. Schulte and others (2022) also found that mitigation outcomes remain limited because necessary factors to operationalize REDD+, such as strong leadership and champions in finance, remain weak.

Governance and institutional capacity

Schulte and others (2022) find that projects can take many years to become established and fail to provide tangible benefits due to insecure finance or poor governance. Witter and others (2012) argue that RBP will not work when the national level is unwilling to decentralize decision space and resources. Further, Waithaka, Cashin and Barasa (2022) found that in most settings, public financial management rules limit the autonomy and flexibility of public providers to decide how to deliver services and which inputs to use.

Stritzke and others (2021) highlight the importance of institutional capacity to develop and execute RBP programmes. The principal should be able to implement robust monitoring and evaluation systems. In addition, institutional capacity-building for recipients can ensure project execution plans are in accordance with RBP modalities and cash flows.

Policy and regulatory frameworks

Snilstveit and others (2019) find that RBP models for PES programmes require strong governance structures to monitor and ensure compliance and behaviour change. This is necessary to monitor and support the participants' compliance with the programme's conditions and to build trust. Existing beneficiary support for environmental protection facilitates implementation, yet it is unclear if financial incentives undermine this.

Fischer and others (2020) find that policy frameworks and law enforcement are linked to reduced deforestation.[57] Policy frameworks with governments and other non-state actors to address environmental issues are insufficient. Law enforcement agencies must enforce these laws and regulations to prevent environmental harm. Furthermore, the ability of forest users to access and obtain forms of formal land tenure was found to reduce deforestation. However, tenure status needs to be enforceable. In this respect, land-use planning, policy frameworks and law enforcement have the strongest effects on deforestation. In some cases, community participation and strong land tenure did not reduce deforestation, suggesting the need for effective legal and political structures to strengthen REDD+ implementation.

Muthee and others (2022) also find that strong policy and institutional frameworks at the local and national levels are important for successfully implementing REDD+. For example, a study in the Amazon basin highlights the weakness in the local and national governance structures and laws as a significant impediment to the successful implementation of REDD+.

Community participation

Participation was found to be an important component of REDD+ implementation and success. Fischer and others (2020) found rich evidence for the positive effects of participation, including cooperative management, respect for customary law, and autonomy of communities and indigenous people.

Community participation is fostered through free, prior, and informed consent, stakeholder consultation, acceptance from leadership and realistic requirements. Involving the community is vital in managing the tensions that can arise when setting up conservation areas.[58]

Muthee and others (2022) identify diverse challenges in rolling out REDD+, including inequality in the distribution of costs and benefits, conflicts related to the usage of forests within the programme and challenges from political influences. The authors highlight unbalanced representation, interests, and inadequate participation, especially from local and indigenous communities, as significant barriers. This was particularly relevant in developing REDD+ mechanisms in Malaysia, Nigeria, and Tanzania, raising issues around the legitimacy and inclusivity in REDD+ project development and implementation.

Schulte and others (2022) find that although communities are the intended implementers and beneficiaries of REDD+, there has been a lack of meaningful community engagement, reducing the likelihood of success. This review attributes the effectiveness of REDD+ to community awareness and participation. They argue that projects can lack free, prior, and informed consent and that project implementers can withhold information to manage community expectations. In some contexts, they found that REDD+ includes elite capture of resources and corruption. However, when local communities sincerely participate and are considered important stakeholders, local institutions and governance mechanisms can enhance scaling up. Overall, the evidence shows that the success of REDD+ implementation ultimately rests on its ability to engage effectively with local actors on the ground. Implementing REDD+ must be based on the local context, informed by robust community engagement.

Financial and technical support

Several factors relating to financial and technical support influence the effectiveness of RBPs. Firstly, the challenge of upfront costs. As payments are made upon milestone delivery, and

[57] The authors analysed 14 studies that used statistics to examine the relationship between governance indicators and deforestation, and 13 that employed qualitative descriptive tools. Qualitative studies showed slightly stronger effects of high governance scores on deforestation. The mean governance effects in the three African studies were the lowest. In contrast, the mean governance effects in the Asian studies were the highest.

[58] For example, indigenous peoples and local communities may not have secure rights or access to grievance mechanisms. Social safeguards, including full and effective participation, are required for REDD+ eligibility.

milestones may not be achieved for a significant period, the funding recipient or agent must be able to access upfront financing. This can often be a challenge in emerging markets due to financial risks, high interest rates or limited access to international capital markets (Stritzke and others, 2021). This can be particularly challenging for smaller companies. They suggest blending RBP with grants to meet initial costs, which can be combined with technical assistance.

Second, local currency risks can be a barrier to RBP. Citing case studies from African countries, including Zambia and Kenya, Stritzke and others (2021) highlight that developing countries can face significant foreign exchange losses. To overcome this, the authors again suggest the inclusion of an upfront grant within an RBP programme to support the pre-financing and cash flow of participants.

Third, financial incentives are also required on the demand-side to attract users towards relevant services. In the context of maternal and child health, James, Lawson and Acharya (2020) find that common enabling factors for institutionalizing RBP are domestic fund mobilization and the incorporation of demand-side tools, such as in-kind incentives, conditional cash transfers or vouchers for user fee exemptions.

Fourth, there are risks of RBP undermining other existing financial systems. For example, Witter and others (2021) find that RBP can help reduce fiduciary risks but tend to increase costs and the risks of operating a parallel information and public finance management system. James, Lawson and Acharya (2020) highlight that when the services included in RBP schemes do not align with overall service provision, RBP modalities can undermine broader access to services. For example, health workers may focus more on targeted services than those not tied to an additional payment. In addition, a lack of transparency in bonus distribution has also led to perceptions of unfairness and dissatisfaction among health workers. Furthermore, user fees can reduce access to health services. Payment delays can also affect the power of incentives, often with lengthy verification processes and heavy administrative burdens. Credible, independent agencies with highly skilled verifiers have sometimes been credited with creating the perception of greater objectivity. However, it can also challenge financial sustainability, national ownership and internal capacity-building.

Finally, the evidence review finds that technical support can make RBP approaches more effective, particularly as verification processes can sometimes lead to delays in the disbursements of funds. Technical assistance can support developing standardized key performance indicators, data-collection and verification processes (Stritzke and others, 2021). For example, tracking health benefits or environmental impacts can be particularly difficult and resource-intensive, so external support is valuable to implementing agents. In terms of introducing new technical processes as part of RBP mechanisms, Waithaka, Cashin and Barasa (2022) found that RBP contracts between purchasers and providers enabled clearer rules and regulations for providers across a range of health contexts. However, these frameworks and regulations affect only the RBP funding, limiting the degree to which they can help to improve governance and institutional arrangements more broadly.

Monitoring, reporting and verification systems

Designing an RBP model requires strong verification systems. Investing in robust information and monitoring systems is a prerequisite, particularly for sustained long-term impact. MRV systems are also crucial for avoiding unintended impacts from schemes. Wiysonge and others (2017) argue that unintended impacts in the health sector can include adverse selection, such as excluding high-risk individuals, over-reporting, and avoiding tasks not rewarded with incentives. Stritzke and others (2021) suggest partnering with independent verification agents with knowledge of local markets and sufficient resources to act as a bridge between the principal and the agent. However, verification visits can strain communication between purchasers and providers and result in competing priorities for managers, leading to frustrations and demotivation.

Kachapila, Kigozi and Oppong (2023) systematically reviewed 80 studies on MRV systems and argued for strategic rather than passive healthcare purchasing in developing countries. They underscore the importance of robust verification systems and reinforcement of management and accounting skills. Duvendack (2017) also highlights the importance of accounting for the actual costs of measurement and verification of results as an integral part of the design of MRV initiatives. Muthee and others (2022) also flag high transaction and implementation costs in MRV processes.

Saeed, McDermott and Boyd (2017) identified 15 SRs through searches, critical appraisal and synthesis, focusing on REDD+ governance. They found most studies adopted different indicators for measuring progress, which makes comparison across interventions difficult. Similarly, Muthee and others (2022) highlight how countries have varying MRV strategies at different levels of government, limiting coordination and coherence.

Challenges related to MRV are also discussed by Duchelle and others (2018), who highlight that as REDD+ is a customized basket of integrated interventions, it is hard to evaluate all treatment components causally.

d. Conclusions on the evidence trends for results-based payment

RBPs typically involve paying for pre-defined results rather than inputs or outputs. RBP can clearly define accountability by linking payments to the achievement of milestones. However, RBP projects can also run parallel to the main administrative and financing systems, increasing fragmentation in governance and institutional arrangements and adding to costs for high-quality data for MRV.

Overall, the RBP model has been somewhat successful in aligning the objectives of the principal and the agent, as it can give more autonomy to the implementing agency to apply the most relevant and adequate approach to achieve pre-decided results. This tailored approach leaves room for more innovation, allowing the agent to enrich the project with local knowledge of socioeconomic and political dynamics, increasing chances of success.

Very little research has been completed relating to RBP in the energy sector. Stronger empirical evidence on whether RBP represent good value for money in developing countries is needed to adopt stronger designs and consider these programmes' long-term implications for costs and health outcomes. In addition, future studies should compare RBP to promising alternative interventions that aim to strengthen the healthcare system.

A range of factors influence the effectiveness of RBP for mitigation and adaptation initiatives. These include political will and support, governance and institutional capacity, robust policy and regulatory frameworks, and community participation. They also include technical and financial support to overcome currency risks by blending RBP with upfront grants and effective MRV systems. These factors are interrelated and differ in priority in different contexts. A core challenge in understanding the effectiveness of RBP across mitigation and adaptation initiatives lies in the difficulties surrounding MRV systems.

More research is needed to understand the long-term implications of RBP and to identify the best ways to design and implement them effectively. However, the evidence suggests that RBP can be a useful tool for improving governance and institutional arrangements, aligning the objectives of the principal and the agent, and giving more autonomy to the implementing agency. RBP presents a promising new approach to development. However, more research is needed to understand their long-term implications and to identify the best ways to design and implement them effectively.

4. WILLINGNESS TO PAY

The evidence review now presents findings from the 26 SRs on WTP modalities identified through the screening, eligibility and inclusion criteria.[59] The synthesized data and conclusions are structured according to key sectors: health, forest ecosystem conservation, energy, water and sanitation and pro-environmental behaviour. Each of these subsections addresses the factors that moderate WTP estimates.

a. Health

WTP in the health sector has been studied widely. This summary covers WTP estimates for health insurance, pension schemes, vaccinations and payments to control endemic diseases. These interventions directly and indirectly enhance the resilience and adaptative capacity of citizens in developing countries.

Community-based health insurance schemes have emerged to achieve financial protection and contribute to health coverage in developing countries. An SR of 25 studies to assess and synthesize factors associated with enrolment (Adebayo and others, 2015) found that low-income levels, poor healthcare quality, trust (in both the community-based health insurance (CBHI) scheme and healthcare providers), educational attainment, gender, age, and household size affected enrolment. It was observed that individuals with higher levels of education were willing to pay more for health insurance. Additionally, men showed a greater WTP for CBHI compared to women. Younger individuals were more willing to pay for CBHI than older individuals. Moreover, households with a larger number of members demonstrated a higher WTP for this form of health insurance than households with fewer members.

Furthermore, the findings also indicated that the WTP was frequently influenced by factors such as affiliation with health associations, high levels of disease and reliance on contemporary medical practices. Other factors emerged as significant predictors of enrolment, including the perception of healthcare quality, knowledge, institutional rigidities in payment modalities, the timing of enrolment campaigns, and cultural beliefs. In addition, Adebayo and others (2015) revealed a correlation between low health insurance coverage and inadequate health quality, which refers to issues such as drug and medical supply shortages, poor attitudes of health workers, treatment effectiveness and extended waiting periods.

Acharya and others (2013) reviewed 19 studies to examine the impact of health insurance in developing countries. Focusing on the informal sector, the SR found that sociodemographic factors, namely, education, gender, age, family size, and composition, were key moderators of enrolment into health insurance. On the other hand, the SR found that factors such as distance to health centres, rural residency, and initial conditions (such as chronic illness) did not affect enrolment. Overall, the SR found low enrolment rates.

Miti and others (2021) analysed the predictors of WTP for health insurance and pension schemes in developing countries. Focusing on the informal workforce, they analysed 34 studies from 17

[59] Our search also provided 15 SRs focused on both non-annex I and annex I countries. Based on the evidence review's inclusion and exclusion criteria, these mixed studies are excluded from the main findings of the current review. However, the review team summarized these studies to identify similarities and/or differences compared to the findings of the included studies. This is presented in the appendices. Many of the mixed studies focused on pro-environmental consumer goods and services (n=5), followed by food and agriculture (n=4), energy (n=2), infrastructure (n=1), forest ecosystem conservation (n=1), water and sanitation (n=1), and climate change (n=1). Under these categories, some subsectors were relatively dominant. For instance, under the food and agriculture category, most of the studies focused on genetically modified foods (n=3). Compared to the non-annex 1 country studies, the WTP determinants found in the mixed studies were broadly similar, particularly the sociodemographic factors. In terms of geographical locations, the mixed studies compared the WTP among different regions. For instance, Europe versus Africa or Asia.

countries.[60] Sociodemographic factors (age, education, religion, gender, family size, and residence), income, culture, and trust were found to influence the WTP for both health insurance and pension schemes. In addition, the attitude and presence of doctors, experience of illness and distance from health facilities were all important WTP determinants. For pension schemes, benefit packages, quality of administration, flexible contribution rates, and government subsidies all played a role in contributions and enrolment.[61]

Still on health insurance, Nosratnejad, Rashidian and Dror (2016) argued that the WTP for health insurance increases when health access largely depends on out-of-pocket spending. This SR assessed whether households were willing to pay for health insurance and by how much and which factors affect WTP for health insurance. The review of 16 studies from 10 countries found a positive relationship between increases in family size, education level, income, past hospitalization, and perceived poor health status with a higher WTP for insurance. Conversely, an increase in age correlated with a decrease in WTP. The SR highlighted that the WTP for health insurance among rural households in developing countries was less than 2 per cent of the gross domestic product (GDP) per capita.[62]

Unlike other WTP SRs included in the current evidence review, Supadmi and others (2019) main focus was not on the factors affecting WTP. Instead, they examined economic evaluations. In analysing nine studies on dengue vaccination from Southeast Asian countries, they considered various parameters, including WTP. In one of the studies they included from Indonesia, they found that most participants (87.5 per cent) indicated they were willing to pay for such vaccines, with the price ranging from USD 0.70 to 14.70. Moreover, the mean values of participants' WTP were estimated to be USD 4.04 (95 per cent confidence interval 3.86-4.23).

Focusing on a tropical disease, malaria, Trapero-Bertran and others (2013) reviewed 59 studies from Africa, Burma, India, Indonesia, and Sri Lanka. The authors explain the variation in mean WTP for goods/services to control malaria through a meta-regression. They found that factors such as socioeconomic status, gender, marital status, education, age, household size, household status, recent experience of malaria, occupation household income, average annual expenditures, and expenditure to treat malaria were associated with WTP (listed in order of the strength of the relationship).

Overall, the present study has yielded considerable evidence to enhance our understanding of WTP moderators in the health sector. Like other sectors, sociodemographic characteristics are the predominant set of factors associated with WTP.

b. Forest ecosystem conservation

The forest sector has witnessed an increasing application of market-based approaches. The topic has also attracted research attention, particularly at the international level. For instance, Abdeta (2022) comprehensively analysed 36 previous contingent valuation studies on forestry in developing countries.[63] The primary objectives of the SR were twofold:

- Examine communities' preferences and WTP for forest conservation

[60] Bangladesh, Ghana, Ethiopia, Nigeria, Cameroon, China, The Philippines, Indonesia, Burkina Faso, India, Togo, China, Kenya, Vietnam, Zambia, Iran and Tanzania.
[61] Miti and others (2021) acknowledged that most of the included studies in their review focused on WTP for health insurance, suggesting that there is a need for further research to address the gap in evidence on WTP for pension schemes.
[62] The SR's authors claim their research is the first to express WTP estimates as a percentage of GDP or national net income per capita.
[63] Abdeta (2022) argued that in the past two decades, there has been notable advancement in the field of environmental contingent valuation studies, particularly in the context of developing countries. The study argued that it is important to acknowledge these studies may be susceptible to biases. Furthermore, it is worth noting that a significant portion of this research lacks the necessary rigour in terms of correctly developed and performed contingent valuation surveys.

- Assess the content and construct validity of the included studies, using the selected indicators from best practice guidelines recommended in the literature

The annual mean WTP estimates in USD per household were calculated based on different years. The findings indicate that WTP estimates exhibit little variation among individual studies conducted within the same nation. However, there is significant variation when comparing different countries. Overall, the yearly mean WTP varies between USD 0.01 and USD 75.36 for monetary payment modes and between 7.17 and 94.34 person-days per household for labour time payment modes. The author argued that the findings suggest that when designing policies for forest conservation programmes, it is important to consider local contexts and other pertinent characteristics. Moreover, the author argues studies should consider the WTP in terms of labour time contribution, as many poorer households are inclined to provide more labour time instead of cash.

Human values play an essential role in forest conservation. Ihemezie and others (2021) focus on the specific human value orientations that influence conservation attitudes and behaviours and the mechanisms through which these orientations exert influence. Their SR explored the potential for enhancing the effectiveness of conservation initiatives by matching their objectives and operations with the prevailing values held by individuals. The SR's authors reviewed 41 studies (quantitative = 18; qualitative = 23) conducted in 19 sub-Saharan African countries. The SR found that the perception of ecosystem services derived from conservation projects, the recognition of forest regulatory ecosystem services, and the appreciation of recreational forest values are all factors associated with individuals' support for conservation efforts, their WTP for conservation initiatives, their engagement and active participation in conservation management and practice, and their adherence to forest regulations.

The primary positive value orientations identified in this study were anthropocentric and relational and associated with utilitarian incentives and cultural beliefs.[64] These include the rural community endorsing conservation efforts, adhering to forest regulations, promoting sustainable forest utilization and engaging in forest management activities. Negative conservation attitudes and behaviours were often triggered by values associated with reliance on forest resources, limited benefits derived from conservation efforts, and the expenses associated with conservation. To successfully attain objectives related to forest conservation, the authors argue it is important for environmental managers, conservationists, and decision makers to fully understand the scope and impact of value orientations on attitudes and behaviours pertaining to conservation.

c. Energy

In a review focusing on energy access, Moore and others (2020) highlighted some demand-side factors influencing consumers' WTP for electricity services. They reviewed 126 studies in the developing world, with most of the studies from South Asia (31) and sub-Saharan Africa (28), with a focus on India (17), Bangladesh (8), Kenya (6), and Ghana (5). The authors found that consumer household income level, attitudes, preferences, beliefs, knowledge, understanding, skills, and neighbourhood effects were all associated with WTP for on- and off-grid electricity access.

A recent study by Phillip and others (2023) analysed some factors affecting the uptake of improved biomass cookstoves based on 33 studies across 10 sub-Saharan African countries.[65] The significant factors include availability of cookstoves, affordability, safety, household air pollution reduction,

[64] Anthropocentric value holds that human existence has intrinsic value and that other entities (such as animals, plants, and mineral resources) are resources that may be exploited for the benefit of humanity. Relational value is about the "reference judgment in how people relate with the natural world." (p. 2). Utilitarian or instrumental values are the human belief that forests should be used to satisfy human needs or to achieve a predetermined end. Cultural values are associated with traditional practices, customs, religious beliefs, and perceptions regarding the forest and forest resources.
[65] Cameroon/Chad, Ethiopia, Ghana, Kenya, Mozambique, Nigeria, Rwanda, Malawi, Uganda, and Senegal.

sustainability, health outcomes and user experience. The SR suggested that since improved biomass cookstoves are crucial as a stopgap measure until clean energy sources and cleaner cooking technologies become widely available, their scale up can be supported by promoting the significant household air pollution reductions they can achieve.

Puzzolo and others (2016) synthesized the evidence available on the adoption and continued use of four clean cooking fuels, namely solar cooking, biogas, liquid petroleum gas, and alcohol, in developing countries. The SR examined the enablers and barriers to adopting these clean cooking solutions. After analysing 44 studies from Africa, Latin America, and Asia (17 on biogas, 12 on liquid petroleum gas, nine on solar, and six on alcohol fuels), the SR found that all four types of interventions had a wide range of interrelated enabling and limiting factors operating across seven prespecified domains:

- Fuel and technology characteristics – fuel savings, impacts on time, general design requirements, durability, operational issues
- Household and setting characteristics – socioeconomic status, education, demographics, household ownership, sufficient land and livestock availability, multiple fuel and stove use, geography and climate
- Knowledge and perceptions – smoke, health and safety, cleanliness, stove costs, and subsidies, tradition and culture
- Financial, tax, and subsidy aspects – stove costs and subsidies, fuel cost
- Market development – demand creation, supply chains and business and sales approach
- Regulation, legislation, and standards – regulation, certification and standardization, and enforcement mechanisms
- Programmatic and policy mechanisms – user training, community involvement, post-acquisition support

The authors of the SR stressed that these factors do not function independently to ensure the successful adoption of clean fuel. It is crucial to consider the interconnectedness of various factors within and across domains, establishing connections between local and macrolevel dimensions.

A similar qualitative study identified the determinants of household uptake of improved solid fuel stoves in developing countries (Debbi and others, 2014). The systematic analysis of 14 qualitative studies[66] highlighted several factors influencing the adoption of the stoves, including cost, stove design, cleanliness, fuel and time savings, health benefits, being able to cook traditional dishes and gender roles.

d. Water and sanitation

According to Null and others (2012), although there is a growing body of research on the effectiveness of water quality improvement and pathogen containment technologies, there are still significant gaps in our knowledge of consumer demand and adoption decisions.[67] They reviewed five experimental studies from Bangladesh, Ghana, Kenya, and Zambia. The interventions considered in the SR provide households with the option to buy or employ various technologies to enhance the quality of their drinking water. All techniques for raising water quality were covered, from source water quality enhancements like spring protection to point-of-use technologies like filtration, chemical treatment (chlorination), solar disinfection and flocculants. The SR found that

[66] Geographically, these studies were conducted in Latin America, Africa, and Asia, in India (4), Mexico (4), Kenya (2), Bangladesh (2), Mongolia (1), and Nepal (1).
[67] The SR's authors stated that they found in the literature that contingent valuation, discrete choice models, and experimental methods were used to measure WTP.

beliefs, household income and knowledge of the cost and benefits of using products influenced the WTP for cleaner water. The review found that the price elasticity of demand contributes to WTP estimates that are frequently lower than the price of these clean water technologies. The SR suggested that future studies on WTP should consider actual purchases and usage.

Annamalai and others (2018) reviewed 59 policy documents in 11 countries[68] from sub-Saharan Africa and South Asia to examine the extent to which Water, Sanitation, and Hygiene (WASH) subsectors incorporated the life cycle approach into policy, programmes, and projects during the Millennium Development Goals period. The SR found that awareness campaigns, the high price of water and soap, and the provision of WASH facilities determined the willingness to adopt WASH practices.

e. Pro-environmental consumer goods and services

SRs on sustainable consumer behaviour have mainly been restricted to Europe and North America. The evidence review lists several SRs focused solely on developing countries. After synthesizing evidence from 71 studies, Elhoushy and Lanzini (2021) found environmental values as a key predictor of sustainable behaviours. The full list of the predictors is presented in Table 7.

Table 7. Main factors affecting sustainable consumer behaviour in the Middle East and North Africa

MAIN PREDICTORS*	# OF STUDIES (EFFECT)
Attitudes	29 (+), 1 (-), 2 (n.s)
Gender	12 (sig.), 12 (n.s)
Age	4 (+), 4 (-), 12 (n.s)
Education	8 (+), 2 (-), 1 (mx), 9 (n.s)
Subjective norms/social influence	12 (+), 6 (n.s)
Environmental concern	16 (+), 1 (n.s)
Self-efficacy	12 (+), 2 (n.s)
Intentions	12 (+), 1 (-)
Environmental knowledge	11 (+), 1(n.s)
Income	8 (+), 2 (-), 2 (n.s)
Environmental awareness	6 (+), 5 (n.s)
Perceived consumer effectiveness	5 (+), 1 (n.s)
Personal/moral norms	5 (+), 1 (n.s)
Trust	5 (+)
Religiosity	6 (+)
Family size	3 (+), 1 (-), 1 (n.s)
Awareness of consequences	4 (+)
Environmental responsibility	4 (+)
Perceived benefits	4 (+)
Anticipated effects/emissions	4 (+), 1 (-)
Scepticism towards environmental claims	2 (-), 2 (n.s)

[68] Nigeria, Tanzania, Kenya, Ethiopia, Madagascar, Uganda, Malawi, Nepal, Pakistan, Bangladesh, and India.

MAIN PREDICTORS*	# OF STUDIES (EFFECT)
Self-identity/image	3 (+), 1 (n.s)

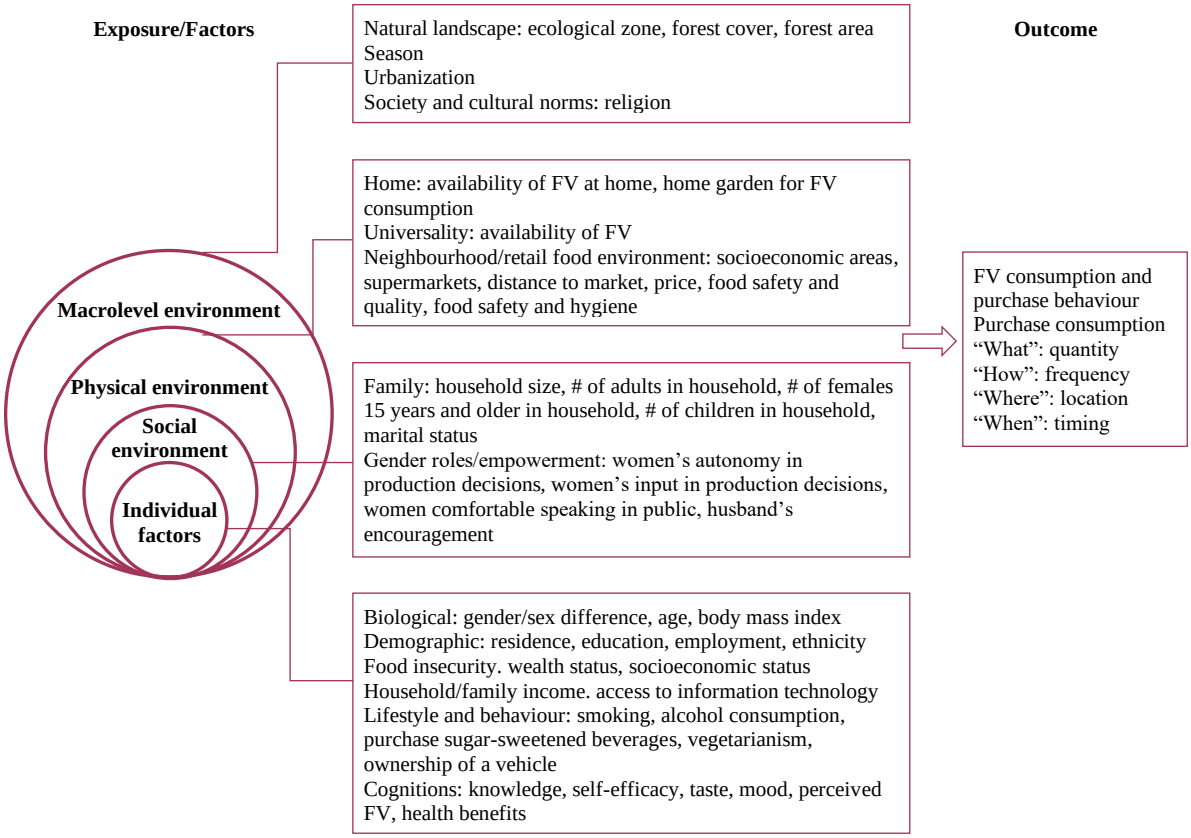
Source: Elhoushy and Lanzini (2021)
Note: *The table lists predictors that were present in at least four studies.

Moreover, de Souza Kirby, da Silva Inácio and Delai (2023) reviewed factors that influence green (sustainable) building[69] consumer behaviour in Brazil. The key determinants from the 30 studies reviewed include motivation, knowledge, environmental attitude, values and personality, physical attributes, external environment, trust, lifestyle and situation.

Evidence from China indicates that sustainable consumption behaviour, including food purchasing behaviour, has increased, especially in urban areas (Shao, 2019). Results from an SR of 121 studies found that full product transparency is associated with higher consumer WTP for premium products.

Stadlmayr and others (2023) sought to examine the factors affecting adult fruit and vegetable consumption and purchase behaviour in sub-Saharan Africa by reviewing 52 studies. Guided by a socio-ecological model, they reported their findings based on individual, social, physical, and macrolevel factors (see Figure 8).

Figure 8. Factors influencing fruit and vegetable consumption and purchase behaviour



Source: Stadlmayr and others (2023)

Traoré, Belinga and Lescuyer (2023) systematically reviewed 48 studies to identify the scope and patterns regarding the topic. The SR revealed that green consumption is rapidly expanding in emerging economies like Nigeria and South Africa. Moreover, the growing middle class is expected

[69] Green buildings are "healthy facilities designed and built in a resource-efficient manner, using ecologically-based principles applied to the entire life cycle of construction, from planning to maintenance and disposal" (Kibert, 2016).

to be a significant milestone in the region's green consumption expansion. In terms of eco-friendly clothing, price, product maintenance, and aesthetics influenced consumer WTP.

WTP SRs have also been conducted on organic agriculture. While numerous academic articles and technical reports extensively emphasize its environmental, social, and economic advantages, particularly within developing nations, research on organic food and farming is limited in West Africa. El Bilali (2020) reviewed 45 studies and found that socioeconomic characteristics, food safety consciousness, product cleanness, freshness, and healthy appearance are the determinants of WTP for organic fruits and vegetables among consumers in Ghana and Benin. Food safety was the major factor influencing consumers to pay premium prices for organic products. The SR emphasized the necessity of enhancing the governance of the organic agriculture industry and establishing comprehensive organic agriculture policies that effectively facilitate organic agricultural research and extension.

5. Conclusion

WTP dynamics are an important aspect market-based solutions and services related to climate change mitigation and adaptation across various sectors.[70]

WTP for solutions that improve agricultural productivity and resilience or more affordable access to safe drinking water, for example, are likely to improve adaptation to climate change impacts. In the case of water, the SR by Null and others (2012) found that most consumers in developing countries are unwilling to pay more, making it harder for private sector-led services to meet the urgent demand for clean water in many communities.

On the mitigation side, WTP analysis shows that solutions and services in sectors like energy and green consumer choices can help to inform pricing and strategy that can help to improve market uptake and scale, with the overall objective of reducing greenhouse gas emissions while also creating local economic development. The review has also found that WTP depends on a range of factors that tend to be unique to each sector and context. Overall, the analysis of WTP is considered a useful insight into the potential for scale and uptake of market-based approaches to climate action.

D. Discussion

As part of the efforts to scale up climate finance to help meet the Paris Agreement targets, there is an urgent need to assess how climate finance providers, including GCF, can accelerate the uptake of market-based approaches. This evidence review has explored four market-based approaches: IBI, PES, RBP and WTP to understand the evidence base around two questions:

- To what extent have the selected market-based approaches relevant to mitigation and adaptation effectively achieved desired outcomes in developing countries?
- What factors influence the effectiveness and efficiency of these market-based approaches in developing countries?

The review has identified a range of insights that can be considered by GCF and other stakeholders to support the uptake of market-based solutions. The key themes are discussed below, under the sections of:

- Findings on the range of factors that influence effectiveness
- Findings on the interlinkages between the four selected approaches

[70] The sectors include health, forest ecosystem conservation, energy, water and sanitation and pro-environmental consumer goods and services.

- Implications for GCF programming

1. Findings on the range of factors that influence effectiveness

This evidence review has explored the factors that influence the effectiveness and efficiency of these market-based approaches in developing countries. These are now summarized in four short sections.

Index-based insurance

Factors that affect the uptake and effectiveness of IBI are broadly consistent among the studies reviewed. These include awareness of the product, understanding its value and whether it can reduce the risk of harm or poor conditions (for solar and wind energy generation, for example). WTP and access to credit are important and closely linked factors influencing IBI uptake. Demand is likely to increase with access to finance, such as microcredit, along with a stronger understanding of the role and value of IBI among customers.

On the supply-side, the uptake and scale of IBI can be constrained by poor cost efficiency and lack of economies of scale, as well as challenges to product design, often caused by data scarcity in many developing countries. The rising frequency of extreme climate events has also forced insurers to increase premium rates, threatening coverage.

The use of innovative and advanced techniques to overcome challenges on both supply and demand sides is likely to improve adoption. Technology such as satellite data and machine learning can improve product quality and cost-effectiveness, reducing barriers related to WTP. However, the review has found that the role of technology is tempered by local constraints, as well as a lack of trust.

The factors determining the effectiveness of IBI approaches and mechanisms in developing countries are summarized in Table 8 and graded according to higher and medium importance.

Table 8. Summary and importance of factors for the effectiveness of index-based insurance

Importance	Factor	Rationale
Higher	Adoption and WTP for IBI	• Importance of WTP considerations vis-a-vis multiple other household/farm spending needs. • Farmers' education, wealth, risk aversion and familiarity with the insurance product. • Adoption of crop insurance is positively correlated with recent experience of disasters, yield volatility, the level of government subsidy and farmers' trust in government.
Higher	Awareness and risk perception of potential IBI customers	• Raising the awareness of customers is important, particularly among farmers in developing countries.
Higher	Access to credit to pay for IBI	• IBI uptake is closely linked to access to credit. Several SRs suggest linking both interventions.
Higher	IBI scheme administration	• Supply-side factors are vital for scaling affordable IBI products in developing countries.
Medium	Minimizing basis risk	• Can be reduced via more accurate risk identification and more granular index measurement.
Medium	Availability of related digital solutions	• Important role in improving the product design and reducing basis risk.

Payments for ecosystem services

The successful implementation of PES depends on many factors, including transparent spatial targeting, land tenure regimes and willingness to participate. In terms of financial and non-financial incentives, local community and stakeholder engagement, low transaction costs, effective governance and monitoring and results systems are key.

These factors are summarized in Table 9 and are graded according to higher, medium and lower importance.

Table 9. Summary and importance of factors for the effectiveness of PES

IMPORTANCE	FACTOR	RATIONALE
Higher	Local community and stakeholder engagement	• Effective coordination, incentivization and management. • Transparency in socioeconomic and financial outcomes. • Fair governance structure for equitable ownership. • High participation of local communities and stakeholders.
Higher	Land tenure	• Secure land tenure structures for PES schemes to complete planned scheme timeframes. • Integrated environmental management behaviour within land management practices.
Higher	Transparent spatial targeting	• Targeted PES schemes can enhance effectiveness and limit adverse self-selection. • Participation of communities and stakeholders enables PES schemes to gain clear information and insight into the location of environmental assets.
Higher	Governance of PES systems	• Effective governance structures enhance co-benefits such as reducing poverty and generating social, economic and environmental capital. • Fair distribution of power between stakeholders is key for equitable distribution of outcomes.
Higher	Monitoring and results systems	• Vital for assessing whether conditions for payment have been met, as well as the effectiveness and quality of PES schemes. • Learning from MRV can be applied to scale up.
Medium	Low transaction costs	• Increase the engagement of community organizations.
Medium	Meaningful revenue from payments	• Clarity of short-term, medium-term and long-term financial gains.
Lower	Willingness to participate: Non-financial motivators	• Notable influence of non-financial outcomes such as pro-social, pro-environmental and risk reduction motivations.

Results-based payments

A range of factors influence RBP effectiveness, including political will and support, governance, robust policy and institutional frameworks, financial and technical support, community participation, and effective MRV. These factors are explained in more detail below.

Political support for embedding institutional frameworks into existing law is a critical enabling factor. Governance and the institutional capacity of parties, funders and recipients are important for RBP to ensure project execution in line with cash flows. RBP initiatives are heavily influenced by

policy and regulatory frameworks and have proven successful in contexts with strong political support, pro-market reforms and financial and technical support. For example, blending RBP with upfront funding such as grants, along with technical assistance, can help overcome cashflow problems, particularly for smaller companies and ensure long-term success. Using existing national systems can limit fragmentation in governance and institutional arrangements.

Participation of local and indigenous communities is important for RBP success in the context of REDD+. Finally, robust and efficient MRV systems are crucial for RBP. This includes the expense of collecting data, both regarding GHGs and other proxy indicators, and using indicators to understand context-specific interventions.

The factors contributing to the effectiveness of RBP approaches and mechanisms in developing countries are summarized in Table 10.

Table 10. Summary and importance of factors for the effectiveness of RBPs

IMPORTANCE	FACTOR	RATIONALE
Higher	Policy and regulatory frameworks	• Policies and regulatory frameworks are needed to monitor and support participants' compliance with programme conditions and to build trust. • Policy and frameworks ensuring formal land tenure have reduced deforestation in RBP interventions. • Strong domestic policies and frameworks are needed to ensure benefits from RBP modalities.
Higher	Governance and institutional capacity	• Strong governance structures and institutional capacity are required to monitor and ensure compliance and behaviour change. • Effective policy implementation and revisions are needed, such as tax reforms and land-use regulations. • Governance structures and institutional capacity are crucial to control and limit corruption.
Higher	Political support	• Political support and commitment can ensure setting and meeting of ambitious targets. • Political support is needed for allocating sufficient resources for RBP programmes. • Mobilize actors and investments in monitoring systems for the long-term success of RBP initiatives.
Higher	MRV systems	• Strong MRV systems are needed to measure and report on progress towards achieving pre-agreed results. • Can help to assess the agent's degree of effort without the need for excessive scrutiny. • Can help verification of reported results to reduce delays in payments for implementing agency.
Medium	Financial and technical support	• Financial incentives can motivate actors to participate in RBP initiatives. • Financial support, such as upfront grants, benefits smaller companies in emerging markets. • Reduce administrative burden. • Costs for running MRV systems and collecting high-quality data can impact the effectiveness of RBP programmes. • Exchange rate fluctuations can make it harder to predict the value of payments over time.

IMPORTANCE	FACTOR	RATIONALE
		• Inflation can significantly impact the effectiveness of RBP programmes. • Technical support can help standardize reporting and verification processes across different RBP programmes.
Medium	Community participation	• High community participation can help ensure respect for customary law, protection of rights and autonomy of indigenous communities. • Local community participation can help enrich RBP programmes with local knowledge of culture, socioeconomic and political dynamics. • Ensures a sense of ownership as benefits are shared among stakeholders, increasing motivation to achieve programme results.

Willingness to pay assessments

Our review of evidence highlights factors influencing WTP in developing countries. The main moderators include sociodemographic, social and cultural, economic and financial factors, environmental policy and governance. While certain factors, such as sociodemographic characteristics, may broadly impact many sectors, other determinants are more relevant to a particular sector. Table 11 provides a summary of the factors across various thematic subsectors.

Table 11. Summary and importance of factors influencing the WTP

IMPORTANCE	FACTOR	RATIONALE
Higher	Sociodemographic	• Educational attainment, gender, age, religion, marital status, and household size influence consumers' WTP for health and energy products and services.
Higher	Financial and economic	• Wealth status, government subsidies, payment modalities, product cost, and flexible contribution rates are key to effectively achieving WTP.
Higher	Environmental policy and governance	• Effective governance structures, regulatory systems, and institutional arrangements increase the uptake of interventions. • Programmatic and policy mechanisms, such as user training, community involvement, and post-acquisition support, are key to enhancing uptake.
Medium	Behavioural	• Environmental responsibility and product safety consciousness could affect WTP.
Medium	Technological	• Technology characteristics (such as general design requirements, durability, operational issues, and access to information technology) can be enablers or barriers to WTP.
Medium	Norms and values	• Consumers' subjective norms, religion, and cultural beliefs can influence whether a consumer/citizen will pay for a particular product/service. • Human value orientations can potentially enhance the effectiveness of conservation initiatives.
Medium	Trust in service providers	• Trust in the intervention or service providers might increase individuals' WTP for the service or propensity to enrol in the intervention.

IMPORTANCE	FACTOR	RATIONALE
Medium	Geographical	• Residency (rural, urban) and distance to service providers can motivate consumers to purchase a product or service.
Lower	Product/service-related information	• Product safety, quality, transparency, and eco-friendliness influence uptake.

We summarize the moderators of all four market-based approaches and prioritized them based on higher, medium and lower levels of importance (see Table 12).

Table 12. Summary of factors influencing the selected approaches and degree of priority

FACTOR / APPROACH		IBI	PES	RBP	WTP
Financial support					
Political	Political support				
	Policy and regulatory framework				
	Governance and institutional capacity				
Technological	Technological support				
	Basis risk[71]				
Social	Stakeholder/ community participation				
	Trust in service provider				
	Socio-demographics				
	User knowledge and perception				
	Norms and values				
Behavioural					
Project	Monitoring, reporting and verification				
	Product/service-related information (quality and characteristics)				
Geographical					
Cross-cutting	Adoption, uptake and use				

Legend: Higher Medium Lower

2. FINDINGS ON INTERLINKAGES BETWEEN THE FOUR MARKET-BASED APPROACHES

The review shows a number of interlinkages between two or more of the four market-based approaches. Firstly, the review has confirmed that WTP is an important factor in the uptake of both PES and IBI related solutions. In the case of PES, it relates to the willingness of a household or smallholder farmer to cover the upfront costs required to change farming or other methods towards those based on environmental stewardship. The review found that the amount of revenue participants receive for environmental practices is a key factor. It is, therefore, vital to set a viable financial model for PES schemes in close collaboration with landowners and land stewards, such

[71] Mismatch between actual losses and predicted losses.

that the revenue received from PES will enable meaningful shifts in land-use and conservation practices. WTP or willingness to accept a certain level of payment is central to this process.

The review found that conservation auctions can help overcome challenges related to pricing in the context of information asymmetry and a lack of trust between potential buyers and sellers of ecosystem services. Auctions can create the foundations for a fair implementation process important for designing an equitable PES scheme. In-kind aspects of 'payment', such as fencing materials or fertilizer, access to information or knowledge-sharing, are also widely discussed in the reviewed SRs and can be considered in tandem with financial aspects.

In the case of WTP for IBI, purchase costs are weighed against competing priorities, such as food, fuel, farming inputs and household needs such as education and healthcare costs. Demand for IBI is highly price sensitive, with substantial subsidies required for product uptake in many contexts in developing countries. Related to WTP, the review found that farmers' education, wealth, risk aversion and familiarity with the insurance product are all important factors affecting small rural households' decisions to purchase IBI.

Secondly, it should be highlighted that results-based payment frameworks underpin many forms of PES, particularly REDD+, and there are many linkages between the two approaches. The success of RBP and PES programmes is both contingent on effective governance and institutional capacity. Strong MRV systems are another factor on which the success of PES and RBP schemes depends. While PES programmes require strong monitoring systems to assess the quality and effectiveness of initiatives, ensure compliance and behaviour change, as well as avoid unintended impacts, RBP programmes rely on effective MRV systems mainly to measure and report on pre-agreed results and reduce delays in payments. Robust and streamlined verification systems also aid in gauging the level of effort by the implementing agency without spending resources on excessive scrutiny. The review also indicates that in developing countries, participation in PES programmes remains limited to those with higher existing levels of capital assets, which is also common in RBP schemes due to the requirement of upfront financing.[72]

3. Implications for GCF programming

This report sets out key aspects of the GCF Strategic Plan 2024-2027 in section A.4. The report's findings allow the GCF to consider whether to use the findings to supplement current origination activities for proposed projects/programmes. The findings presented can accelerate the uptake and scale of market-based approaches within GCF-funded interventions.

Firstly, the GCF strategy emphasizes the focus on catalysing private sector finance to help achieve climate action at scale. Here, the findings concerning RBP are particularly appropriate, as the factors influencing RBP success are mainly at the national and institutional levels, suggesting this approach is more suited to regional or national interventions. In this respect, GCF financial support for RBP modalities could consider regions or countries demonstrating attributes such as solid policy and regulatory frameworks, governance and institutional capacity and broad political support. Further moderators for successful RBP finance focus on characteristics of agencies and actors, such as MRV systems, and the degree of financial and technical support. Again, GCF financial support for RBP modalities could consider paying specific attention to these characteristics and community participation.

Secondly, the GCF Strategy 2024-2027 emphasizes that the Fund will focus on testing and scaling up financing for adaptation and resilience solutions. Here, the findings concerning WTP are particularly appropriate. The main moderators beyond income and wealth influencing WTP across

[72] It should be noted that other linkages may occur between the four approaches, but were not explicitly mentioned in the SRs covered by this synthesis review.

various sectors focused mainly on household characteristics – sociodemographic aspects, social and cultural beliefs, behavioural aspects and geographical proximity. This is in addition to aspects of the product/service itself. In this respect, the GCF can carefully consider specific locations or segments of populations that are most likely to adopt and utilize pilot interventions. These WTP insights can support appropriate pricing to improve the uptake of solutions and services. This can help define if a proposed initiative is commercially viable or requires greater early-stage support to enable scale and greater impact. For example, programmes focused on accelerating the uptake of decentralized renewable energy at the household level, such as rooftop solar, can draw on these findings related to WTP factors and explore the evidence further to help inform project design.

A further example of the importance of the findings on WTP relates to testing and scaling up IBI. WTP is critical for adopting IBI, alongside awareness and risk perception of potential customers and access to credit. These factors are as important as the administration of the IBI scheme administration, the minimization of basis risk and the availability of related digital solutions. Additionally, as the uptake of IBI in developing countries is generally contingent on subsidies, there may be a valuable role for GCF to provide grants or take a first-loss position in such initiatives.

Thirdly, the Fund's focus on partnerships within private sector finance can support interventions on PES. For example, a draft proposal on the financing of RBP for REDD+, building on the outcomes of the pilot phase, was considered by the Board at B.37 (Green Climate Fund, 2023b).[73] This evidence review has found how the key factors that influence the effectiveness of PES schemes are predominantly at the local and institutional levels. Examples include the following: local community and stakeholder engagement, land tenure arrangements, transparent spatial targeting, the governance of PES schemes, monitoring and results systems, transaction costs, and financial and non-financial motivators.

The report has shown that RBP schemes, which reflect the REDD+ modality within the GCF, are generally contingent on strong enabling environments for partnerships. As highlighted above, this could guide where the role of partnerships and RBP can be implemented as part of GCF programmes, as well as informing considerations of how GCF can strengthen the enabling environment in developing countries for appropriate partnership models.

E. CONCLUSIONS

The evidence review underscores the critical role the GCF can play in leveraging private sector finance for impactful climate action in developing countries. Focusing on four key market-based approaches – IBI, PES, RBP and WTP – provides valuable insights for enhancing private sector participation in climate action.

The study, synthesizing findings from 79 SRs across multiple databases, highlights the commonalities and/or variations in the effectiveness of these four approaches across different contexts.

Despite gaining popularity, our review found that IBI faces challenges in developing countries, frequently requiring subsidies. Supply-side challenges, such as cost efficiency and complex product design, highlight the need for innovative solutions that use cutting-edge technologies like satellite data and machine learning. The review highlights the factors contributing to uptake, including customer awareness, product value understanding, WTP, and access to financing.

[73] In July 2024, the GCF Board approved the principles for mainstreaming REDD+ results-based payments into the regular project and programme activity cycle of the Fund, as well as, on an exceptional basis, extending the pilot programme on REDD+ results-based payments.

The review found that successful PES initiatives involve combining cash and in-kind incentives, raising environmental awareness, engaging diverse stakeholders, ensuring transparent spatial targeting, and guaranteeing strong conditionality. For the long-term sustainability of PES schemes, continuous funding, community empowerment, and equitable cost-sharing must be prioritized and rigorously pursued.

RBP are effective in aligning principal-agent objectives, granting implementing agencies autonomy, and fostering innovation. Nevertheless, there are substantial challenges in fragmented governance, complex institutional structures, and the need for high-quality data to facilitate MRV. The effectiveness of RBP largely depends on a number of factors, including political will, governance capacity, regulatory frameworks, financial support and community involvement. The findings suggest that policymakers should prioritize strengthening MRV systems, recognizing their pivotal role in RBPs. This may entail investing in technology, capacity-building, and international collaboration to overcome data quality and reliability challenges.

WTP dynamics are crucial in various market-based approaches across sectors relevant to mitigation and adaptation. WTP is influenced by context-dependent and sector-specific factors, emphasizing its role in shaping pricing strategies and the market uptake of climate-related solutions. In addition to the product/service and income/wealth levels, WTP is strongly related to household characteristics – sociodemographic aspects, social and cultural beliefs, behavioural aspects and geographical proximity.

Overall, the review offers insightful evidence of the potential for scaling market-based approaches to climate action. Although each approach presents its own set of unique opportunities and challenges, the evidence suggests that the selected market-based approaches can, to some extent, contribute to climate finance targets. However, further synthesis products are required to address existing gaps, maximize effectiveness and efficiency, and guarantee long-term sustainability in the face of the climate emergency.

APPENDICES

Appendix 1. SEARCH TERMS

The evidence review search terms were structured according to Population, Methodology, Intervention and General Restrictions. The complete set of search terms is presented below.

A. MAIN SEARCH TERMS

1. POPULATION

Africa OR Asia OR Caribbean OR "West Indies" OR "South America" OR "Latin America" OR "Central America" OR Afghanistan OR Albania OR Algeria OR Angola OR Antigua OR Barbuda OR Argentina OR Armenia OR Azerbaijan OR Bahamas OR Bahrain OR Bangladesh OR Barbados OR Benin OR Belize OR Bhutan OR Bolivia OR Bosnia OR Herzegovina OR Hercegovina OR Botswana OR Brasil OR Brazil OR Darussalam OR "Burkina Faso" OR "Burkina Fasso" OR "Upper Volta" OR Burundi OR Urundi OR Cambodia OR "Khmer Republic" OR Kampuchea OR Cameroon OR Cameroons OR Cameron OR Camerons OR "Cabo Verde" OR "Cape Verde" OR "Central African Republic" OR CAR OR Chad OR Chile OR China OR Colombia OR Comoros OR "Comoro Islands" OR Comores OR "Cook Islands" OR Congo OR Zaire OR "Costa Rica" OR "Cote d'Ivoire" OR "Ivory Coast" OR Croatia OR Cuba OR Cyprus OR Czechoslovakia OR "Czech Republic" OR Slovakia OR "Slovak Republic" OR Djibouti OR "French Somaliland" OR Dominica OR "Dominican Republic" OR "East Timor" OR "East Timur" OR "Timor Leste" OR Eswatini OR Ecuador OR Egypt OR "United Arab Republic" OR "El Salvador" OR Eritrea OR Estonia OR Ethiopia OR Fiji OR Gabon OR "Gabonese Republic" OR Gambia OR Georgia OR Ghana OR "Gold Coast" OR Greece OR Grenada OR Guatemala OR Guinea OR Haiti OR Honduras OR India OR Maldives OR Indonesia OR Iran OR Iraq OR Israel OR Jamaica OR Jordan OR Kazakhstan OR Kazakh OR Kenya OR Kiribati OR Korea OR Kosovo OR Kyrgyzstan OR Kirghizia OR "Kyrgyz Republic" OR Kirghiz OR Kirgizstan OR "Lao PDR" OR Laos OR Latvia OR Lebanon OR Lesotho OR Basutoland OR Liberia OR Libya OR Macedonia OR Madagascar OR "Malagasy Republic" OR Malaysia OR Malaya OR Malay OR Maldives OR Malawi OR Nyasaland OR Mali OR Mauritania OR Mauritius OR Mexico OR Micronesia OR "Middle East" OR Moldova OR Moldovia OR Mongolia OR Montenegro OR Morocco OR Mozambique OR Mocambique OR Myanmar OR Myanma OR Burma OR Namibia OR Nauru OR Nepal Nicaragua OR Niger OR Nigeria OR "Northern Mariana Islands" OR Niue OR Oman OR Pakistan OR Palau OR Palestine OR Panama OR Paraguay OR Peru OR Philippines OR Philipines OR Phillipines OR Phillippines OR "Puerto Rico" OR Romania OR Rumania OR Roumania OR Rwanda OR Ruanda OR "Saint Kitts" OR "St Kitts" OR Nevis OR "Saint Lucia" OR "St Lucia" OR "Saint Vincent" OR "St Vincent" OR Grenadines OR Samoa OR "Samoan Islands" OR "Sao Tome" OR Principe OR "Saudi Arabia" OR Senegal OR Serbia OR Montenegro OR Seychelles OR "Sierra Leone" OR Slovenia OR "Sri Lanka" OR Singapore OR "Solomon Islands" OR Somalia OR Sudan OR Suriname OR Surinam OR Swaziland OR Syria* OR Tajikistan OR Tadzhikistan OR Tadjikistan OR Tadzhik OR Tanzania OR Thailand OR Togo OR "Togolese Republic" OR Tonga OR Trinidad OR Tobago OR Tunisia OR Turkey OR Turkmenistan OR Turkmen OR Tuvalu OR Uganda OR Ukraine OR "United Arab Emirates" OR UAE OR Uruguay OR Uzbekistan OR Uzbek OR Vanuatu OR "New Hebrides" OR Venezuela OR Vietnam OR "Viet Nam" OR "West Bank" OR Yemen OR Zambia OR Zimbabwe OR "developing country" OR "developing countries" OR "developing nation" OR "developing nations" OR "developing world" OR "less-developed countr*" OR "less developed countr*" OR "less-developed world" OR "less-developed world" OR "lesser-developed countr*" OR "lesser developed countr*" OR "lesser-developed nation" OR "lesser developed

nation*" OR "lesser developed world" OR "lesser-developed world" OR "under-developed countr*" OR "under developed countr*" OR "under-developed nation*" OR "under developed nation*" OR "under-developed world" OR "underdeveloped world" OR "under developed world" OR "underdeveloped countr*" OR "under-developed countr*" OR "Under developed countr*" OR "under developed nation*" OR "under-developed nation*" OR "underdeveloped nation*" OR "lower middle income countr*" OR "lower middle-income countr*" OR "lower middle income nation*" OR "lower middle-income nation*" OR "upper middle-income countr*" OR "upper middle income countr*" OR "upper middle-income nation*" OR "upper middle income nation*" OR "low-income countr*" OR "low income countr*" OR "low-income nation*" OR "low income nation*" OR "lower income countr*" OR "lower-income countr*" OR "lower income nation*" OR "lower-income nation*" OR "Low- and Middle- Income countr*" OR "Low and Middle Income Countr*" OR "underserved country" OR "underserved countries" OR "underserved nation" OR "underserved nations" OR "underserved world" OR "under served country" OR "under served countries" OR "under served nation" OR "under served nations" OR "under served world" OR "deprived country" OR "deprived countries" OR "deprived nation" OR "deprived nations" OR "deprived world" OR "poor country" OR "poor countries" OR "poor nation" OR "poor nations" OR "poor world" OR "poorer country" OR "poorer countries" OR "poorer nation" OR "poorer nations" OR "poorer world" OR "developing economy" OR "developing economies" OR "less developed economy" OR "less developed economies" OR "lesser developed economy" OR "lesser developed economies" OR "under developed economy" OR "under developed economies" OR "underdeveloped economy" OR "underdeveloped economies" OR "middle income economy" OR "middle income economies" OR "low income economy" OR "low income economies" OR "lower income economy" OR "lower income economies" OR lmic OR lmics OR "third world" OR "lami country" OR "lami countries" OR "transitional country" OR "transitional countries" OR "LMIC" OR "LMICs" OR "LIC" OR "LICs" OR "UMICs" OR "UMIC" OR ("khmer" AND "republic") OR ("cape" AND "verde") OR ("central" AND "african" AND "republic")

2. METHODOLOGY

"Systematic review*" OR "Systematic rev*" OR "meta-analy*" OR "meta analy*" OR "metaanaly*" OR "meta-regress*" OR "meta regress*" OR "metaregress*" OR "systematic literature rev*" OR "rapid evidence assessment*" OR "rapid review*" OR "evidence assessment" OR "evidence assess*" OR "scoping review" OR "evidence and gap map" OR "evidence gap map" OR "mixed method review" OR "integrative review" OR "living systematic rev*" OR "review of complex interventions" OR "review of complex int*" OR "review of system*" OR "review of rev*" OR "umbrella review" OR ""research synthesis" OR "rapid evidence assessment*" OR "systematic literature review*" OR "systematic* review*"

3. INTERVENTIONS

Willingness to pay

"Willingness to pay" OR "willingness-to-pay" OR "WTP" OR "willingness to accept" OR "acceptance to pay" OR "willingness to purchase" OR "willing to pay" OR "willingness to buy" OR "consumer behavior" OR "consumer behavior" OR "contingent valuation" OR "contingent valuation method" OR "willingness*" OR "choice experiment" OR "discrete choice experiment" OR "price premium" OR "preference*" OR "purchase behavior" OR "purchase behavior" OR "purchase intention" OR "price acceptance" OR "stated preference*" OR "revealed preference*" OR "discrete choice model" OR "discrete choice conjoint experiment" OR "part-worth" OR "functional measurement" OR "choice experiment"

Results-based payments

"payment* by result*" OR "result*-based payment*" OR "result*-based financ*" OR "result*-based fund*" OR "result*-based aid" OR "pay*-for-result*" OR "pay*-for-performance" OR "pay*-forsuccess" OR "performance-based fund*" OR "performance-based financ*" OR "performance-based aid" OR "performance-based pay*" OR "performance-related pay*" OR "performance-based incentiv*" OR "cash on delivery" OR "performance-based incentive*" OR "output-based aid" OR "outcome-based financ*" OR "incentiv* pay*" OR "merit pay" OR "performance-oriented transfer*" OR "performance-based contracting" OR "performance-driven loan*" OR "policy-based loan*" OR "result*-based lending" OR "grand challenge*" OR "proportional prize" OR "winner-takeall" OR "inducement prize*" OR "impact bond*" OR "social benefit bond*" OR "green bond*" OR "development bond*" OR "payment* for ecosystem* service*" OR "payment* for environment* service*" OR "payment* for ecosystem* benefit*" OR "payment* for environment* benefit*" OR "carbon credit*" OR "carbon offset*" OR "advance* market commitment*" OR "pull mechanism*" OR "pull fund*" OR "pull financ*"

Insurance

“index based insurance” OR “index-based insurance” OR “weather index insurance” OR “weather-index insurance” OR “index-based insurance” OR “index micro-insurance” OR “index* micro insurance” OR “rainfall insurance” OR “yield insurance” OR “livestock insurance” OR “area yield insurance” OR “crop insurance” OR “parametric insurance” OR “rainfall-insurance” OR “yield-insurance” OR “livestock-insurance” OR “area-yield insurance” OR “crop insurance” OR “parametric insurance” OR “parametric index ins*” OR “parametric ins*” “parametric crop*” OR "parametric rainfall*” OR "parametric livestock*” OR “basis risk” OR “index insurance” OR “agricultural insurance” OR “weather derivative” OR “weather insurance” OR "crop-yield insurance" OR "crop-revenue insurance" OR “index-linked insurance”

Payments for ecosystem services

“Payments for Environmental Services” OR “Payments for Environmental Services” OR “Payments for Ecosystem Services” OR “Payments for Ecosystem Services” OR “Rewards for Environmental Services” OR “Reward for Environmental Services” OR “Rewards for Ecosystem Services” OR “Reward for Ecosystem Services” OR “PES” OR "payment* for ecosystem* service*" OR "payment* for environment* service*" OR "payment* for ecosystem* benefit*" OR "payment* for environment* benefit*" OR "carbon credit*" OR "carbon offset*" OR "advance* market commitment*" OR "pull mechanism*" OR "pull fund*" OR "pull financ*"

4. General restrictions

“Climate change mitigation” OR “climate change adaptation” OR “emissions reduction” OR “resilience”

B. Combination of search terms

Many databases did not accept the search terms above due to limitations of words, characters or Boolean operators. In such cases, combinations of search terms were used to screen the databases.

Appendix 2. ADDITIONAL SOURCES AND FINDINGS

The evidence review identified a number of sources of information that are not solely from non-Annex I countries. Fifteen studies included evidence from both Annex I and non-Annex I countries. A summary of these 'mixed' studies has been presented under the following sectors: food and agriculture, water and sanitation, infrastructure and green buildings, energy, forest ecosystem conservation, climate change, and pro-environmental consumer goods and services.

Food and agriculture

De Steur and others (2017) reviewed 11 economic valuation studies of genetically modified (GM) biofortified food crops. Globally, customers were willing to pay a 23.9 per cent price premium for GM biofortified food crops. The SR also showed a positive relationship between objective GM food knowledge, acceptance of GM rice, and GM food risk perceptions. In contrast, a negative relationship was shown between WTP and GM food pricing perceptions. Thus, consumer WTP was highest when given positive information (benefits of nutrition and GM), as opposed to negative, objective and contradicting GM information. In terms of setting, rural farmers were, on average, willing to pay a premium of 67 per cent for GM biofortified crops compared to the average premium of urban consumers estimated at 21.1 per cent. The fact that (subsistence) farmers' premiums rose when they were impoverished or lived in rural areas highlights the viability of using biofortification to reach these groups. The authors of the SR stressed the potential of GM biofortified crops to address hidden hunger effectively in a cost-effective and widely accepted manner.

Frewer and others (2013) systematically analysed 25 studies on WTP for GM foods or foods free from GM. They defined WTP "as the maximum amount a person would be willing to pay or exchange to gain something positive (a "good") or avoid something negative or undesired." (p. 143). The findings showed that European consumers tended to be willing to pay more for GM-free food compared to consumers from North America. Regarding attitudes, European consumers exhibited comparatively greater negativity towards GM foods than their counterparts in Northern America and Asia. However, more significant ethical and moral concerns existed among customers in North America (and potentially Asia) than in Europe. An example of these concerns is "the notion that the use of genetic modification is "playing God" (p. 143).

Another SR focusing on GM foods was by Kamrath and others (2019). They analysed 183 studies to identify and compare major factors of supply chain actors' (mainly consumers and farmers) evaluation of new food technologies. One of the main evaluation indicators that the review covered is WTP. The results showed that age, gender, educational level, income level, health care/status, household size and presence of children, residence, religion, and ethnicity are the key predictors of WTP. For age, the SR found both positive and negative relationships. While some studies found that older people were less willing to pay for GM food, other studies found that older people were willing to pay for GM food. For gender, women evaluated GM foods more than men. For education and income, the results were mixed. Higher education and/or higher income influenced higher positive evaluations of novel food technologies.

On the other hand, some studies demonstrated contrary findings. For health care/status, consumers' health status negatively influenced GM food evaluation but positively influenced functional food evaluation. For household size, it was reported that the larger the household size, the higher its WTP for functional food and its consumption of it. Moreover, households with young children had a lower WTP or consumption of GM food. In terms of residence, the results were mixed. Some studies reported that urban residents had a higher WTP for functional food. In comparison, others showed a lower WTP for GM food. Agricultural households showed lower WTP for GM food and consumption of functional food. For religion, there was a negative relationship between religious

consumers and support for biotechnology. Regarding ethnicity, Blacks were more morally opposed to the genetic modification of plants compared to Whites. However, Hispanics were more supportive than Whites.

While a wider range of studies has been conducted to review the adoption of agricultural innovations, "…the first SR on the adoption of agricultural innovations by farmers while looking at the wide spectrum of agricultural innovations'' (Olum and others 2019, p. 2) was completed in 2019 and included 80 causal studies. The SR found that even though farmers are typically willing to pay a premium for improved agricultural technologies, WTP depends on the innovation or innovation system. For instance, regarding irrigation water, farmers are willing to pay a premium ranging from USD 0.125 to 2.0 per cubic metre. The SR showed that farmers tend to accept most agricultural technologies, irrespective of the context and methods used, as evidenced by the relatively high WTP. The factors that affect farmers' WTP for agricultural innovations can be classified into sociodemographic, biophysical, technological, institutional and behavioural factors. The SR found that the main variables affecting farmers' WTP include income level, education, access to credit, and perceived benefits of the innovations. According to the authors, sociodemographic and farm-related factors, such as perceptions, attitudes, and knowledge, have been studied more frequently than behavioural and other intrinsic determinants of farmers' adoption and WTP. This makes it difficult to fully understand farmers' responses to agricultural innovations and may partly explain why the literature has not provided conclusive evidence regarding the factors determining adoption.

Water and sanitation

A meta-analysis by Mutuku and others (2022) focused on WTP for cleaning up beach litter from 63 primary studies from Europe (42 per cent), the Americas (24 per cent), Oceania (12 per cent), Asia (20 per cent), and Africa (3 per cent). The findings indicate that a 1 per cent decrease in all categories of beach litter would have an annual mean effect size of USD 0.71 (or USD 35.29) per person. In addition, the findings also show that at a 5 per cent level of significance, a 1 per cent increase in per capita income increases the WTP by USD 0.27 per person to reduce beach litter by 1 per cent. Moreover, the WTP elicitation techniques, beach characteristics, geographic locations, and per capita income are linked to the observed heterogeneity. In other words, the frequency of trips to the beach was positively associated with WTP, indicating that individuals who visited the beach more frequently were willing to pay more. On the other hand, the width of the beach was found to have a negative association with WTP, suggesting that individuals were willing to pay less for beaches with greater width. Compared to Europe, America and Australia have higher WTP levels for initiatives to clean up beach rubbish. The WTP positively correlated with countries characterized by warmer summer temperatures (above 25^{o}C). Countries with a higher GDP per capita tend to demonstrate a correspondingly higher WTP. The meta-analysis provides useful data that policymakers may use to create cost-effective regulations. It suggests using standardized measurements to track changes in marine litter pollution.

Infrastructure and green buildings

The evidence review did not find many SRs on WTP for infrastructure. However, the topic of green buildings was covered by Joyram, Govindan and Nunkoo (2022). Green building technologies are one plausible solution for addressing sustainability challenges, including climate change. According to Chan and others (2018), green building technologies are integrated into building design to enhance building sustainability. They include wall technologies, green roofing, solar systems, smart lighting, and energy-efficient appliances. A study that systematically reviewed 45 peer-reviewed articles (Joyram, Govindan and Nunkoo, 2022) found that a lack of subjective knowledge about an

insulation material that prevents hot/cold air from entering buildings (termed eco-block)[74], lack of trust in the suppliers of eco-blocks, high price sensitivity, low education, and low-income households were the factors hindering adoption among residents in developing countries.

Energy

In the context of renewable energy, Soon and Ahmad (2015) posit that several valuation studies have been conducted to assess the WTP for renewable energy sources. However, they argue that these studies have yet to achieve a satisfactory consensus regarding the extent to which households are willing to pay. They claim that the results of previous studies exhibit significant disparities owing to sample methodologies, valuation methodologies, and the specific types of renewable energy sources being examined. In order to tackle this matter, the primary aims of the SR were to derive a comprehensive estimate of WTP by aggregating many reported estimates and to elucidate the factors influencing the observed variances in WTP. Thirty studies met the inclusion criteria of this SR. A summary estimate of the WTP was derived by employing a random-effects model that assumes considerable heterogeneity across studies (See Table A - 1), yielding a value of USD 7.16 per month. WTP estimate of USD 3.33 per month was obtained from a fixed effects model completed as a robustness check. The SR found that households, on average, exhibit a WTP of an increased monthly amount over their present energy costs to transition to renewable energy sources. Further, the SR employed sensitivity and subgroup analysis. Based on that approach, the SR observed that metropolitan inhabitants and North American households have a higher WTP than their rural and Asian counterparts. Evidence also indicates that more households were willing to pay for renewable energy sources. However, various renewable energy sources do not appear to have any discernible influence on WTP.

Table A - 1. Summary WTP estimates

	SUMMARY ESTIMATE	95% CONFIDENCE INTERVAL (LL)[75]	95% CONFIDENCE INTERVAL (UL)	P-VALUE[76]
Random-effect (RE)	7.162	6.664	7.660	0.000
Fixed-effect[77]	3.333	3.312	3.354	0.000

Source: Soon and Ahmad (2015)

A 2021 SR by Chaikumbung (2021) found that recently, there has been an increasing body of economic valuation research that has examined the preferences of customers and their WTP for renewable sources of electricity. However, the findings from different individual studies pose a challenge for policymakers in assessing the key determinants of consumer WTP and consumer behaviour concerning green energy. The study further claims that gaining insight into the factors influencing customers' WTP for green energy products can provide valuable guidance for policymakers and market designers seeking to stimulate voluntary consumer demand. After analysing 91 renewable energy studies in 27 countries, the SR concluded that various factors influence WTP values. These include country-specific[78] and survey-specific factors[79], political and

[74] Eco-block, also referred to as an insulated block, is a green building technology consisting of an insulation material that prevents hot/cold air from entering inside buildings, conserves energy, and improves indoor comfort in comparison to a conventional block.
[75] Confidence interval, LL: lower limit, UL: upper limit.
[76] Significant p-values indicate that the summary estimates are indeed different from zero.
[77] SR report the FE summary estimate here for comparison purposes only.
[78] Country-specific factors include GDP per capita, the share of renewable and non-renewable energy in total production, Gini Index, the volume of CO_2 emission per GDP, and change in temperature per year and locations.
[79] Survey-specific variables include valuation method, pilot survey, focus group, urban, interview, mail, telephone, online, education, gender, income, age, attitude, knowledge, year of survey, published paper, impact factor, and thesis.

economic institutions, and the forms of renewable energy. In addition, citizens in nations with a more liberal and democratic government place greater emphasis on renewable energy.

Furthermore, countries with higher GDP per capita have higher WTP estimates. However, countries with higher CO_2 emissions per GDP have lower WTP for green electricity. WTP is higher for solar, wind, and biomass energy and lower for hydropower. The meta-regression analysis findings suggest that fostering democracy and economic freedom is one strategy to raise public acceptance of the deployment of green energy to obtain a more secure and cleaner energy in the future.[80] The SR argued that recently, numerous renewable energy policies (such as feed-in tariffs, renewable green certificates, auction schemes, and more) have been put into place across countries for implementation. Based on the research, the SR recommended a feed-in tariff policy to promote using renewable energy sources globally, particularly in democratic and capitalist nations.

Forest ecosystem conservation

An SR on markets for ecosystem services (MES) (Bruzzese and others, 2023) set out to: (i) analyse the distribution of actual or potential markets for forest ecosystem services (FES) that exist internationally today, (ii) identify the spatial scale at which market-based instruments are applied and the respective measures of economic value used to assess FES, and (iii) to identify the actors and their involvement in the implementation of forestry MES.

After analysing 52 forestry MES studies, the SR found that Europe has the greatest number of countries with one or more MES. In terms of scale, market-based instruments utilized the local scale the most, followed by the subnational, national and international scales. The principal stakeholders in a top-down approach to forest MES are buyers, sellers and intermediaries. Regarding the measures of economic value used to assess FES, Bruzzese and others (2023) found that most studies adopted willingness to accept (WTA) (30 studies) compared to WTP (17 studies), and five studies adopted both, while 10 studies did not report any economic value. Moreover, WTA (20 studies) was found to be the main measure of economic value in real (actual) markets as opposed to WTP (15 studies), which is the most widely adopted in potential markets. WTP is most appropriate for potential markets because the supply of an ecosystem service is still undefined in those markets, making WTP a better tool for determining the price at which consumers are ready to pay sellers for a wanted and requested service. The SR recommended that future studies focus on gaining a more comprehensive understanding of the various stages involved in the development, execution, effectiveness, and governance of an MES. Additionally, it is suggested that further study should be conducted in Africa.

Climate change

WTP for climate mitigation and adaptation policies has been investigated by Chaikumbung (2023). Using a meta-regression, the author examined the influence of institutions and cultures on WTP to tackle climate change. The study analysed 1,501 WTP estimates from 224 studies conducted in 47 countries. The results of the SR show that citizens in less corrupt nations are more likely to help combat climate change, whereas societies that are more indulgent and uncertainly averse provide less support for mitigation and adaptation measures. The different climate change initiatives – mitigation or adaptation – also seem to matter. For instance, people are more willing to pay for climate mitigation activities such as GHG reduction and energy-efficient vehicle policies but less willing to pay for agricultural adaptation policies. WTP is negatively impacted by policies aimed at latitudinal positions. In other words, geographical locations influence individuals' WTP to support climate policies. In terms of this criterion, it was found that Australia, Asia, and Africa stated a

[80] There is a clear positive coefficient between democracy and green energy in the meta-regression, ceteris paribus, yet this may be influenced by a third factor which is not controlled for (unobservable).

lower WTP than Europe. More specifically, the results of the SR showed that citizens of larger emitters of CO_2 have a higher WTP for renewable energy.

Additionally, citizens in nations with significant forested regions support climate change legislation more. The results revealed that religious conviction and education also impact adaptation and mitigation behaviours. Higher education generally results in a greater WTP for combating climate change. Regarding religion on WTP, Christianity appears to have a sizeable favourable impact. According to the results, Christians are more eager to help solve the problem of climate change than non-Christians. In addition, published articles seem to indicate higher WTP estimates than unpublished research. To ensure that the included publications are representative and comparable, the SR's author used a funnel plot and regression to detect publication bias.[81] Moreover, the sensitivity and subgroup analysis highlighted how a higher WTP was observed in surveys conducted face-to-face than in surveys conducted online, and a lower WTP was reported in surveys conducted over the phone than in surveys conducted online. These findings suggest that the design of WTP studies has a significant role in influencing the public's acceptance of measures related to climate change.

Pro-environmental consumer goods and services

An SR by Abdu and Mutuku (2021) focused on studies that estimated WTP for coffee eco-labelling from 2005 to 2020. The primary studies in the review determined customers' WTP for one or more coffees that have been eco-labelled in a single nation and occasionally in more than one nation. The estimations do not go beyond describing consumers' WTP in that research location for a certain attribute. This makes it difficult to separate the differences in impact sizes between and within nations, possibly due to publication bias or other factors. To determine the average role of each attribute and investigate the causes of the variation in effect size over the past 15 years, the SR used a meta-analysis that includes individual WTP (n=97) from 22 key studies. According to the SR's analysis, customers are significantly and positively willing to pay for a pound of organic, fair-trade, and country-of-origin-labelled coffee. The average value a consumer would pay for eco-labelled coffee was USD 1.36 per pound. According to the meta-analysis findings, the organic characteristic has the greatest impact on consumers' WTP for eco-coffee.[82] Consumer preference for coffee eco-labelling was found to be heterogeneous, as evidenced by variations in impact size among areas. In summary, the analysis finds that consumers' buying behaviour in a few selected nations is pro-organic. The availability of a growing range of eco-labels on the market may lead to a loss in consumers' trust and WTP over time.

Another sector that WTP researchers have focused their attention on is the restaurant industry, given the increase in pro-environmental attitudes among consumers. For instance, customers can be concerned about green consumerism, green purchasing and waste reduction. By definition, a pro-environmental attitude is "the consumer's perception of pro-environmental behaviour as good or bad" (Madaganuli and others, 2021a, p. 2230). Due to its environmentally unsustainable practices, the restaurant business can be wasteful and have a significant environmental impact. In light of this, the SR analysed and synthesized the extant literature on consumers' adoption of green restaurants. The SR's originality comes from the design of a "green restaurant adoption research framework" that synthesizes many theoretical viewpoints to explain why customers choose green restaurant services.[83] It was found that age, gender, income level, and education affect green restaurant

[81] Publication selection bias may occur when researchers, reviewers, and editors have a strong preference to report and publish statistically significant results that conform to prior theoretical expectations (Rosenberger and Stanley, 2006).
[82] Methodologically, choice experiment can potentially and accurately quantify the effect size compared to other expressed preference methods.
[83] The following questions guided the content analysis of 50 research studies: (i) What is the research profile of the studies addressing the consumer adoption of green restaurant services? (ii) What are the key themes of analysis in the body of

adoption. In addition, external factors such as marketing messages and service quality positively impacted customer attitudes towards restaurants and green issues.

The SR has several practical implications. First, consumers who care about their health and the environment are willing to pay premium prices, which suggests that the hospitality and restaurant sectors are increasingly aware of green practices. It was estimated that green restaurants levy a 6 per cent premium to their patrons. The SR also showed that restaurant management may use this data to choose the best marketing channels, such as social media groups focusing on health and wellness. Second, restaurant managers must understand how consumers' internal decision-making heuristics influence their adoption of green restaurant products and services. Notable heuristics include attitudes, expectations, values, and perceived behavioural controls. Third, the SR provided a framework to guide restaurant managers to understand their consumers better. In conclusion, the SR suggested that future studies on green restaurants should be based on business innovation themes to provide practitioners with distinctive sustainable and regenerative initiatives.

In a further study on green consumer behaviour, a review by Madaganuli and others (2021b) used the systematic literature review methodology to locate and analyse 76 articles across 20 countries investigating green hotels' consumer uptake. The SR's results indicate a growing body of literature focusing on consumer adoption and consumption of environmentally friendly hotel products and services, including in China, Taiwan, and India.[84] The primary contribution of the review was the creation of a comprehensive framework that integrates consumer uptake and consumption of green hotel products and services. This framework emphasizes the need for a multifaceted analysis of the topic, drawing on multiple theories. This review is one of the initial efforts to synthesize the expanding body of literature about consumer uptake and utilization of green hotel products and services. Concerning WTP, the review found that customers were willing to pay a premium of 4.29 euros per stay for hotels with water-saving devices.

Regarding aviation, a review by Cordes (2020) demonstrated the broad relationships between study participants' environmental knowledge and their WTP for carbon offsets. Using 47 studies for qualitative synthesis and 47 for quantitative synthesis, the SR was guided by the question: How does the environmental knowledge of the passengers affect their WTP, and which specific factors were supporting or hindering? The most noteworthy finding was acknowledging the role of aviation and passengers in contributing to climate change. Furthermore, the SR found that while some studies indicated sociodemographic characteristics, including age, gender, and education, to be a reliable predictor for the WTP, the majority did not support these findings, demonstrating the influence of the studies' geographical and cultural backgrounds.

A review of 24 studies by Csordás and others (2022) focused on the characteristics and attitudes of short food supply chain consumers. Overall, it is difficult to identify the characteristics that influence consumers' willingness to purchase from short food supply chains. The SR reported that most studies highlighted the importance of age and education. However, even these findings cannot be generalized. Consequently, some consumers of non-global food supply chains may be adequately characterized. However, these observations may vary in various instances due to local factors.

literature? (iii) What are the limitations of the existing studies, and what future research questions can be drawn from them? and (iv) Can a unified theoretical framework be developed from the results of the existing body of literature?

[84] The studies revealed four primary themes: (i) the consumer behaviour variables that are addressed, (ii) the antecedents and mediators of green hotel adoption, (iii) the moderators of the relationship, and (iv) the methodological considerations. Within each theme, limitations and suggestions for future research were identified.

Additional evidence for IBI

An evidence review by Ategeka and others (forthcoming)[85] examined the effects of insurance on (i) consumption and expenditure, (ii) crop yield, and (iii) income. For expenditure, they found that insurance for losses had a positive and significant effect on expenditure.[86] Regarding crop yield, the review found that insurance had positive but statistically insignificant effects[87]. The findings were not different for income, with the meta-analysis results showing that insurance for flood and drought interventions had a large positive but statistically insignificant effect on income[88]. Based on the GRADE[89] quality of evidence assessment, the evidence on the effects of insurance for losses due to flood and drought is of low quality (for expenditure) and very low quality (for yield and income).

Additional evidence for PES

A meta-analysis of two quasi-experimental studies by Ategeka and others (forthcoming)[90] indicated that PES interventions affect income positively and significantly.[91] Based on the GRADE quality of evidence assessment, the meta-analysis showed that evidence of the effect of PES on income is of very low quality.

[85] This is an evidence review conducted by the IEU. We included the findings from Ategeka and others (forthcoming) to add more evidence to this section. The study is not an included study within the present evidence review.
[86] The pooled effect estimate (z=89.53, p<0.001) based on the random-effects model was $\hat{\mu}$=1.26 (CI: 1.23 to 1.29).
[87] The pooled effect estimate (z=0.09, p<0.93) based on the random-effects model was $\hat{\mu}$=0.06 (CI: -1.36 to 1.49).
[88] The pooled effect estimate (z=171, p<0.09) based on the random-effects model was $\hat{\mu}$= 0.68 (CI: -0.10 to 1.46).
[89] GRADE (Grading of Recommendations, Assessment, Development, and Evaluations) is a framework for developing and presenting summaries of evidence and provides a systematic approach for grading the quality of evidence presented in systematic reviews. The framework is from the medical sciences and prioritises closed experimentation and randomized trials. When the GRADE framework is applied in the social and economic sciences, it often rates the evidence base as being very low or low due to the difficulties inherent in conducting closed experimentation in social and economic systems, and the use of quasi-experimental methods.
[90] Same as footnote 81 above.
[91] The pooled effect estimate (z=3.77, p <0.001) based on the random-effects model was $\hat{\mu}$=0.23 (CI: 0.11 to 1.34).

Appendix 3. SUMMARY OF THE KEY RESULTS-BASED PAYMENT INTERVENTION TYPES

The structure, targeting, and delivery of incentive payments in specific RBP interventions can vary significantly (Meuth Alldredge and others, 2020).[92] According to the authors, RBP can be categorized into three main groups based on the targeted agent, namely, supply-side, demand-side and hybrid types. Supply-side RBP change incentives for service providers to boost the supply of beneficial goods and services. For example, advance market commitments involve funders committing to purchasing a set quantity of a desired good or service (like a vaccine) upon development, thereby reducing private sector risks in high-cost research and development by establishing a viable market. In contrast, demand-side incentives directly target final beneficiaries to stimulate demand and encourage using beneficial goods and services. For instance, conditional cash transfers offer incentives to households or individuals in exchange for using social services that enhance socioeconomic and demographic outcomes. Hybrid incentives combine characteristics of both supply- and demand-side mechanisms. As an example of such hybrids, pull mechanisms incentivize the sale of beneficial goods and services by private sector service providers. By tying incentive payments to verified sales, pull mechanisms motivate service providers to increase their capacity to supply targeted goods or services while actively stimulating demand among potential end users and customers. A detailed summary of the main RBP types is presented in Table A - 2.

Table A - 2. Overview of key RBP interventions

RBP TYPE	RBP INTERVENTION	INCENTIVE STRUCTURE	KEY FEATURES
Supply-side	Grand challenge	Donor pays out a grand prize to typically one winner upon achieving a prespecified outcome	• Typically used for technology development (e.g. climate-resilient houses) • Puts multiple agents in competition with each other • Places high-risk on competitors because only one (or few) prizes are awarded • Encourages participation of agents that have resources for initial investment and the ability to take the higher risk of not winning a prize (because only one or few prizes are awarded) • May lead to monopolistic pricing of innovation, especially if only one prize is awarded • Increases the pool of resources to solve the problem
	Advance market commitment	Donor makes a binding agreement to purchase or subsidize the purchase of a prespecified quantity of the innovation if it meets pre-defined characteristics	• Used for technology development (e.g., vaccines) • Puts multiple agents in competition with each other • Encourages participation of agents that have resources for initial investment and ability to

[92] Within their review, Meuth Alldredge and others (2020) included studies that assess the effectiveness of an RBP intervention in (i) non-Annex I countries (ii) low-income contexts/settings (defined in relative terms) in Annex I countries and (iii) non-Annex I and Annex I countries (jointly) if associated analyses distinguish effects and report results separately across the two samples.

RBP TYPE	RBP INTERVENTION	INCENTIVE STRUCTURE	KEY FEATURES
			take the higher risk (because products of only the winners are purchased) • Limits monopolistic pricing because donors set the product's price • Increases the pool of resources to solve the problem
	Impact bond	Investors and donors enter a contract that prespecifies the outcomes to be achieved by the investment and the payment schedule by which donors repay the investors if the project achieves prespecified social outcomes	• Used for service delivery • Does not typically put several agents in competition • Focused on investors and service providers rather than the private sector • Increases the pool of resources (from investors) to solve the problem
	Payments for environmental services	Donors or entities benefiting from the actions pay agents if and only if they take actions that improve environmental outcomes (e.g. planting trees)	• Used for encouraging beneficiary adoption of existing products and services; reduces their risk of adoption • Prizes are awarded to multiple agents (beneficiaries), but the agents are not in competition with each other
Hybrid	Pull mechanism	Market incentivization prize that pays private sector agents if they sell products that meet prespecified characteristics and sale agreements. Payments can be per unit of sale or proportional to sale relative to other sellers with or without milestone prizes that are awarded to a limited number of agents	• Simultaneously incentivizes supply and demand of the technology through agent effort to increase the sale of technology • Used for encouraging the adoption of products and services • Aims to address market failure limiting development of market for a technology • Puts multiple agents in varying degrees of competition with each other depending on specific incentive structure (e.g. proportional, per unit, with or without milestone prizes) • Increases the pool of resources (from investors) to solve the problem • Aims to create a market for the technology
	Voucher	Donor commits to reimburse accredited providers based on services delivered to voucher recipients	• Simultaneously incentivizes supply and demand of the technology through agent effort to increase the use of vouchers • Focused on increased delivery and adoption of services • Brings in multiple actors but not in direct competition • Increases in the pool of resources
Demand-side	Conditional cash transfer	Donor promises monetary transfers to families, conditional on those households taking pre-agreed actions that improve social	• Focused on the adoption of services by beneficiaries • Beneficiaries are typically not in direct competition with each other if there is an adequate supply of services available based on which cash awards are made, and as long

RBP TYPE	RBP INTERVENTION	INCENTIVE STRUCTURE	KEY FEATURES
		outcomes (e.g., sending children to school)	there is an adequate supply of resources for providing cash transfers • Does not increase the pool of resources except through households' efforts to utilize socially beneficial services

Source: Meuth Alldredge and others, 2020

Appendix 4. LIST OF TARGETED DATABASES

DATABASE TYPE	NAME OF DATABASE
Academic	Scopus
	Web of Science (Social Science Citation Index, Science Citation Index Expanded, Emerging Sources Citation Index)
	EconLit
	GreenFILE
	3ie International Initiative for Impact Evaluation https://www.3ieimpact.org/evidence-hub
	Pais Index
	Panagaea http://www.pangaea.de/
	Campbell Collaboration https://www.campbellcollaboration.org/
	GREENR (Global Reference on the Environment, Energy and Natural Resources) https://www.library.tufts.edu/ezproxy/ezproxy.asp?location=greenr
	Environment Complete http://www.library.tufts.edu/ezproxy/ezproxy.asp?LOCATION=EnvPolInd
	Agricultural and Environmental Science Collection https://tufts-primo.hosted.exlibrisgroup.com/primo-explore/fulldisplay?docid=01TUN_ALMA61160357310003851&context=L&vid=01TUN&search_scope=TUFTS_ALMA&tab=tufts_alma&lang=en_US
	Environment and Energy https://www.eenews.net/
	EcoAmericas https://www.ecoamericas.com/
	Bloomberg New Energy Finance https://researchguides.library.tufts.edu/bloomberg
	JSTOR https://www.jstor.org/
	Science Direct https://www.sciencedirect.com/
Grey literature	African Development Bank https://www.afdb.org/en
	Asian Development Bank https://www.adb.org/
	Bill & Melinda Gates Foundation https://www.gatesfoundation.org/
	Building Resilience and Adaptation to Climate Extremes and Disasters http://www.braced.org
	Collaboration for Environmental Evidence Database of Evidence Reviews https://environmentalevidence.shinyapps.io/CEEDER/
	Conservation Evidence https://www.conservationevidence.com/
	Ecologic Institute EU (Ecologic) https://www.ecologic.eu/
	Earth–Eval https://www.eartheval.org/
	Collaboration for Environmental Evidence https://environmentalevidence.org/ceeder-search/
	Global Environment Facility https://www.thegef.org/projects-operations/database
	Green Climate Fund https://www.greenclimate.fund/publications
	Green Finance Platform https://www.greenfinanceplatform.org/
	Innovations for Poverty Action – Publications https://www.poverty-action.org/publications

DATABASE TYPE	NAME OF DATABASE
	Inter-American Development Bank – Impact Evaluations Repository https://www.iadb.org/en/topics-effectiveness-improving-lives/impact-evaluations-repository
	International Drought Resilience Alliance https://idralliance.global/
	International Fund for Agricultural Development https://www.ifad.org/en/
	International Initiative for Impact Evaluation: 3ie Development Evidence Portal https://developmentevidence.3ieimpact.org/
	International Institute for Environment and Development www.iied.org/
	J-PAL https://www.povertyactionlab.org/evaluations
	REAL – Resilience, Evaluation, Analysis and Learning https://www.fsnnetwork.org/REAL
	The World Bank www.worldbank.org/
	United Nations Framework Convention on Climate Change (REDD+) https://unfccc.int/topics/land-use/workstreams/reddplus
	United Nations Framework Convention on Climate Change https://unfccc.int/
	United Nations Food and Agriculture Organization https://www.fao.org/home/en
	USAID Development Experience Clearinghouse https://dec.usaid.gov/dec/content/search.aspx
	World Bank eLibrary https://elibrary.worldbank.org/

Appendix 5. LIST OF SYSTEMATIC REVIEWS INCLUDED IN THE SYNTHESIS

The following 79 SRs were included in this evidence review, as set out in section B on methods. Several SRs applied to more than one topic.

Index-based insurance (13)

Abdi, M. J., and others (2022). Index-based insurance and hydroclimatic risk management in agriculture: A systematic review of index selection and yield-index modelling methods. *International Journal of Disaster Risk Reduction*, vol. 67, 102653. Available at https://www.sciencedirect.com/science/article/abs/pii/S2212420921006142.

Adeyinka, A.A., and others (2022). Global disparities in agricultural climate index-based insurance research. *Climate Risk Management*, vol. 35, 100394. Available at https://doi.org/10.1016/j.crm.2022.100394.

Akinyi, D.P., S.K. Ng'Ang'A and E. Girvetz (2021). Trade-offs and synergies of climate change adaptation strategies among smallholder farmers in sub-Saharan Africa: A systematic review. *Regional Sustainability*, vol. 2, issue 2, pp. 130-143. Available at http://regsus.xjegi.com/article/2021/2666-660X/2666-660X-2-2-130.shtml.

Benso, M.R., and others (2023). Review article: Design and evaluation of weather index insurance for multi-hazard resilience and food insecurity. *Natural Hazards and Earth System Sciences*, vol. 23, issue 4, pp. 1335-1354. Available at https://doi.org/10.5194/nhess-23-1335-2023.

Cole, S., and others (2012). Systematic Review. The effectiveness of index-based micro-insurance in helping smallholders manage weather-related risks. London, UK: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London. Available at https://www.gov.uk/research-for-development-outputs/systematic-review-the-effectiveness-of-index-based-micro-insurance-in-helping-smallholders-manage-weather-related-risks#citation.

Goodwin, D., and others (2022). What is the evidence linking financial assistance for drought-affected agriculture and resilience in tropical Asia? A systematic review. *Regional Environmental Change*, vol. 22, No. 12. Available at https://link.springer.com/article/10.1007/s10113-021-01867-y.

Lu, Y., and others (2022). Impacts and synergies of weather index insurance and microcredit in rural areas: A systematic review. *Environmental Research Letters*, vol. 17, No. 10. Available at https://iopscience.iop.org/article/10.1088/1748-9326/ac9244.

Marr, A., and others (2016). Adoption and impact of index-insurance and credit for smallholder farmers in developing countries: A systematic review. *Agricultural Finance Review*, vol. 76, issue 1, pp. 94-118. Available at https://doi.org/10.1108/AFR-11-2015-0050.

Muchuru, S., and G. Nhamo (2019). A review of climate change adaptation measures in the African crop sector. *Climate and Development*, vol. 11, issue 10, pp. 873-885. Available at https://doi.org/10.1080/17565529.2019.1585319.

Mushonga, F.B., and S. Mishi (2022). Natural hazard insurance demand: A systematic review. *Jàmbá: Journal of Disaster Risk Studies*, vol. 14, No. 1. Available at https://jamba.org.za/index.php/jamba/article/view/1379/2528.

Ouedraogo, A., and others (2022). Farmers' Demand for Climate Information Services: A Systematic Review. *Sustainability*, vol. 14, issue 15, 9025. Available at https://doi.org/10.3390/su14159025.

Singh, P. and Agrawal, G. (2019) Efficacy of weather index insurance for mitigation of weather risks in agriculture: An integrative review. *International Journal of Ethics and Systems*, vol. 35, No. 4. Pp. 584-616. Available at https://doi.org/10.1108/IJOES-09-2018-0132.

Vyas, S., and others (2021). Mapping global research on agricultural insurance. *Environmental Research Letters*, vol. 16, No. 10. Available at https://iopscience.iop.org/article/10.1088/1748-9326/ac263d/meta.

Payments for ecosystem services (28)

Aronson, J., and others (2010). Are socioeconomic benefits of restoration adequately quantified? A meta-analysis of recent papers (2000-2008) in Restoration Ecology and 12 Other Scientific Journals. *Restoration Ecology*, vol. 18, issue 2, pp. 143-154. Available at https://doi.org/10.1111/j.1526-100X.2009.00638.x.

Blundo-Canto, G., and others (2018). The Different Dimensions of Livelihood Impacts of Payments for Environmental Services (PES) Schemes: A Systematic Review. *Ecological Economics*, vol. 149, pp.

160-183. Available at https://www.sciencedirect.com/science/article/pii/S0921800917306006?via%3Dihub.

Börner, J., and others (2017). The Effectiveness of Payments for Environmental Services. *World Development*, vol. 96, pp. 359-374. Available at https://www.sciencedirect.com/science/article/pii/S0305750X17300827.

Brandt, J. S., and R.C. Buckley (2018). A global systematic review of empirical evidence of ecotourism impacts on forests in biodiversity hotspots. *Current Opinion in Environmental Sustainability*, vol. 32, pp. 112-118. Available at https://www.sciencedirect.com/science/article/abs/pii/S1877343517301847.

Bruzzese, S., and others (2023). A systematic review of markets for forest ecosystem services at an international level. *Canadian Journal of Forest Research*, vol. 53, No. 7. Available at https://cdnsciencepub.com/doi/abs/10.1139/cjfr-2022-0230.

Castle, S.E. and others (2021). The impacts of agroforestry interventions on agricultural productivity, ecosystem services, a human well-being in low- and middle-income countries: A systematic review. *Campbell collaboration*, vol. 17, isue 2, e1167. Available at https://onlinelibrary.wiley.com/doi/full/10.1002/cl2.1167.

Duchelle, A.E., and others (2018). What is REDD+ achieving on the ground? *Current Opinion in Environmental Sustainability*, vol. 32, pp. 134-140. Available at https://www.sciencedirect.com/science/article/pii/S1877343517301872.

Hänggli, A., and others (2023). A systematic comparison of deforestation drivers and policy effectiveness across the Amazon biome. *Environmental Research Letters*, vol. 18, isue 7. Available at https://iopscience.iop.org/article/10.1088/1748-9326/acd408/meta.

Jones, K.W., and others (2020). Participation in payments for ecosystem services programs in the Global South: A systematic review. *Ecosystem Services*, vol. 45. Available at https://www.sciencedirect.com/science/article/abs/pii/S2212041620301017?via%3Dihub.

Kaiser, J., D. Haase and T. Krueger (2023). Collective payments for ecosystem services: a counterpart of commodification and privatization trends in nature conservation? *Ecology & Society*, vol. 28, issue 1, article 13. Available at https://ecologyandsociety.org/vol28/iss1/art13/.

Kindu, M., and others (2022). Auctioning approaches for ecosystem services – evidence and applications. *Science of The Total Environment*, vol. 853. Available at https://doi.org/10.1016/j.scitotenv.2022.158534.

Li, F., and others (2023). A PES framework coupling socioeconomic and ecosystem dynamics from a sustainable development perspective. *Journal of Environmental Management*, vol. 329. Available at https://www.sciencedirect.com/science/article/abs/pii/S0301479722026160.

Martin-Ortega, J., and others (2019). Dissecting price setting efficiency in Payments for Ecosystem Services: A meta-analysis of payments for watershed services in Latin America. *Ecosystem Services*, vol. 38. Available at https://www.sciencedirect.com/science/article/abs/pii/S2212041618303693?via%3Dihub.

Miller, D. C., and others (2020). The impacts of agroforestry on agricultural productivity, ecosystem services, and human well-being in low-and middle-income countries: An evidence and gap map. Campbell Systematic Review, vol. 16, issue 1. Available at https://doi.org/10.1002/cl2.1066.

Min-Venditti, A.A., G.W. Moore and F. Fleischman (2017). What policies improve forest cover? A systematic review of research from Mesoamerica. *Global Environmental Change*, vol. 47, pp. 21-27. Available at https://www.sciencedirect.com/science/article/abs/pii/S0959378016305453.

Montero-de-Oliveira, F.E., G. Blundo-Canto and D. Ezzine-de-Blas (2023). Under what conditions do payments for environmental services enable forest conservation in the Amazon? A realist synthesis. *Ecological Economics*, vol. 205. Available at https://doi.org/10.1016/j.ecolecon.2022.107697.

Morgan, E.A., and others (2022). Capturing multiple forest ecosystem services for just benefit sharing: The Basket of Benefits Approach. *Ecosystem Services*, vol. 55. Available at https://www.sciencedirect.com/science/article/abs/pii/S2212041622000171.

Mota, P.K., and others (2023). Payment for Environmental Services: A critical review of schemes, concepts, and practice in Brazil. *Science Total Environment*, vol. 899. Available at https://pubmed.ncbi.nlm.nih.gov/37478951/.

Nguyen, C., and others (2022). Spatial coordination Incentives for landscape-scale environmental management: A systematic review. *Land Use Policy*, vol. 114, 105936. Available at https://doi.org/10.1016/j.landusepol.2021.105936.

Perevochtchikova, M., and others (2021). A systematic review of scientific publications on the effects of payments for ecosystem services in Latin America, 2000–2020. *Ecosystem Services*, vol. 49, 101270. Available at https://www.sciencedirect.com/science/article/abs/pii/S2212041621000280.

Pirard, R., and others (2019). Effectiveness of forest conservation interventions: An evidence gap map. IEU Learning Paper No.2. Songdo, South Korea: Independent Evaluation Unit, Green Climate Fund. Available at https://ieu.greenclimate.fund/sites/default/files/document/learning-paper-effectiveness-forestry-conservation-interventions-evidence-gap-map.pdf.

Quevedo, J. M. D., Y. Uchiyama and R. Kohsaka (2023). Progress of blue carbon research: 12 years of global trends based on content analysis of peer-reviewed and 'gray literature' documents. *Ocean and Coastal Management*, vol. 236. Available at https://doi.org/10.1016/j.ocecoaman.2023.106495.

Saeed, A.R., C. McDermott and E. Boyd (2017). Are REDD+ community forest projects following the principles for collective action, as proposed by Ostrom? *International Journal of the Commons*, vol 11, No. 1. Available at https://www.jstor.org/stable/26522926.

Samii, C., and others (2014). Effects of Payment for Environmental Services (PES) on Deforestation and Poverty in Low and Middle Income Countries: A Systematic Review. *Campbell Systematic Reviews*, vol. 10, issue 1. Available at https://doi.org/10.4073/csr.2014.11.

Scullion, J.J., and others (2019). Conserving the Last Great Forests: A Meta-Analysis Review of the Drivers of Intact Forest Loss and the Strategies and Policies to Save Them. *Frontiers in Forests and Global Change*, vol. 2. Available at https://www.frontiersin.org/articles/10.3389/ffgc.2019.00062/full.

Shen, X., P. Gatto and F. Pagliacci (2023). Unravelling the Role of Institutions in Market-Based Instruments: A Systematic Review on Forest Carbon Mechanisms. *Forests*, vol. 14, issue 1, 136. Available at https://doi.org/10.3390/f14010136.

Snilstveit, B., and others (2019). Incentives for climate mitigation in the land-use sector – the effects of payment for environmental services (PES) on environmental and socio-economic outcomes in low- and middle-income countries: A mixed-method systematic review. 3ie Systematic Review No. 44. Available at https://www.3ieimpact.org/evidence-hub/publications/systematic-reviews/incentives-climate-mitigation-land-use-sector-effects.

Yang, W., and Q. Lu (2018). Integrated evaluation of payments for ecosystem services programs in China: a systematic review. *Ecosystem Health and Sustainability*, vol. 4, issue 3, pp. 73-84. Available at https://spj.science.org/doi/10.1080/20964129.2018.1459867.

Results-based payment (16)

Das, A., S.S. Gopalan and D. Chandramohan (2016). Effect of pay for performance to improve quality of maternal and child care in low- and middle-income countries: a systematic review. *BMC Public Health*, vol. 16, No. 321. Available at https://pubmed.ncbi.nlm.nih.gov/27074711/.

Duchelle, A., and others (2018). What is REDD+ achieving on the ground? *Current Opinion in Environmental Sustainability*, vol. 32, pp. 134-140. Available at https://www.sciencedirect.com/science/article/pii/S1877343517301872.

Duvendack, M. (2017). Semi-systematic review to understand Payments- by-Results mechanisms in developing countries. Department for International Development Cover Note. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/684277/full-report-UEA1-merged.pdf.

Fischer, R., L. Giessen and S. Günter (2020). Governance effects on deforestation in the tropics: A review of the evidence. *Environmental Science and Policy*, vol. 105, pp. 84-101. Available at https://www.sciencedirect.com/science/article/abs/pii/S146290111930509X.

James, N., K. Lawson and Y. Acharya (2020). Evidence on result-based financing in maternal and child health in low- and middle-income countries: a systematic review. *Global Health Research and Policy*, vol. 5, issue 31. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7329425/.

Kachapila, M., J. Kigozi and R. Oppong (2023). Exploring the roles of players in strategic purchasing for healthcare in Africa-a scoping review. *Health Policy and Planning*, vol. 38, issue 1, pp. 97-108. Available at https://academic.oup.com/heapol/article/38/1/97/6786241.

Munar, W., and others (2019). Evidence gap map of performance measurement and management in primary healthcare systems in low-income and middle-income countries. *BMJ Global Health*, vol. 4, issue suppl. 8. Available at https://gh.bmj.com/content/4/Suppl_8/e001451.

Muthee, K., and others (2022). A review of Global Policy Mechanisms Designed for Tropical Forests Conservation and Climate Risk Management. *Frontiers in Forests and Global Change*, vol. 4, article 748170. Available at https://www.frontiersin.org/articles/10.3389/ffgc.2021.748170/full.

Patel, S. (2018). Structural, institutional and organizational factors associated with successful pay for performance programmes in improving quality of maternal and child health care in low- and middle-

income countries: a systematic literature review. *Journal of Global Health*, vol. 8, No. 2, 121001. Available at https://jogh.org/documents/issue201802/jogh-08-021001.pdf.

Saeed, A.R., C. McDermott and E. Boyd (2017). Are REDD+ community forest projects following the principles for collective action, as proposed by Ostrom? *International Journal of the Commons*, vol. 11, No. 1. Available at https://www.jstor.org/stable/26522926.

Schulte, I., and others (2022). What influences the implementation of natural climate solutions? A systematic map and review of evidence. *Environmental Research Letters*, vol. 17, issue 1. Available at https://iopscience.iop.org/article/10.1088/1748-9326/ac4071.

Snilstveit, B., and others (2019). Incentives for climate mitigation in the land use sector – the effects of payment for environmental services (PES) on environmental and socio-economic outcomes in low- and middle-income countries A mixed-method systematic review. 3ie Systematic Review No. 44. Available at https://www.3ieimpact.org/evidence-hub/publications/systematic-reviews/incentives-climate-mitigation-land-use-sector-effects.

Turcotte-Tremblay, A.M., and others (2016). Does performance-based financing increase value for money in low- and middle- income countries? A systematic review. *Health Economics Review*, vol. 6, No. 30. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4967066/.

Waithaka, D., C. Cashin and E. Barasa (2022). Is Performance-Based Financing A Pathway to Strategic Purchasing in Sub-Saharan Africa? A Synthesis of the Evidence. *Health System Reform*, vol. 8, issue 2. Available at https://pubmed.ncbi.nlm.nih.gov/35666240/.

Witter, S., and others (2012). Paying for performance to improve the delivery of health interventions in low- and middle-income countries. *Cochrane Database Systematic Review*, vol. 15, issue 2. Available at https://pubmed.ncbi.nlm.nih.gov/22336833/.

Wiysonge, C.S., and others (2017). Financial arrangements for health systems in low-income countries: an overview of systematic reviews. *Cochrane Database of Systematic Reviews*, issue 9, No. CD011084. Available at https://doi.org/10.1002/14651858.CD011084.pub2.

Willingness to pay (26)

Abas, A., and K. Aiyub (2021). Systematic review on ecosystem services (ES) of ecotourism in South-East Asia (ASEAN). *Problemy Ekorozwoju*, vol. 16, issue 1, pp. 113-122. Available at https://www.researchgate.net/publication/347510506_Systematic_Review_on_Ecosystem_Services_ES_of_Ecotourism_in_South-East_Asia_ASEAN.

Abdeta, D. (2022). Willingness to pay for forest conservation in developing countries: A systematic literature review. *Environmental and Sustainability Indicators*, vol. 16, 100201. Available at https://doi.org/10.1016/j.indic.2022.100201.

Acharya, A., and others (2013). The Impact of Health Insurance Schemes for the Informal Sector in Low- and Middle-Income Countries: A Systematic Review. Policy Research Working Paper (January). World Bank Group. Available at https://elibrary.worldbank.org/doi/abs/10.1596/1813-9450-6324.

Adebayo, E.F., and others (2015). A systematic review of factors that affect uptake of community-based health insurance in low-income and middle-income countries. *BMC Health Services Research*, vol. 15, No. 543. Available at https://doi.org/10.1186/s12913-015-1179-3.

Akinyi, D.P., S. Karanja Ng'ang' and E.H. Girvetz (2021). Trade-offs and synergies of climate change adaptation strategies among smallholder farmers in sub-Saharan Africa: A systematic review. *Regional Sustainability*, vol. 2, issue 2, pp. 130-143. Available at https://doi.org/10.1016/j.regsus.2021.05.002.

Annamalai, T.R., and others (2018). Incorporating the life-cycle approach into WASH policies and programmes: A systematic review. 3ie Systematic Review No. 35. Available at https://www.3ieimpact.org/evidence-hub/publications/systematic-reviews/incorporating-life-cycle-approach-wash-policies-and.

Debbi, S., and others (2014). Factors influencing household uptake of improved solid fuel stoves in low-and middle-income countries: a qualitative systematic review. *International Journal of Environmental Research and Public Health*, vol. 11, issue 8, pp. 8228-8250. Available at https://doi.org.10.3390/ijerph110808228.

El Bilali, H. (2020). Organic food and farming in West Africa: A systematic review. *Landbauforschung – Journal of Sustainable and Organic Agricultural Systems*, vol. 70, issue 2, pp. 94-102. Available at https://doi.org/10.3220/LBF1611507579000.

Elhoushy, S., and Lanzini, P. (2021). Factors Affecting Sustainable Consumer Behavior in the MENA Region: A Systematic Review. *Journal of International Consumer Marketing*. Available at

https://www.academia.edu/64240980/Factors_Affecting_Sustainable_Consumer_Behavior_in_the_MENA_Region_A_Systematic_Review.

Entierro, J.M., and others (2023). Acceptability and feasibility of HIV self-testing in Southeast Asia: A scoping review. *International Journal of STD and AIDS*, vol. 34, issue 11. Available at https://journals.sagepub.com/doi/10.1177/09564624231188747.

Gwara, S., and others (2020). Why do We Know So Much and Yet So Little? A Scoping Review of Willingness to Pay for Human Excreta Derived Material in Agriculture. *Sustainability*, vol. 12, issue 16, 6490. Available at https://www.mdpi.com/2071-1050/12/16/6490.

Hemming, D.J., and others (2018). Agricultural input subsidies for improving productivity, farm income, consumer welfare and wider growth in low- and middle-income countries: A systematic review. 3ie Systematic Review No. 41. Available at https://www.3ieimpact.org/evidence-hub/publications/systematic-reviews/agricultural-input-subsidies-improving-productivity.

Ihemezie, E.J., and others (2021). The influence of human values on attitudes and behaviours towards forest conservation. *Journal of Environmental Management*, vol. 292, 112857. Available at https://www.sciencedirect.com/science/article/abs/pii/S0301479721009191?via%3Dihub.

Marr, A., and others (2016). Adoption and impact of index-insurance and credit for smallholder farmers in developing countries: A systematic review. *Agricultural Finance Review*, vol. 76, issue 1, pp. 94-118. Available at https://doi.org/10.1108/AFR-11-2015-0050.

Miti, J.J., and others (2021). Factors associated with willingness to pay for health insurance and pension scheme among informal economy workers in low- and middle-income countries: a systematic review. *International Journal of Social Economics*, vol. 48, issue 1. Available at https://www.emerald.com/insight/content/doi/10.1108/IJSE-03-2020-0165/full/html.

Moore, N., and others (2020). Effects of Access to Electricity Interventions on Socioeconomics Outcomes in Low- and Middle- Income Countries. 3ie Systematic Review. Available at https://www.adb.org/sites/default/files/evaluation-document/515326/files/in242-20_6.pdf.

Nosratnejad, S., A. Rashidian and D.M. Dror (2016). Systematic review of willingness to pay for health insurance in low and middle income countries. PloS One, vol. 11, issue 6, 0157470. Available at https://doi.org/10.1371/journal.pone.0157470.

Null, C., and others (2012). Willingness to pay for cleaner water in less developed countries: Systematic review of experimental evidence. 3ie systematic review No. 6. Available at https://www.3ieimpact.org/evidence-hub/publications/systematic-reviews/willingness-pay-cleaner-water-less-developed-countries.

Phillip, E., and others (2023). Improved cookstoves to reduce household air pollution exposure in sub-Saharan Africa: A scoping review of intervention studies. *PLoS One*, vol. 18, issue 4. Available at https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0284908.

Puzzolo, E., and others (2016). Clean fuels for resource-poor settings: A systematic review of barriers and enablers to adoption and sustained use. *Environmental research*, vol. 146, pp. 218-234. Available at https://doi.org/10.1016/j.envres.2016.01.002.

Rodríguez-Martínez, C.E., M.P. Sossa-Briceño and J.A. Castro-Rodriguez (2013). Cost-utility analysis of the inhaled steroids available in a developing country for the management of pediatric patients with persistent asthma. *Journal of Asthma*, vol. 50, issue 4, pp. 410-418. Available at https://pubmed.ncbi.nlm.nih.gov/23356720/.

Shao, J. (2019). Sustainable consumption in China: New trends and research interests. *Business Strategy and the Environment*, vol. 28, issue 8, pp. 1507-1517. Available at https://onlinelibrary.wiley.com/doi/abs/10.1002/bse.2327.

Stadlmayr, B., and others (2023). Factors affecting fruit and vegetable consumption and purchase behavior of adults in sub-Saharan Africa: A rapid review. *Frontiers in Nutrition, Section Nutrition and Sustainable Diets*, vol. 10. Available at https://www.frontiersin.org/articles/10.3389/fnut.2023.1113013/full.

Supadmi, W., and others (2019). Economic Evaluations of Dengue Vaccination in the Southeast Asia Region: Evidence From a Systematic Review. Value in Health, Regional Issues, vol. 18, pp. 132-144. Available at https://doi.org/10.1016/j.vhri.2019.02.004.

Traoré, L., B. Belinga and G. Lescuyer (2023). A Systematic Review of the Scope and Patterns of Green Consumption in Sub-Saharan Africa. *Sustainability*, vol. 15, issue 8. Available at https://www.mdpi.com/2071-1050/15/8/6343.

Trapero-Bertran, M., and others (2013). A systematic review and meta-analysis of willingness-to-pay values: The case of malaria control interventions. *Health Economics*, vol. 22, issue 4, pp. 428-450. Available at https://doi.org/10.1002/hec.2810.

REFERENCES

Abdeta, D. (2022). Willingness to pay for forest conservation in developing countries: A systematic literature review. *Environmental and Sustainability Indicators*, vol. 16, 100201. Available at https://doi.org/10.1016/j.indic.2022.100201.

Abdi, M. J., and others (2022). Index-based insurance and hydroclimatic risk management in agriculture: A systematic review of index selection and yield-index modelling methods. *International Journal of Disaster Risk Reduction*, vol. 67, 102653. Available at https://www.sciencedirect.com/science/article/abs/pii/S2212420921006142.

Abdu, N., and J. Mutuku (2021). Willingness to pay for socially responsible products: A meta-analysis of coffee ecolabelling. Heliyon, vol. 7, issue 6. Available at https://doi.org/10.1016/j.heliyon.2021.e07043.

Acharya, A., and others (2013). The Impact of Health Insurance Schemes for the Informal Sector in Low- and Middle-Income Countries: A Systematic Review. Policy Research Working Paper (January). World Bank Group. Available at https://elibrary.worldbank.org/doi/abs/10.1596/1813-9450-6324.

Adebayo, E.F., and others (2015). A systematic review of factors that affect uptake of community-based health insurance in low-income and middle-income countries. *BMC Health Services Research*, vol. 15, No. 543. Available at https://doi.org/10.1186/s12913-015-1179-3.

Adeyinka, A.A., and others (2022). Global disparities in agricultural climate index-based insurance research. *Climate Risk Management*, vol. 35, 100394. Available at https://doi.org/10.1016/j.crm.2022.100394.

Akinyi, D.P., S.K. Ng'Ang'A and E. Girvetz (2021). Trade-offs and synergies of climate change adaptation strategies among smallholder farmers in sub-Saharan Africa: A systematic review. *Regional Sustainability*, vol. 2, issue 2, pp. 130-143. Available at http://regsus.xjegi.com/article/2021/2666-660X/2666-660X-2-2-130.shtml.

Annamalai, T.R., and others (2018). Incorporating the life-cycle approach into WASH policies and programmes: A systematic review. 3ie Systematic Review No. 35. Available at https://www.3ieimpact.org/evidence-hub/publications/systematic-reviews/incorporating-life-cycle-approach-wash-policies-and.

Appui au Développement Autonome (2022). Index-based agricultural insurance strengthens resilience of smallholder farmers. Blog, 20 June. Available at https://www.ada-microfinance.org/en/blog-news-ada/index-based-agricultural-insurance-strengthens-resilience-smallholder-farmers.

Aronson, J., and others (2010). Are socioeconomic benefits of restoration adequately quantified? A meta-analysis of recent papers (2000-2008) in Restoration Ecology and 12 Other Scientific Journals. *Restoration Ecology*, vol. 18, issue 2, pp. 143-154. Available at https://doi.org/10.1111/j.1526-100X.2009.00638.x.

Ategeka, J., and others (forthcoming). Coastal and terrestrial water sector interventions in developing countries: A systematic review. IEU learning paper. Songdo, South Korea: Independent Evaluation Unit, Green Climate Fund.

Benso, M.R., and others (2023). Review article: Design and evaluation of weather index insurance for multi-hazard resilience and food insecurity. *Natural Hazards and Earth System Sciences*, vol. 23, issue 4, pp. 1335-1354. Available at https://doi.org/10.5194/nhess-23-1335-2023.

Blundo-Canto, G., and others (2018). The Different Dimensions of Livelihood Impacts of Payments for Environmental Services (PES) Schemes: A Systematic Review. *Ecological Economics*, vol. 149, pp. 160-183. Available at https://www.sciencedirect.com/science/article/pii/S0921800917306006?via%3Dihub.

Börner, J., and others (2017). The Effectiveness of Payments for Environmental Services. *World Development*, vol. 96, pp. 359-374. Available at https://www.sciencedirect.com/science/article/pii/S0305750X17300827.

Brandt, J. S., and R.C. Buckley (2018). A global systematic review of empirical evidence of ecotourism impacts on forests in biodiversity hotspots. *Current Opinion in Environmental Sustainability*, vol. 32, pp. 112-118. Available at https://www.sciencedirect.com/science/article/abs/pii/S1877343517301847.

Bruzzese, S., and others (2023). A systematic review of markets for forest ecosystem services at an international level. *Canadian Journal of Forest Research*, vol. 53, No. 7. Available at https://cdnsciencepub.com/doi/abs/10.1139/cjfr-2022-0230.

Carter, M.R., and others (2014). Index-based weather insurance for developing countries: A review of evidence and a set of propositions for up-scaling, FERDI Working Paper, No. P111. Available at https://www.econstor.eu/bitstream/10419/269392/1/ferdi-wp111.pdf.

Castle, S.E. and others (2021). The impacts of agroforestry interventions on agricultural productivity, ecosystem services, a human well-being in low- and middle-income countries: A systematic review. *Campbell collaboration*, vol. 17, isue 2, e1167. Available at https://onlinelibrary.wiley.com/doi/full/10.1002/cl2.1167.

Chaikumbung, M. (2021). Institutions and consumer preferences for renewable energy: A meta-regression analysis. *Renewable and Sustainable Energy Reviews*, vol. 146, 111143. Available at https://www.sciencedirect.com/science/article/abs/pii/S1364032121004317.

Chaikumbung, M. (2023). The effects of institutions and cultures on people's willingness to pay for climate change policies: A meta-regression analysis. *Energy Policy*, vol. 177, 113513. Available at https://doi.org/10.1016/j.enpol.2023.113513.

Chan, A.P.C., and others (2018). Critical barriers to green building technologies adoption in developing countries: the case of Ghana. *Journal of Cleaner Production*, Vol. 172, pp. 1067–1079. Available at https://doi.org/10.1016/j.jclepro.2017.10.235.

Ci-Dev (2020). Ci-Dev Supports Off-grid Solar Markets and Access to Energy. Article, 13 February. Carbon Initiative for Development. Available at https://www.ci-dev.org/result-stories/ci-dev-supports-grid-solar-markets-and-access-energy.

Ci-Dev (n.d.). Approach. Carbon Initiative for Development. Available at https://www.ci-dev.org/approach.

Climate Policy Initiative (2022). Global Landscape of Climate Finance: A Decade of Data. Available at https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-a-decade-of-data/.

Cole, S., and others (2012). Systematic Review. The effectiveness of index-based micro-insurance in helping smallholders manage weather-related risks. London, UK: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London. Available at https://www.gov.uk/research-for-development-outputs/systematic-review-the-effectiveness-of-index-based-micro-insurance-in-helping-smallholders-manage-weather-related-risks#citation.

Connor, D.M. (1988). A New Ladder of Citizen Participation. *National Civic Review*, vol. 77, No. 3. Available at https://geog.sdsu.edu/People/Pages/jankowski/public_html/web780/Connor_1988.pdf.

Cordes, H. (2020). Voluntary carbon offsets in the aviation industry: how environmental knowledge affects travellers willingness to pay: a systematic review. Jyväskylän yliopisto, Finland: University of Jyväskylä. Available at https://jyx.jyu.fi/handle/123456789/73117.

Csordás, A., P. Lengyel and I. Füzesi (2022). Who Prefers Regional Products? A Systematic Literature Review of Consumer Characteristics and Attitudes in Short Food Supply Chains. *Sustainability*, vol. 14, issue 15, 8990. Available at https://www.mdpi.com/2071-1050/14/15/8990.

Das, A., S.S. Gopalan and D. Chandramohan (2016). Effect of pay for performance to improve quality of maternal and child care in low and middle-income countries: a systematic review. *BMC Public Health*, vol. 16, No. 321. Available at https://pubmed.ncbi.nlm.nih.gov/27074711/.

de Steur, H., and others (2017). The socioeconomics of genetically modified biofortified crops: a systematic review and meta-analysis. Annals of the New York Academy of Sciences, vol. 1390, issue 1, pp. 14-33. Available at https://doi.org/10.1111/nyas.13199.

de Souza Kirby, Regiane C.L., Leticia da Silva Inácio and Ivete Delai (2023). Factors affecting green building consumer behaviour: evidence from Brazil. *International Journal of Sustainable Development and World Ecology*, vol. 30, issue 2, pp. 164-178. Available at https://doi.org/10.1080/13504509.2022.2127033.

Debbi, S., and others (2014). Factors influencing household uptake of improved solid fuel stoves in low-and middle-income countries: a qualitative systematic review. *International Journal of Environmental Research and Public Health*, vol. 11, issue 8, pp. 8228-8250. Available at https://doi.org.10.3390/ijerph110808228.

Duchelle, A., and others (2018). What is REDD+ achieving on the ground? *Current Opinion in Environmental Sustainability*, vol. 32, pp. 134-140. Available at https://www.sciencedirect.com/science/article/pii/S1877343517301872.

Duvendack, M. (2017). Semi-systematic review to understand Payments- by-Results mechanisms in developing countries. Department for International Development Cover Note. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/684277/full-report-UEA1-merged.pdf.

Ecosystem Valuation (n.d-a). Contingent Valuation Method. Available at https://www.ecosystemvaluation.org/contingent_valuation.htm.

Ecosystem Valuation (n.d-b). Hedonic Pricing Method. Available at https://www.ecosystemvaluation.org/hedonic_pricing.htm.

Ehlers, T., and others (2022). How to Scale Up Private Climate Finance in Emerging Economies. International Monetary Fund Blog, 7 October. Available at https://www.imf.org/en/Blogs/Articles/2022/10/07/how-to-scale-up-private-climate-finance-in-emerging-economies.

El Bilali, H. (2020). Organic food and farming in West Africa: A systematic review. *Landbauforschung – Journal of Sustainable and Organic Agricultural Systems*, vol. 70, issue 2, pp. 94-102. Available at https://doi.org/10.3220/LBF1611507579000.

Elhoushy, S., and Lanzini, P. (2021). Factors Affecting Sustainable Consumer Behavior in the MENA Region: A Systematic Review. *Journal of International Consumer Marketing*. Available at https://www.academia.edu/64240980/Factors_Affecting_Sustainable_Consumer_Behavior_in_the_MENA_Region_A_Systematic_Review.

Fischer, R., L. Giessen and S. Günter (2020). Governance effects on deforestation in the tropics: A review of the evidence. *Environmental Science and Policy*, vol. 105, pp. 84-101. Available at https://www.sciencedirect.com/science/article/abs/pii/S146290111930509X.

Forest Europe (n.d.) Payments: Payments for Ecosystem Services. Available at https://foresteurope.org/ecosystem-services/payments/.

Frewer, L.J., and others (2013). Public perceptions of agri-food applications of genetic modification – A systematic review and meta-analysis. *Trends in Food Science & Technology*, vol. 30, issue 2, pp. 142-152. Available at https://doi.org/10.1016/j.tifs.2013.01.003.

Fripp, E. (2014). Payments for Ecosystem Services (PES): A practical guide to assessing the feasibility of PES projects. Bogor, Indonesia: CIFOR. Available at https://www.cifor.org/publications/pdf_files/Books/BFripp1401.pdf.

Goodwin, D., and others (2022). What is the evidence linking financial assistance for drought-affected agriculture and resilience in tropical Asia? A systematic review. *Regional Environmental Change*, vol. 22, No. 12. Available at https://link.springer.com/article/10.1007/s10113-021-01867-y.

Green Climate Fund (2011). Governing Instrument. Available at https://www.greenclimate.fund/sites/default/files/document/governing-instrument.pdf.

Green Climate Fund (2023a). *Strategic Plan for the Green Climate Fund 2024–2027*. Available at https://www.greenclimate.fund/sites/default/files/document/strategic-plan-gcf-2024-2027.pdf.

Green Climate Fund (2023b). GCF/B.37/14: Proposal on the financing of results-based payments for REDD+. B.37 Action Item. Available at https://www.greenclimate.fund/document/gcf-b37-14.

Hänggli, A., and others (2023). A systematic comparison of deforestation drivers and policy effectiveness across the Amazon biome. *Environmental Research Letters*, vol. 18, isue 7. Available at https://iopscience.iop.org/article/10.1088/1748-9326/acd408/meta.

Hevenstone, D., and others (2023). Why is impact measurement abandoned in practice? Evidence use in evaluation and contracting for five European Social Impact Bonds. *Evaluation*, vol. 29, issue 1, pp. 91-109. Available at https://doi.org/10.1177/13563890221136890.

Hinojosa, C. (n.d.) Case study: Payments for Ecosystem Services in Costa Rica. Donor Committee for Enterprise Development: Business Environment Reform & Green Growth. Available at https://www.enterprise-development.org/wp-content/uploads/DCED-GGWG-Case-study-PES.pdf.

Holmes, T.P., W.L. Adamowicz and F. Carlsson (2017). Chapter 5: Choice Experiments. In *A Primer on Non-market Valuation*, 2nd ed., P.A. Champ, K.J. Boyle and T.C. Brown, eds. Dordrecht, Netherlands: Springer. Available at https://www.srs.fs.usda.gov/pubs/ja/2017/ja_2017_holmes_003.pdf.

Ihemezie, E.J., and others (2021). The influence of human values on attitudes and behaviours towards forest conservation. *Journal of Environmental Management*, vol. 292, 112857. Available at https://www.sciencedirect.com/science/article/abs/pii/S0301479721009191?via%3Dihub.

James, N., K. Lawson and Y. Acharya (2020). Evidence on result-based financing in maternal and child health in low- and middle-income countries: a systematic review. *Global Health Research and Policy*, vol. 5, issue 31. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7329425/.

Jones, K.W., and others (2020). Participation in payments for ecosystem services programs in the Global South: A systematic review. *Ecosystem Services*, vol. 45. Available at https://www.sciencedirect.com/science/article/abs/pii/S2212041620301017?via%3Dihub.

Jones, K.W., and others (2023). The emergence and persistence of payments for watershed services programs in Mexico. *Water Resources and Economics*, vol. 42. Available at https://www.sciencedirect.com/science/article/abs/pii/S2212428423000026.

Joyram, H., K. Govindan and R. Nunkoo (2022). A comprehensive review on the adoption of insulated block/eco-block as a green building technology from a resident perspective. *Cleaner Engineering and Technology*, vol. 8, 100480. Available at https://doi.org/10.1016/j.clet.2022.100480.

Kachapila, M., J. Kigozi and R. Oppong (2023). Exploring the roles of players in strategic purchasing for healthcare in Africa-a scoping review. *Health Policy and Planning*, vol. 38, issue 1, pp. 97-108. Available at https://academic.oup.com/heapol/article/38/1/97/6786241.

Kaiser, J., D. Haase and T. Krueger (2023). Collective payments for ecosystem services: a counterpart of commodification and privatization trends in nature conservation? *Ecology & Society*, vol. 28, issue 1, article 13. Available at https://ecologyandsociety.org/vol28/iss1/art13/.

Kamrath, C., and others (2019). What do we know about chain actors' evaluation of new food technologies? A systematic review of consumer and farmer studies. *Comprehensive Reviews in Food Science and Food Safety*, vol. 18, issue 3, pp. 798-816. Available at https://doi.org/10.1111/1541-4337.12442.

Kibert, C.J. (2016). Sustainable construction: green building design and delivery, 4th ed. Hoboken, USA: John Wiley and Sons.

Kindu, M., and others (2022). Auctioning approaches for ecosystem services – evidence and applications. *Science of The Total Environment*, vol. 853. Available at https://doi.org/10.1016/j.scitotenv.2022.158534.

Li, F., and others (2023). A PES framework coupling socioeconomic and ecosystem dynamics from a sustainable development perspective. *Journal of Environmental Management*, vol. 329. Available at https://www.sciencedirect.com/science/article/abs/pii/S0301479722026160.

Liu, X., and others (2019). Does experience with natural disasters affect willingness-to-pay for weather index insurance? Evidence from China. *International Journal of Disaster Risk Reduction*, vol. 33, pp. 33-43. Available at https://doi.org/10.1016/j.ijdrr.2018.09.006.

Lu, Y., and others (2022). Impacts and synergies of weather index insurance and microcredit in rural areas: A systematic review. *Environmental Research Letters*, vol. 17, No. 10. Available at https://iopscience.iop.org/article/10.1088/1748-9326/ac9244.

Madaganuli, A.T., and others (2021a). What motivates the adoption of green restaurant products and services? A systematic review and future research agenda. *Business Strategy and the Environment*, vol. 30, issue 4, pp. 2224-2240. Available at https://doi.org/10.1002/bse.2755.

Madaganuli, A.T., and others (2021b). What drives the adoption and consumption of green hotel products and services? A systematic literature review of past achievements and future promises. *Business Strategy and the Environment*, vol. 30, issue 5, pp. 2637-2655. Available at https://onlinelibrary.wiley.com/doi/full/10.1002/bse.2768.

Marr, A., and others (2016). Adoption and impact of index-insurance and credit for smallholder farmers in developing countries: A systematic review. *Agricultural Finance Review*, vol. 76, issue 1, pp. 94-118. Available at https://doi.org/10.1108/AFR-11-2015-0050.

Martin-Ortega, J., and others (2019). Dissecting price setting efficiency in Payments for Ecosystem Services: A meta-analysis of payments for watershed services in Latin America. *Ecosystem Services*, vol. 38. Available at https://www.sciencedirect.com/science/article/abs/pii/S2212041618303693?via%3Dihub.

Meuth Alldredge, J., and others (2020). Evidence review on results-based payments: Evidence Gap Map and Intervention Heat Map. IEU learning paper (December). Songdo, South Korea: Independent Evaluation Unit, Green Climate Fund. Available at https://ieu.greenclimate.fund/sites/default/files/page/210201-egm-rbp-top_0.pdf.

Miller, D. C., and others (2020). The impacts of agroforestry on agricultural productivity, ecosystem services, and human well-being in low-and middle-income countries: An evidence and gap map. Campbell Systematic Review, vol. 16, issue 1. Available at https://doi.org/10.1002/cl2.1066.

Min-Venditti, A.A., G.W. Moore and F. Fleischman (2017). What policies improve forest cover? A systematic review of research from Mesoamerica. *Global Environmental Change*, vol. 47, pp. 21-27. Available at https://www.sciencedirect.com/science/article/abs/pii/S0959378016305453.

Miti, J.J., and others (2021). Factors associated with willingness to pay for health insurance and pension scheme among informal economy workers in low- and middle-income countries: a systematic review. *International Journal of Social Economics*, vol. 48, issue 1. Available at https://www.emerald.com/insight/content/doi/10.1108/IJSE-03-2020-0165/full/html.

Montero-de-Oliveira, F.E., G. Blundo-Canto and D. Ezzine-de-Blas (2023). Under what conditions do payments for environmental services enable forest conservation in the Amazon? A realist synthesis. *Ecological Economics*, vol. 205. Available at https://doi.org/10.1016/j.ecolecon.2022.107697.

Moore, N., and others (2020). Effects of Access to Electricity Interventions on Socioeconomics Outcomes in Low- and Middle- Income Countries. 3ie Systematic Review. Available at https://www.adb.org/sites/default/files/evaluation-document/515326/files/in242-20_6.pdf.

Morgan, E.A., and others (2022). Capturing multiple forest ecosystem services for just benefit sharing: The Basket of Benefits Approach. *Ecosystem Services*, vol. 55. Available at https://www.sciencedirect.com/science/article/abs/pii/S2212041622000171.

Mota, P.K., and others (2023). Payment for Environmental Services: A critical review of schemes, concepts, and practice in Brazil. *Science Total Environment*, vol. 899. Available at https://pubmed.ncbi.nlm.nih.gov/37478951/.

Munar, W., and others (2019). Evidence gap map of performance measurement and management in primary healthcare systems in low-income and middle-income countries. *BMJ Global Health*, vol. 4, issue suppl. 8. Available at https://gh.bmj.com/content/4/Suppl_8/e001451.

Mushonga, F.B., and S. Mishi (2022). Natural hazard insurance demand: A systematic review. *Jàmbá: Journal of Disaster Risk Studies*, vol. 14, No. 1. Available at https://jamba.org.za/index.php/jamba/article/view/1379/2528.

Muthee, K., and others (2022). A review of Global Policy Mechanisms Designed for Tropical Forests Conservation and Climate Risk Management. *Frontiers in Forests and Global Change*, vol. 4, article 748170. Available at https://www.frontiersin.org/articles/10.3389/ffgc.2021.748170/full.

Mutuku, J., and others (2022). Willingness to pay for cleaning up beach litter: A meta-analysis. *Marine Pollution Bulletin*, vol. 185, part A, 114220. Available at https://doi.org/10.1016/j.marpolbul.2022.114220.

Nguyen, C., and others (2022). Spatial coordination Incentives for landscape-scale environmental management: A systematic review. *Land Use Policy*, vol. 114, 105936. Available at https://doi.org/10.1016/j.landusepol.2021.105936.

Nosratnejad, S., A. Rashidian and D.M. Dror (2016). Systematic review of willingness to pay for health insurance in low and middle income countries. PloS One, vol. 11, issue 6, 0157470. Available at https://doi.org/10.1371/journal.pone.0157470.

Null, C., and others (2012). Willingness to pay for cleaner water in less developed countries: Systematic review of experimental evidence. 3ie systematic review No. 6. Available at https://www.3ieimpact.org/evidence-hub/publications/systematic-reviews/willingness-pay-cleaner-water-less-developed-countries.

Olum, S., and others (2019). Farmers' adoption of agricultural innovations: A systematic review on willingness to pay studies. *Outlook on Agriculture*, vol. 49, issue 3, pp. 187–203. Available at https://journals.sagepub.com/doi/abs/10.1177/0030727019879453.

Osewe, I., and others (2023) Critical Analysis of Payments for Ecosystem Services: Case Studies in Kenya, Uganda and Tanzania. Forests, 14(6):1209. Available at https://www.mdpi.com/1999-4907/14/6/1209 (Accessed on 01/08/23)

Ouedraogo, A., and others (2022). Farmers' Demand for Climate Information Services: A Systematic Review. *Sustainability*, vol. 14, issue 15, 9025. Available at https://doi.org/10.3390/su14159025.

Patel, S. (2018). Structural, institutional and organizational factors associated with successful pay for performance programmes in improving quality of maternal and child health care in low- and middle-income countries: a systematic literature review. *Journal of Global Health*, vol. 8, No. 2, 121001. Available at https://jogh.org/documents/issue201802/jogh-08-021001.pdf.

Perevochtchikova, M., and others (2021). A systematic review of scientific publications on the effects of payments for ecosystem services in Latin America, 2000–2020. *Ecosystem Services*, vol. 49, 101270. Available at https://www.sciencedirect.com/science/article/abs/pii/S2212041621000280.

Pirard, R., and others (2019). Effectiveness of forest conservation interventions: An evidence gap map. IEU Learning Paper No.2. Songdo, South Korea: Independent Evaluation Unit, Green Climate Fund. Available at https://ieu.greenclimate.fund/sites/default/files/document/learning-paper-effectiveness-forestry-conservation-interventions-evidence-gap-map.pdf.

Puzzolo, E., and others (2016). Clean fuels for resource-poor settings: A systematic review of barriers and enablers to adoption and sustained use. *Environmental research*, vol. 146, pp. 218-234. Available at https://doi.org/10.1016/j.envres.2016.01.002.

Quevedo, J. M. D., Y. Uchiyama and R. Kohsaka (2023). Progress of blue carbon research: 12 years of global trends based on content analysis of peer-reviewed and 'gray literature' documents. *Ocean and Coastal Management*, vol. 236. Available at https://doi.org/10.1016/j.ocecoaman.2023.106495.

REDD Net (2010). Carbon Rights and REDD+. Asia and the Pacific Bulletin, issue 3 (November). Available at https://seors.unfccc.int/applications/seors/attachments/get_attachment?code=LO2GONPO5SX9BS2JMQ11C61T153A2VBQ.

Rosenberger, R.S., and T.D. Stanley (2006). Measurement, generalization, and publication: sources of error in benefit transfers and their management. *Ecological Economics*, vol. 60, issue 2, pp. 372–378. https://doi.org/10.1016/j.ecolecon.2006.03.018.

Saeed, A.R., C. McDermott and E. Boyd (2017). Are REDD+ community forest projects following the principles for collective action, as proposed by Ostrom? *International Journal of the Commons*, vol. 11, No. 1. Available at https://www.jstor.org/stable/26522926.

Salzman, J., and others (2018). The global status and trends of Payments for Ecosystem Services. *Nature Sustainability*, vol. 1, pp. 136–144. Available at https://www.nature.com/articles/s41893-018-0033-0#citeas.

Samii, C., and others (2014). Effects of Payment for Environmental Services (PES) on Deforestation and Poverty in Low and Middle Income Countries: A Systematic Review. *Campbell Systematic Reviews*, vol. 10, issue 1. Available at https://doi.org/10.4073/csr.2014.11.

Schulte, I., and others (2022). What influences the implementation of natural climate solutions? A systematic map and review of evidence. *Environmental Research Letters*, vol. 17, issue 1. Available at https://iopscience.iop.org/article/10.1088/1748-9326/ac4071.

Scullion, J.J., and others (2019). Conserving the Last Great Forests: A Meta-Analysis Review of the Drivers of Intact Forest Loss and the Strategies and Policies to Save Them. *Frontiers in Forests and Global Change*, vol. 2. Available at https://www.frontiersin.org/articles/10.3389/ffgc.2019.00062/full.

Shao, J. (2019). Sustainable consumption in China: New trends and research interests. *Business Strategy and the Environment*, vol. 28, issue 8, pp. 1507-1517. Available at https://onlinelibrary.wiley.com/doi/abs/10.1002/bse.2327.

Shen, X., P. Gatto and F. Pagliacci (2023). Unravelling the Role of Institutions in Market-Based Instruments: A Systematic Review on Forest Carbon Mechanisms. *Forests*, vol. 14, issue 1, 136. Available at https://doi.org/10.3390/f14010136.

Sieleunou, I., and others (2021). Strategic Health Purchasing Progress Mapping in Cameroon: A Scoping Review. *Health Systems & Reform*, vol. 7, issue 1. Available at https://doi.org/10.1080/23288604.2021.1909311.

Singh, P., and G. Agrawal (2019). Efficacy of weather index insurance for mitigation of weather risks in agriculture: An integrative review. *International Journal of Ethics and Systems*, vol. 35, No. 4, pp. 584-616. Available at https://doi.org/10.1108/IJOES-09-2018-0132.

Snilstveit, B., and others (2019). Incentives for climate mitigation in the land use sector – the effects of payment for environmental services (PES) on environmental and socio-economic outcomes in low- and middle-income countries A mixed-method systematic review. 3ie Systematic Review No. 44. Available at https://www.3ieimpact.org/evidence-hub/publications/systematic-reviews/incentives-climate-mitigation-land-use-sector-effects.

Soon, J.J., and S.A. Ahmad (2015). Willingly or grudgingly? A meta-analysis on the willingness-to-pay for renewable energy use. *Renewable and Sustainable Energy Reviews*, vol. 44, pp. 877-887. Available at https://doi.org/10.1016/j.rser.2015.01.041.

Stadlmayr, B., and others (2023). Factors affecting fruit and vegetable consumption and purchase behavior of adults in sub-Saharan Africa: A rapid review. *Frontiers in Nutrition, Section Nutrition and Sustainable Diets*, vol. 10. Available at https://www.frontiersin.org/articles/10.3389/fnut.2023.1113013/full.

Steinmetz, T. (n.d.). Steps to determine whether index-based agricultural insurance can be an effective tool for development. Feed The Future. Available at https://agrilinks.org/sites/default/files/resource/files/glee_senegal_index_insurance_handout_final.pdf.

Streimikiene, D., and others (2019). A Review of Willingness to Pay Studies for Climate Change Mitigation in the Energy Sector. *Energies*, vol. 12, issue 8, 1481. Available at https://www.mdpi.com/1996-1073/12/8/1481.

Stritzke, S., and others (2021). Results-Based Financing (RBF) for Modern Energy Cooking Solutions: An Effective Driver for Innovation and Scale? *Energies*, vol. 14, issue 15, 4559. Available at https://doi.org/10.3390/en14154559.

Supadmi, W., and others (2019). Economic Evaluations of Dengue Vaccination in the Southeast Asia Region: Evidence From a Systematic Review. Value in Health, Regional Issues, vol. 18, pp. 132-144. Available at https://doi.org/10.1016/j.vhri.2019.02.004.

Traoré, L., B. Belinga and G. Lescuyer (2023). A Systematic Review of the Scope and Patterns of Green Consumption in Sub-Saharan Africa. *Sustainability*, vol. 15, issue 8. Available at https://www.mdpi.com/2071-1050/15/8/6343.

Trapero-Bertran, M., and others (2013). A systematic review and meta-analysis of willingness-to-pay values: The case of malaria control interventions. *Health Economics*, vol. 22, issue 4, pp. 428-450. Available at https://doi.org/10.1002/hec.2810.

Turcotte-Tremblay, A.M., and others (2016). Does performance-based financing increase value for money in low- and middle- income countries? A systematic review. *Health Economics Review*, vol. 6, No. 30. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4967066/.

Villamayor-Tomas, S., and others (2022). Community-based water markets and collective payment for ecosystem services: toward a theory of community-based environmental markets. *Current Opinion in Environmental Sustainability*, vol. 59, 101221. Available at https://www.sciencedirect.com/science/article/pii/S1877343522000732.

Vyas, S., and others (2021). Mapping global research on agricultural insurance. *Environmental Research Letters*, vol. 16, No. 10. Available at https://iopscience.iop.org/article/10.1088/1748-9326/ac263d/meta.

Waithaka, D., C. Cashin and E. Barasa (2022). Is Performance-Based Financing A Pathway to Strategic Purchasing in Sub-Saharan Africa? A Synthesis of the Evidence. *Health System Reform*, vol. 8, issue 2. Available at https://pubmed.ncbi.nlm.nih.gov/35666240/.

Witter, S., and others (2012). Paying for performance to improve the delivery of health interventions in low- and middle-income countries. *Cochrane Database Systematic Review*, vol. 15, issue 2. Available at https://pubmed.ncbi.nlm.nih.gov/22336833/.

Witter, S., and others (2021). Performance-based Financing versus "Unconditional" Direct Facility Financing - False Dichotomy? Health Systems and Reform, vol. 7, issue 1, e 2006121. Available at https://pubmed.ncbi.nlm.nih.gov/34874806/.

Wiysonge, C.S., and others (2017). Financial arrangements for health systems in low-income countries: an overview of systematic reviews. *Cochrane Database of Systematic Reviews*, issue 9, No. CD011084. Available at https://doi.org/10.1002/14651858.CD011084.pub2.

World Bank (2022). What You Need to Know About Results-Based Climate Finance. Feature story, 17 August. Available at https://www.worldbank.org/en/news/feature/2022/08/17/what-you-need-to-know-about-results-based-climate-finance.

World Bank Group (2020). Program Alliance Partner Update – Summary of Global Index Insurance Facility Activities in 2020. Annual Report 2020. InsuResilience Global Partnership. Available at https://annualreport.insuresilience.org/global-index-insurance-facility-giif/.

Xiao, H., and others (2019). Weather index insurance for wind energy. Global Energy Interconnection, vol. 2, issue 6, pp. 541-548. Available at https://doi.org/10.1016/j.gloei.2020.01.008.

Yang, W., and Q. Lu (2018). Integrated evaluation of payments for ecosystem services programs in China: a systematic review. *Ecosystem Health and Sustainability*, vol. 4, issue 3, pp. 73-84. Available at https://spj.science.org/doi/10.1080/20964129.2018.1459867.

Zhang, Q., and others (2010). *An Eco-Compensation Policy Framework for the People's Republic of China: Challenges and Opportunities*. Manila, Philippines: Asian Development Bank (ADB). Available at https://www.adb.org/publications/eco-compensation-policy-framework-peoples-republic-china-challenges-and-opportunities.

Independent Evaluation Unit
Green Climate Fund
175 Art center-daero, Yeonsu-gu
Incheon 22004, Republic of Korea
Tel. (+82) 032-458-6450
ieu@gcfund.org
https://ieu.greenclimate.fund

GREEN CLIMATE FUND | Independent Evaluation Unit

TRUSTED **EVIDENCE**.
INFORMED **POLICIES**.
HIGH **IMPACT**.