

# Finance for low-emission food systems:

six financial instruments with country  
examples



INITIATIVE ON  
Low-Emission  
Food Systems



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# Summary

Finance is a crucial ingredient of any scaling strategy for climate action. Finance can be relevant as a direct source of funds for climate investments. But financial instruments can also take the shape of incentives for climate-positive decisions and behaviour, for example in the form of carbon credits and payments for ecosystem services: these instruments generate additional revenue streams for farmers and agribusinesses and thus stimulate them to invest in climate-relevant measures. At a higher macro level, the greening of existing investment portfolios and capital flows can have a large influence on climate-related decisions of companies and households, both urban and rural.

The core of the present report is an exhibit of six cases of financial instruments: green finance, blended finance, carbon credits, payments for ecosystem services, tax incentives and the repurposing of agricultural subsidies. These are examples from a wide array of financial instruments, both public and private, including financing instruments and incentives. The six cases were selected because the research team expected that these instruments could have significant potential to contribute to the low emission food system targets in the four focus countries of the CGIAR research initiative for Low-emission Food Systems (“the MITIGATE+ Project”). The cases include examples of the application of the financial instrument in these focus countries. There are substantial differences in the global market volumes of these instruments, with blended finance and carbon credits being relatively small in US\$ volume in comparison to some of the other instruments.

Each of the six cases starts with a general introduction of the instrument, including its history and global volume, its operating rationale, the typical actors involved and types of investments supported. Subsequently a brief assessment is made of the accessibility and affordability of the instrument, as well as its applicability to the goals of low-emission food systems. Some examples are shown of how the instrument is being applied in the four focus countries mentioned. Each case ends with a few take-aways about the role of the instrument in upscaling low-emission food systems.

The final chapter summarises some early cross-cutting take-aways from the six cases. A first observation is that the maturity of the instruments differs per country, with some instruments being fully deployed in a given country and others still in an infant stage. Some of the instruments can be used in pilot contexts, others – such as tax incentives – are only applicable at larger scales.

Regarding accessibility and affordability, several of the instruments are more suited for the formal economy of agri-food companies than for the informal economy of smallholder farmers and informal traders. Nonetheless, smaller economic actors can sometimes benefit indirectly through aggregation structures, such as cooperatives or service companies. The importance of effective MRV protocols is highlighted, including the transaction and certification costs which can be prohibitive for smaller actors.

Regarding the instruments’ applicability to low-emission food systems, the report notes that some of the instruments are more geared towards the primary production sector (e.g. PES), whereas others intervene more downstream in the chain. For carbon credits and green and blended finance, the application to the AFOLU sector is still limited, but has potential to grow.

Finally, the report shows some examples of synergies between the financial instruments assessed. In such cases, different financial instruments are linked or combined to achieve greater impact. Examples are carbon tax with carbon credits, green with blended finance, PES with carbon credits. Combining financial instruments can also be used as a strategy to achieve double or triple purposes of low-emission food systems, bringing together goals of climate mitigation with climate adaptation and other SDG co-benefits. This often requires concerted long-term efforts of stakeholders in one territory or sector domain, as well as a customised and contextual application of financial instruments.

# Introduction

## Background and relevance

The quest to transition from high-emission to low-emission food systems is often formulated in terms of climate mitigation benefits, in the form of reduced GHG emissions and increased carbon sequestration. But it also encompasses wider Sustainable Development Goals (SDGs)

co-benefits, such as a stronger prioritisation of SDGs, climate adaptation and resilience in the Global South, as well as inclusion of smallholders and women. These goals not only relate to the AFOLU domain and primary production in the food system, but also to agri-food value chains and the wider food system.

### **Box 1: The CGIAR Research Initiative on Low-Emission Food Systems (MITIGATE+)**

*This CGIAR initiative aims to reduce annual global food systems emissions by 7% by 2030. It will work closely with key actors in the target countries to ensure they are equipped to make evidence-based decisions and address challenges in food systems discourse, policy development and implementation to reduce greenhouse gas emissions. The Project will work in four focus countries (Colombia, Kenya, Vietnam, China), possibly followed by three more (Peru, Ethiopia, Bangladesh).*

*One of the work packages in the MITIGATE+ Project focuses on scaling a selection of proven innovations. These key innovations and technologies aim to achieve climate mitigation and other co-benefits in the AFOLU domain, in the framework of the wider food system. Financial instruments are treated as one of the ingredients that contribute to the scaling objective.*

*Source: CGIAR (2022).*

Finance is a crucial ingredient of any scaling strategy for climate action. Finance can be relevant as a direct source of funds for climate investments. But financial instruments can also take the shape of incentives for climate-positive decisions and behaviour (for example in the form of carbon credits and payments for ecosystem services, generating additional revenue streams for farmers and agribusinesses and thus stimulating them to invest in climate-relevant measures). At a higher macro level, the greening of existing investment portfolios and capital flows can have a large influence on climate-related decisions of companies and households, both urban and rural.

Financial institutions use different sustainable financial and technical instruments, the choice of which is guided by their own incentives and by their key client and investor portfolios. Public entities participate in financial instruments, among others through development banks and blended finance models. They also deploy other financial incentives for scaling mitigation measures and innovations, such as subsidies or tax measures. In most cases, such private and public financial instruments involve multiple layers of intermediation and aggregation, before reaching the actual operators on the ground (farmers, agribusinesses). In these layers of aggregation, choices are made regarding their focus clientele, sectoral and geographic focus, finance propositions and conditions, and risk management

arrangements. These choices do not always lead to an efficient allocation of capital through market mechanisms, for example because of social and environmental externalities or because of transaction costs. This may create a case for additional government intervention.

It is therefore important to understand the rationale of the financial instruments, to explore how they can be mobilised for the purpose of low-emission food systems. This report aims to contribute to such understanding.

## Objective

This report contributes to an initial mapping of the global climate finance landscape, and especially the financial instruments that can contribute to the scaling of measures for achieving lower emissions in food systems.

The objective of this report is to explore the potential for deployment at scale of six financial instruments that can support investments in low-emission food systems. The six case profiles are embedded in a global typology of financial instruments for low-emission food systems that was published by Wattel et al. (2023). Together, these two reports constitute the stepping stone for further research into the potential of financial instruments for the scaling of

specific low-emission technologies and innovations in the food system.

The six cases were selected because of their assumed relevance to the promotion of low-emission food systems in the four focus countries of the CGIAR Research Initiative on Low-Emission Food Systems. The six cases selected and their selection process are presented in the Methodology section. Each case discusses one financial instrument, first in generic terms, and then zooming in to the applications in the focus countries of MITIGATE+ (Colombia, Kenya, Vietnam, China).

### Reader's guide

After a presentation of the methodology (Chapter 2), the report is structured into three parts. The first section (Chapter 3) introduces a global typology of financial instruments relevant to the goals of low-emission food systems. This typology serves as a background framework for the cases. The second part (Chapter 4) is the core of the report and consists of six cases, each of them presenting a financial instrument in general terms and in terms of its application in the focus countries of the Project. The third part presents some early cross-cutting take-aways from the six cases.

The objective of the cases is to understand the rationale of each instrument and to explore its applicability to the goals of the Project.

The cases are presented as short case profiles. They are structured into 1: a general description of the financial instrument at global level and 2: examples of the instrument's application in some of the focus countries of the MITIGATE+ Project.

- The general description presents the background of the instrument in terms of origin and global volume, and then explains its operating rationale (actors, investments financed, key conditions). The accessibility and affordability of the instrument are assessed from the perspective of farmers and other actors involved (e.g. companies elsewhere in the food system, finance providers, government, depending on the case at hand). Finally, a reflection is made about the applicability of the instrument to the specific goals of the MITIGATE+ Project (mitigation, adaptation and SDG co-benefits).
- The country examples for each instrument follow a similar outline, but in a slightly more compact version. Some of the country examples focus on a single application, whereas others show the instrument's deployment in the country in more general terms.
- Each case concludes with take-aways related to the role of the instrument in the scaling of low-emission food systems.

After the six cases, the report concludes with general observations as well as some early cross-cutting lessons learnt from the six cases.

*This study has benefited greatly from input from country-level experts of MITIGATE+ in the form of interviews, collegial discussions and supplementary information on examples of how climate finance for low-emission food systems works in practice. These experts have also contributed as co-authors to the writing and reviewed this synthesis report. Any remaining errors are the sole responsibility of the lead authors.*

# Methodology

## Methodology

The case studies in this report are primarily based on a review of available literature, both academic and professional.

The literature review was complemented with several rounds of collegial discussion between the WUR research team and each of the CGIAR country experts. The first round of discussion was to identify the relevant financial instruments in each country. The second round was to identify essential country literature about the selected cases and to clarify facts and context. The third round was to validate the case descriptions and analysis.

The six cases of financial instruments were selected after an inventory of the most relevant financial instruments by consultation with the involved CGIAR country experts in

Colombia, Kenya, Vietnam and China. The inventory listed financial instruments and financing initiatives in each country that the CGIAR country teams considered promising for the objective of scaling low-emission food systems. From this inventory, six cases were selected representing instruments that are relevant for several of the focus countries. This is expected to make the report useful for different country teams in the project. The cases highlight specific financing instruments rather than funding sources or funds. For that latter reason, programmes and grants as a generic category was excluded from the selection, even if in some countries it may be the single most important source of funding for climate action in the food system.

The six cases of financial instruments assessed are the following (country examples in brackets):

Case of financial instruments
<b>Case examples of private financial instruments</b>
Case 1: Green finance (KE, CH, CO)
Case 2: Blended finance (CO, KE, VN)
<b>Case examples of private incentives</b>
Case 3: Carbon credits (CO, KE, VN)
Case 4: Payment for Ecosystem Services (KE, VN)
<b>Case examples of public financial instruments</b>
Case 5: Tax incentives (CO, KE, VN)
Case 6: Repurposing agricultural subsidies (CH, KE)

## Global market volumes of the different instruments

Although the different types of financial instruments cannot be easily compared (“apples and oranges”), and some

overlaps may exist between the different instruments, some insight can be drawn from comparing the total global volumes of the different instruments (Figure 1).<sup>1</sup>

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<sup>1</sup> The sources of the different figures can be found in the respective case chapters.

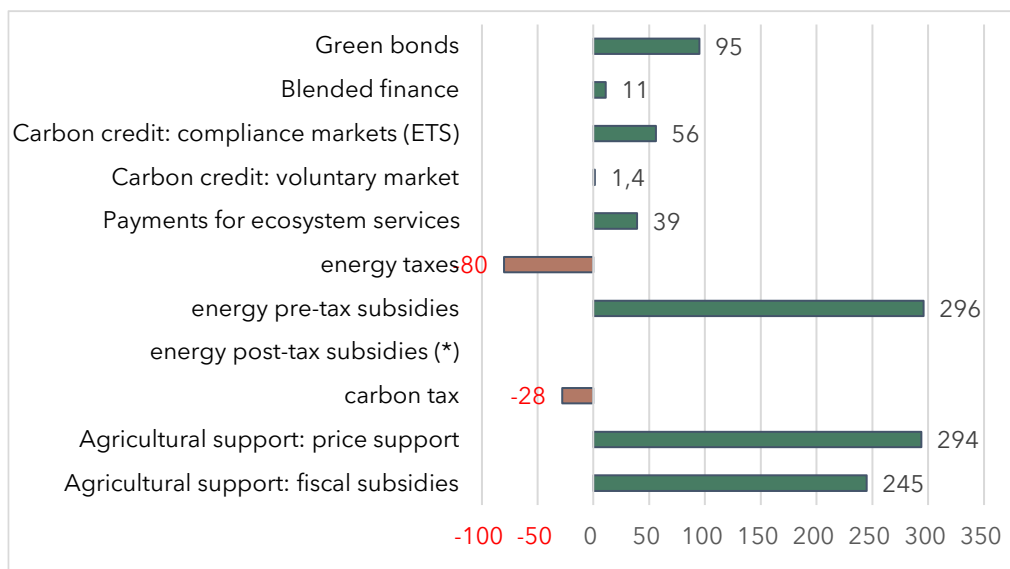


Figure 1. Global market volumes of different instruments, estimated annual turnover, US\$ billion<sup>1</sup>.

(\*) Energy post-tax subsidies are not included here. Post-tax subsidies occur when taxes do not reflect the full social cost of carbon emissions, local air pollution and vehicular externalities.

First, the private financial instruments are quite different in market size: green bonds are a far larger global market than blended finance (about eight times as large). Second, the voluntary carbon market is very small in comparison to the compliance market for carbon credits (US\$ 1.4bn compared to US\$ 56bn). The global Payment for Ecosystem Services (PES) market is a slightly smaller market than the total carbon market, but still substantial (US\$ 36-42bn). By far the largest instruments – in global volume – are the agricultural subsidies, with a total of US\$ 540bn, and the energy subsidies (US\$ 296bn). Energy taxes (US\$ 80bn) are a fraction of energy subsidies, showing that in net terms energy is subsidised rather than taxed, even without taking into account the so-called post-tax subsidies. All in all, the cases described represent only a fraction of the total variety and volume of global climate finance (US\$ 652bn) (CPI 2021). Moreover, it is important to recall that the volume proportions may be quite different in specific countries, such as the focus countries of MITIGATE+, and in specific sectoral domains (such as the food system).

### Assessment criteria

The cases are presented in terms of descriptive criteria and assessment criteria.

The descriptive criteria used are:

- *Background and definition:*
  - History: What is its historical origin and context?
  - Volume: What is its global market size? The best estimates about its global market volume are presented, from different available sources. Global market volumes (in US\$) represent the financial instrument as a whole, and not the specific figures about volumes targeted at low-emission food system investments as the latter figures are not readily available.
- *Profile:*
  - Operating rationale: What is the instrument's operating rationale? How does the mechanism work?
  - Actors: Who are the typical actors involved, both at the supply and the demand side of the financial instrument.
  - Investments financed: What kind of investments are typically financed? (as close as possible to low-emission food system investments).
  - Financing conditions: What are the key financing conditions? (at a high level).

The assessment criteria used are:

- *Accessibility and affordability:*
  - *Accessibility:* Is the financial instrument accessible for different kinds of users? (farmers and other food system actors). Are there important challenges for providers of the instrument to reach out to food system actors?
  - *Affordability:* are there important barriers to affordability of the financial instrument, such as high costs?

Accessibility and affordability are analysed from the farmers' perspective and from the perspective of other actors, such as food chain actors or the providers of the financial instrument.

- *Applicability:* is it easy to apply the financial instrument to the goals of low emission food systems, such as climate mitigation, climate adaptation and SDG co-benefits?

Accessibility and affordability are key concepts in the international definition of inclusive finance (UNSGSA 2023, World Bank 2022b). The criterion of applicability is introduced to assess whether a generic financial instrument can be applied specifically to the goals and domain at hand: investments in low-emission food systems.

The country examples under each financial instrument follow a similar sequence, but in a more condensed form. They first describe the financial instrument, then assess its accessibility and affordability, and finally reflect on the upscaling potential of the financial instrument for the purposes of low-emission food systems.

At the end of each case, some key take-aways are formulated about the upscaling potential of the financial instrument to achieve a low-emission food system.

## Limitations

The six cases highlight a limited set of instruments, out of the wide variety of climate finance instruments. The selection was based on consultations with the involved CGIAR country staff and focuses on instruments that are used in several of the Project's focus countries.

The report is not intended to provide country-level overviews of financing for low-emission food systems. The entry point for the cases was the financial instrument, and the country examples are illustrations of how this instrument has been applied in the focus countries.



# Typology of financial instruments for low-emission food systems

Before we zoom in to the six cases, we will briefly present a global typology of financial instruments for low-emission food systems. This typology will serve as a background framework for the six case studies presented in Chapter 4.

A more extensive version of this typology was published in a white paper (Wattel et al. 2023). The white paper also contains some global figures about climate and mitigation related finance and its applications in the food system domain, as well as a reflection on how financial instruments can be used for scaling low-emission food systems.

## Typology

The global typology of financial instruments for low-emission food systems considers those instruments that are relevant to GHG mitigation in the food system, that is, in the AFOLU sector and the wider agro-food domain. It considers

all investments from financial institutions, investors and public entities that are made into businesses and farms with the goal to redirect existing capital flows towards a low-emission transition. Figure 2 provides a graphical presentation of the typology.

The typology covers two large groups of instruments, visualised in the upper row of the Figure:

- Private instruments;
- Public policy instruments.

Each of these two groups is divided into financial instruments (reimbursable) and incentives (not reimbursable). In the case of the public policy instruments, a third subgroup covers the enabling environment instruments, such as laws, regulations and policies.

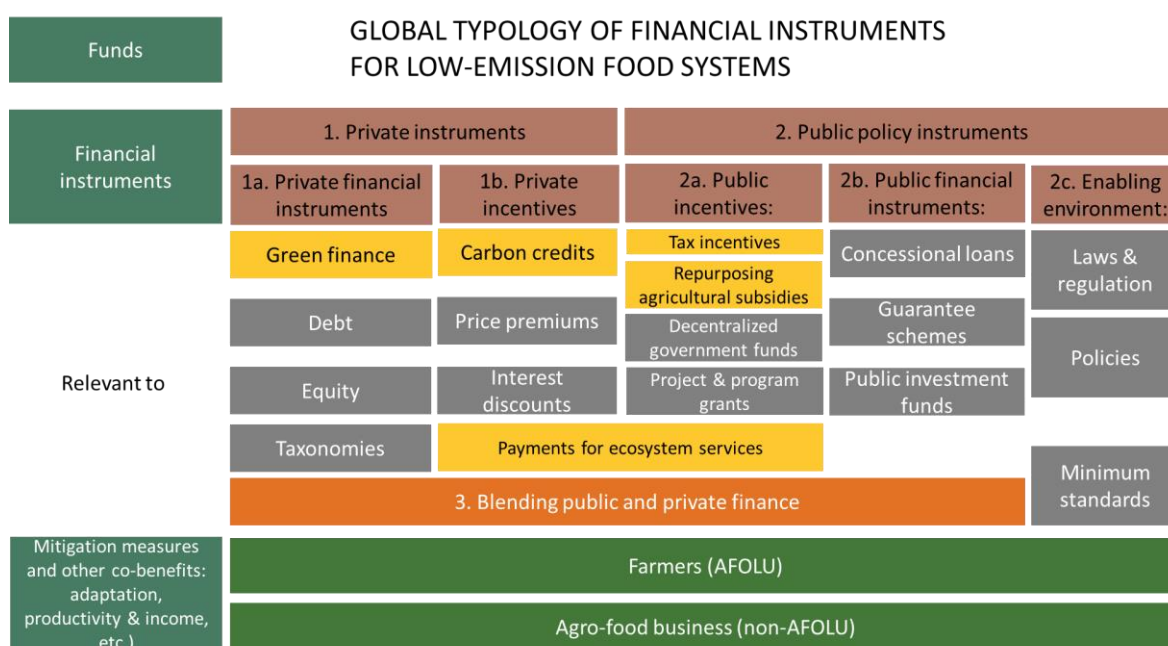


Figure 2. Global typology of financial instruments for low-emission food systems.

## Private financial instruments

In the first group, the financial sector offers financial products and services such as loans, equity investments, insurances, guarantees and bonds.<sup>2</sup> These financial products have a commercial basis: they are reimbursable and carry a cost in the form of interests, fees, insurance premiums or dividend payments. Under the general heading of private financial instruments, many different financial products exist, each with their own purpose and target clients: some are more intended for smallholders' farmers, other are meant to serve commercial farmers, agribusinesses and food companies, or are designed to operate in the world of capital markets and investors.

In the space of climate and environment, financial institutions can offer specific products such as sustainability linked loans to farmers and agribusinesses, as well as green products for retail clients (e.g. green investment funds, green credit cards).

Green finance refers to investments that provide environmental benefits (IFC/World Bank 2017). It helps businesses to obtain capital for an environmentally friendly purchase, project or investment at as low as possible costs. And it helps small investors, but also institutional investors such as pension funds or insurance funds, who are looking for more green investments in their financial portfolios.

In the sphere of capital markets, more sophisticated instruments appear such as green bonds, investment funds that are ESG screened (that is, on Environmental, Social and Governance criteria) and fossil free, responsible investment funds registered on the stock exchange, and so-called yield companies operating wind or solar energy parks, all just examples of financial instruments to accelerate the low-emission transition. Financial institutions also engage in market transactions to reduce the risk of (climate related) price fluctuations for their clients or futures, options are linked to sustainable funding instruments, such as green bonds. This also includes low emission certified soft commodities such as agricultural produce and livestock.<sup>3</sup>

All these financial instruments should make it easier for investors to put their capital into more environmentally-friendly projects. In turn, this would increase the financing available for businesses and farmers who wish to operate in

a climate- and nature-friendly manner. The EU taxonomy for sustainable activities and similar catalogues of sustainable measures and investments are being developed and operationalised to give this development more impetus.<sup>4</sup>

## Private incentives

The second category of instruments consists of incentives of different types, paid by private sector parties for more sustainable products. A prominent example is carbon credits, paid by businesses or households who want to compensate for their emissions, to agricultural producers or supply chain companies who remove or reduce them (see Box 5, later in this document). Other examples are price premiums for sustainable and climate-friendly products, interest discounts on climate investments and an increasing supply of green and sustainable finance capital.

All these incentives are conditional upon clear definitions and standards for sustainable practices and measures, driven by evidence-based impact frameworks, operationalised through compliance monitoring (e.g. certification, traceability, registration) and governed by an architecture that safeguards integrity at scale. The effects of such standards have been widely studied for voluntary sustainability standards (Oosterveer et al. 2014; Troester et al. 2018). For the carbon credit market, several standards are operational but the global integrity architecture is still being upgraded (World Bank 2022a; ICVCM 2023).

## Public policy instruments

The third group of instruments are the public policy instruments. Many if not all public policies can have an impact - positive or negative - on the shift to low-emission food systems. But a few policy domains stand out: (renewable) energy policy, carbon pricing and trading, forestry and farming policies, land use and environmental policies, nutrition and dietary policies, agricultural trade policies, corporate responsibility policies, financial sector policies and cross-sectoral innovation policies.

Under these policies a wide array of instruments is applied, usually in the hands of governments, public agencies and non-profit organisations. The public incentives can range

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<sup>2</sup> In this report, loans and debt are used as equivalents: they bear a fixed interest rate and need to be repaid in a pre-defined period. Equity investments refer to investments in capital shares of a company: the investor receives a dividend if the company makes a profit and can sell the shares after a certain period. Bonds are a flexible variant of loans: larger companies can raise debt capital by issuing bonds; investors gain a fixed interest on the bond and can buy and sell the bonds on the capital market.

<sup>3</sup> The futures and options contract would contain a provision linking it to a green certificate. Making debt swaps green means that lending countries waive repayments in exchange for the borrowing country undertaking climate mitigating actions.

<sup>4</sup> More details about the EU taxonomy and similar catalogues can be found in the whitepaper (Wattel et al. 2023, section on Measures).

from taxes and tax incentives to subsidies, grants and innovation funds. In the subgroup of public financial instruments (reimbursable), we observe public debt instruments such as concessional loans, public investment funds providing share capital in projects, and public guarantee funds. Many of these public financial instruments and incentives are currently facilitating high-emission food systems, for example through subsidies on fossil fuels and inorganic fertiliser. To make public financial instruments supportive to low-emission food systems, the instruments promoting high-emission food systems need to be reoriented and new instruments to stimulate low-emission innovations need to be deployed (Feng et al. 2022).

Payments for ecosystem services (PES) is one specific example, often applied to goals of biodiversity, nature conservation and reforestation in connection with hydropower, water supply and tourism sectors. Payments for ecosystem services are performance-based incentives for communities and economic actors around certain ecosystems, in exchange for them to protect the ecosystems.

Governments also have non-financial instruments at their disposal, such as legislation, regulation and standard-setting, which can be quite influential for mitigation purposes. Regarding the financial sector policies, recent examples are the central banks' increasing interest for climate change risks in financial institutions' portfolios (OMFIF 2019), and the EU taxonomy for sustainable activities.

### **Blended finance**

A fourth group of instruments could be called blended finance. In blended finance, private and public finance

instruments are combined to reach goals that none of these instruments could achieve separately. The blended finance approach usually includes a number of private and public partners that divide investment risks according to their goals and their ability to carry risk. Hereby public finance can help reduce risks with concessional tranches in the capital structure of the asset. These can take for example the form of equity grants for project development, first-loss guarantees, credit guarantees, or capped returns (Convergence, 2022). A Convergence data brief on blended finance for food systems highlights how blended finance can support the growth of sustainable food systems, by breaking down 127 blended finance transactions into how they have been applied across the food value chain, namely growing (63%), processing (46%), storage and transport (10%), trading and market access (10%), and vertically integrated (17%) (Convergence, 2022b).

### **Financial instruments throughout the food system**

Financial instruments for lower emissions can be applied in different places in the food system (see Figure 3). For example, carbon credits are originated mostly in the production and supply chain stages of the food system, whereas they are bought by households and companies outside the food system. Green bonds are issued by financial institutions or by a select group of corporate companies in the supply chain, but green loans may be applied anywhere in the supply chain including the primary production and the pre-production (providers of inputs, equipment and services). Some tax instruments are typically applied at consumer level (e.g. meat tax, zero VAT for fruits and vegetables), others are more applicable in the production sector (e.g. tax credits for certain sustainability activities) and elsewhere.

## Financial instruments throughout the food system - some examples

	Pre-production	Production / AFOLU	Post-production	Consumption	Disposal	Other sectors (hh's, companies)	Landscape level (cross-sector)
Private financial instruments (FIs)			Green bonds			Green credit cards & wallets	
	Green loans & investments					Green inv. funds	
	DFI loans					Green pensions	
					Land acq. funds		
Private incentives	Carbon credit (CO <sub>2</sub> C) originators					CO <sub>2</sub> C buyers	
	Sustainability premiums / GHG labelling						
	Interest discounts based on sustainability criteria						
Public incentives		Payments 4 Ecosystem Services (PES)					PES
	Carbon taxes	Works 4 Taxes		0-VAT for F&V	Waste recycling incentives		Landscape finance
	Energy taxes			Meat tax			Incentives for sustainable production systems
	Climate innovation subsidies & grants						
	FLW incentives						
Public FIs	Concessionary loans for "green" and climate purposes						
Blended finance	Various mixes of public and private funding						

Figure 3. Financial instruments throughout the food system - some examples.

Whereas a large number of instruments can theoretically be applied in the primary production and in the downstream supply chain, in practice there seems to be a bias against primary production, and against informal (micro and small)

enterprise and smallholder farmers. This bias is related to typical problems of aggregation, transaction costs, information transparency and risks.

# Cases

## CASE 1: GREEN FINANCE

	<b>Instrument: GREEN FINANCE</b>
	Category: Private financial instruments

### Background and definition

Green finance is a sub-category of sustainable finance, the financing of investments that integrate environmental, social and governance (ESG) considerations into the investment decisions (Green Finance Platform website). A schematic overview of sustainable finance and green finance is shown in Figure 4. Green finance refers to those financial

investments made into projects and initiatives to accrue positive benefits to the environment (World Economic Forum, 2021; IFC, 2017). It refers to any financial instruments whose proceeds are used for environmentally sustainable projects and initiatives, environmental products and policies under the single goal of promoting a green economic transformation toward low-carbon, sustainable and inclusive pathways.

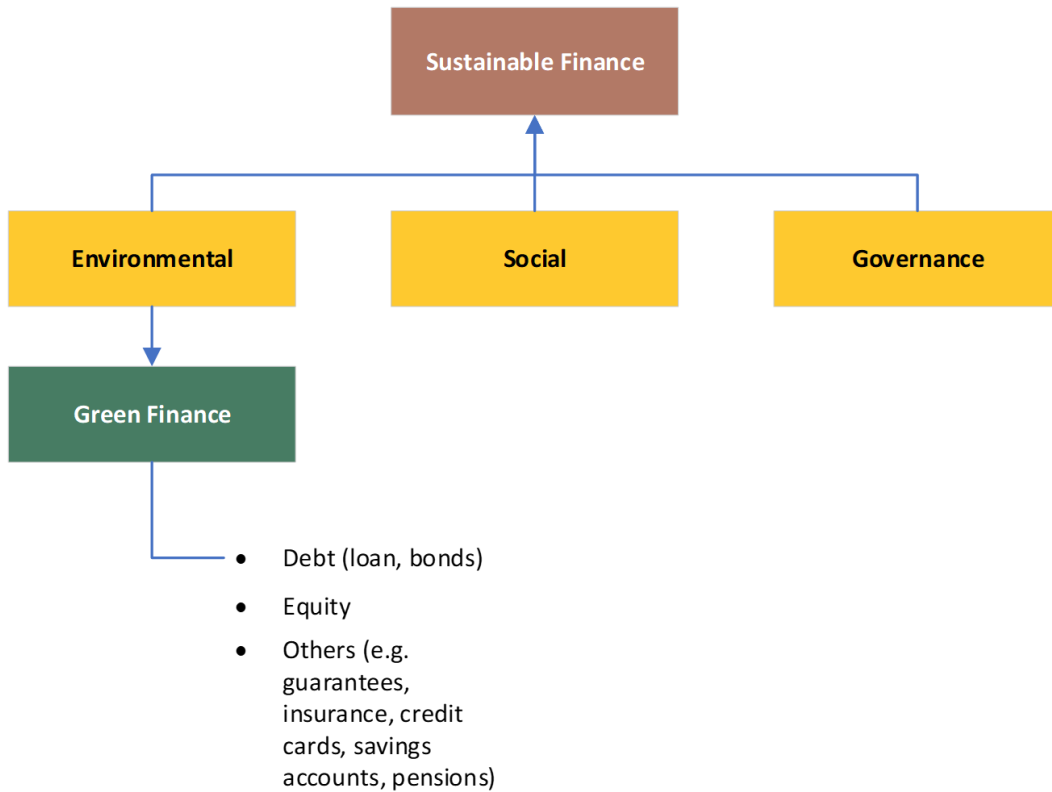


Figure 4. Green finance as a sub-category of sustainable finance.

## History

The first green bond<sup>5</sup> was issued in 2008 by the World Bank in response to the Intergovernmental Panel for Climate Change's (IPCC) report in which the need to consider financing projects that contributed positively to the environment were encouraged.

## Volume

Today, more than 50 countries have issued green bonds with the United States being the largest source of green bond issuances. The East Asia and Pacific region is the region with the main green bond issuance, with China being the fourth largest volume of green bonds globally, with US\$ 59bn in 2021 issuance. Conversely, Colombia's green bond market remains relatively small, with issuance of around US\$ 1bn by the end of 2021 (IFC 2022). In contrast, green bond markets in Sub-Saharan Africa and South Asia are still in nascent stages, with Kenya's issuance standing at US\$ 58m and Vietnam's at US\$ 227m (IFC, 2022).

## Profile of the instrument

### Operating rationale

The predominant financial instruments in green finance are debt and equity (Krushelnyska 2019). Debt can take the form of green loans from financial institutions to companies. Alternatively it can take the form of green bonds issued by financial institutions or by a select group of corporate companies who are able to raise their capital directly from the capital market. Green bonds are earmarked exclusively for new and existing projects that have environmental benefits (IFC 2022). These bonds typically come with tax advantages to encourage adoption and bridge the green funding gap (Chang et al. 2021).

### Actors

The main suppliers of green loans are (international and domestic) financial institutions. Green bonds are generally issued by larger corporates, banks, governments and supra-national organisations.

In the AFOLU sector or the wider food system, the users of green finance could be local, regional or national producers or producer communities, who make investments into projects and initiatives to accrue positive benefits to the

environment. An example is the Green Investment Fund (GIF) of the Asian Development Bank (ADB), which makes equity investments into small and medium-sized enterprises (SMEs) in eco-tourism and eco-agriculture. See details in Example Box 2.1.

## Investments financed

Green loans and bonds can be applied anywhere in the supply chain, including the primary production and the pre-production (providers of inputs, equipment and services) or the post-production (trading, stocking, processing). Targeted investments generate environmental benefits. Typical examples of green finance are loans for renewable energy, climate-smart agriculture, sustainable agriculture, sustainable supply chain solutions and waste management. Sectors such as renewable energy, including wind and solar power, have been significant users of green bonds. These projects require substantial upfront investments and benefit from long-term financing options provided by green bonds.

## Conditions

International standardisation of criteria is the main condition for green finance and green bonds (i.e., through a green taxonomy). Standardisation assures the financier that certain green conditions are met. For green bonds, key relevant international standards are for example the Green Bond Principles (GBP), Climate Bonds Standards, European Union Green Bond Standards and International Capital Market Association Standards. The GBP developed under the auspices of the International Capital Markets Association (ICMA) have four components: use of proceeds, process for project evaluation and selection, management of proceeds, and reporting. A number of countries and jurisdictions have developed their own set of guidelines for green bond issuance, many of which align with the GBP (IFC, 2021). A national initiative should thus adhere as much as possible to these standards to tap into the international financial markets, see for example the Kenya Sovereign green bond framework (Republic of Kenya, 2021).

## Accessibility and affordability

### Farmers' perspective

Green finance helps businesses to obtain capital for an environmentally friendly purchase, project or investment at

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<sup>5</sup> Green bonds are one of the instruments of green finance (see Figure 4). A bond is a debt certificate issued by a government, a

financial institution or a larger company. By issuing bonds, the organisation can borrow money from investors in the capital market.

as low as possible costs. However, for the informal enterprises, including smallholder farmers but also smaller agri-food SMEs, green finance is not a direct financing option, because they often have difficulties accessing the services of formal financial institutions. They might benefit indirectly if their larger business partners have access to the green finance market; these business partners can then transmit the green conditionality to their supply chain, in exchange for a share in the financial benefits of green finance (e.g. access to loans, interest rate discounts).

### Other actors' perspectives

Green finance and green bonds mechanisms are typically accessible for companies that have access to the capital market or to formal financial institutions. These companies can issue green bonds themselves, or can ask financial institutions to provide finance to them under green conditions. Such companies can be found mostly in the pre-production and post-production segments of the food system, and in large-scale agriculture and forestry.

Green finance is an instrument for institutional investors, such as pension funds or insurance funds, who are looking for more green investments within their financial portfolios. Developing their green finance portfolios often comes with

challenges. Most importantly, they may have capital to invest, but it is often hard for them to find good projects for their portfolio, that is, projects that meet their requirements of scale, operationality and profitability, and with a project owner who can provide a solid track record and collateral.

### Applicability for MITIGATE+ goals

How can green finance be applied to achieve reduced GHG emissions, increased carbon sequestration and other SDG co-benefits? Green finance and blended finance partially overlap each other and so does the applicability for MITIGATE+ goals. As with blended finance, reaching smallholder farmers and informal MSMEs in the value chain is challenging, even indirectly through intermediaries such as farmer organisations or cash crop commodity systems. There are trade-offs and compatibility between green finance goals and low emission and inclusiveness goals. The effects of green growth policies, such as increasing energy prices to support renewable energy, can have negative income effects on impoverished individuals (Pegels 2015). Therefore, there is a need for comprehensive analysis and policy design to ensure that green finance goals align with low-emission and inclusiveness goal.

## Examples from MITIGATE+ focus countries

<b>Example box 1.1</b>	<b>GREEN FINANCE</b>
	Country: Colombia
	Who/provider: Government (sovereign green bonds), Large transport and utility companies (green bonds), Commercial banks (green loans)
	Size: Green, Social and Sustainability (GSS) bonds issued: US\$ 1.3bn (by mid-2021), of which 52% is green bonds and the remainder sustainability or social bonds. Most of this is issued in national currency (Colombian Peso).
	Unit size: green bonds in 2019-2020 were issued in sizes between US\$ 30m and US\$ 80m each.
	Regions: national

### A. Description of mechanism

The bank supervisory authority (Superintendencia Financiera de Colombia, SFC) is taking four measures for greening the financial system:

- A taxonomy for green investments is being elaborated, based on international good practices.
- Good practice guidelines are being developed for financial institutions and pension funds to provide guidance on the incorporation of ESG criteria in their investment decisions and risk management processes.
- Efforts are made to standardise ESG reporting and ESG transparency by financial institutions.
- New analytical models are being developed – in a joint effort of the Central Bank and the bank supervisory authority – to forecast the impact of climate risks and other environmental risks.

Clavijo Ramírez et al. (2020) distinguish different roles that central banks can play to stimulate the greening of the national financial system:

- Applying ESG criteria in the investment of the country's foreign exchange reserves.
- Applying ESG criteria in its monetary policy, i.e. in the acceptance of financial assets that commercial banks pledge with the central bank in exchange for liquidity.
- Integration of ESG risks in the monitoring of the financial stability and the supervision of commercial financial institutions.

The Central Bank of Colombia is monitoring the discussion on the application of ESG criteria, for its own investment policies regarding the country's foreign reserves. The Central Bank is taking a cautious stand, emphasising that the law induces the bank to manage the foreign reserves in terms of only financial criteria, such as security, liquidity and profitability (Toro 2022). Therefore, any strategy to include ESG criteria in these policies must be compatible with the financial criteria mentioned. The Central Bank also emphasises the hurdles for applying ESG criteria, such as the small market for ESG investments and the lack of international standardisation of ESG criteria. But it explains that ESG criteria are applied indirectly, because the credit rating agencies and asset managers whose services the Central Bank uses have included ESG criteria in their assessments.

The Colombian government has taken several policy measures to contribute its share to the greening of finance (World Bank 2022a):

- Development of a local green bonds market, based on a green bond framework in accordance with the Green Bond Principles of the International Capital Market Association (ICMA). The government issued its first sovereign green bonds in 2021, that is, government bonds for green purposes, for an initial amount of ~US\$ 300m. The first issuances had an impact on the financial market: the demand outnumbered the available bonds by a factor 3:1 and the "greenium", that is, the interest differential between green bonds and conventional bonds, increased from 0.07% to 0.15% per annum.
- Development of the green taxonomy (mentioned above), with support of the World Bank to develop the AFOLU criteria in this taxonomy.
- Inclusion of ESG criteria in the public-private concessions for key infrastructure for rail, river and air transport
- Inclusion of ESG criteria in the financial sector (see above)
- Inclusion of credit lines through FINAGRO targeted at explicit societal goals. The new National Development Plan (NDP) provides strategic orientations for this and is in process of being elevated to the status of law.

Various commercial banks in Colombia have started to issue loans with positive impact goals (Portafolio 2021). Achievement of the agreed impact goals is remunerated with an interest rate discount. The first examples, however, are connected to the purchase of electric cars, sustainable housing, renewable energy and green bonds, and not related to the food system.



## B. Accessibility and applicability

The Colombian government is aware that smallholders constitute a large part of the AFOLU sector. Therefore the taxonomy formulates land use improvement criteria for three levels of cost and complexity: basic, intermediate and advanced. The more basic levels should enable small farmers to apply land use improvements and benefit – at least in theory – from green bonds and green investments (World Bank, 2022).

## C. Upscaling

Colombia is being recognised as a front-runner in green finance and green bonds in Latin America. The policy and regulation measures taken are intended to achieve impact at scale. However, for green finance to be applicable to specific innovations or technologies promoted by the CGIAR network, these innovations need to be applied in a company context with larger business partners who have access to the green finance market. Alternatively, the benefits from green finance may be realised indirectly through aggregation of informal enterprises and smaller farmers into linkages with the larger companies.

Example	GREEN FINANCE
box 1.2	Country: China
	Who/provider: Top-Down Governance model of green finance: mandated by the State Council, organised by the Peoples Bank of China, and implemented by central government ministries and regulators
	Size: Green loans: US\$ 1.2tn by 2017. Green bond issuance: US\$ 59bn in 2021
	National

### A. Description of mechanism

China has made significant progress in green finance, driven by strong commitment from the central government that have been implemented through a top-down governance model. In 2015, two major policy documents have served as the foundation for green policies in China:

- The “Opinions of China’s central party committee and the state council on accelerating the development of ecological civilisation”, and
- The “Overall plan for the structural reform for ecological civilisation”

China has a separate definition of green credit and green bonds, known as the “Chinese taxonomy” (regulation concerning green bonds) (OECD, 2020). There are disparities between China’s local green bond guidelines and international standards. While the international guidelines focus on climate change adaptation and mitigation, China’s domestic guidelines also highlight additional environmental benefits such as pollutant reduction, resource conservation, and ecological protection, in addition to GhG (China Green Bond Market, 2019).

### B. Accessibility and applicability

Chinese banks are the primary sources of green finance in China. By the end of 2017, 21 major Chinese banks had collectively provided US\$ 1.1tn in green loans, which accounted for around 9% of their total lending. Based on data from the Climate Bonds Initiative (CBI), China was the second largest global issuer of green bonds in 2019, issuing a total of US\$ 31.3bn, following the USA with US\$ 51.3bn issued. However, it is worth noting that US\$ 24.2bn of Chinese green bond issuances were not considered compliant with international green bond standards and were excluded from the figures provided by CBI (OECD 2020). It is not known how much of the green finance is invested in the food system.

An example from China is the Green Investment Fund (GIF) of the Asian Development Bank (ADB). GIF makes market-based equity investments into small and medium-sized enterprises (SMEs) in eco-tourism and eco-agriculture in the watershed of the Xin’an River and Huangshan region, whereas its sister fund Green Incentive Mechanism (GIM) provides incentives of ecological compensation to farmers. Both funds together work with the objective of better watershed management and green development (Fan et al. 2022).

### C. Upscaling

Specific areas of green finance seem to gain prominence in China based on an analysis of recent speeches by leading policy makers and think tanks. The People’s Bank of China will improve and apply successful practices and experiences of green finance to support transition activities (Nedopil and Song 2023).

<b>Example box 1.3</b>	<b>GREEN FINANCE</b>
	Country: Kenya
	Who/provider: Government, Commercial Banks, Development partners and finance institutions
	Size: unknown

### A. Description of mechanism

In Kenya, sources of green finance are mainly external loans and grants from international public institutions. However, the national government also allocates budget to climate and/or green related projects. On average, 40% of these funds were raised domestically and 60% from international sources in 2019/2019 (FSD, 2022). The National Drought Management Authority estimates the value of private sector investments (national and international) in the renewable energy sector to be about US\$ 2.8bn (Odhengo et al. 2019, GoK 2018), driven mainly by tax incentives provided by the government. The investments are in geothermal, small hydroelectric projects, biomass and solar energy.

In 2020, Acorn Holdings Ltd, a real estate firm, in partnership with Private Equity Fund Helios was able to issue the first Green Bond instrument in Kenya. The purpose of the bond was to finance the construction of student hostels that are environmentally friendly (KBA 2021). In the same year, KCB Bank was accredited by the Green Climate Fund (GCF), making it eligible to receive GCF funds for on-lending towards green and climate friendly projects.

### B. Accessibility and applicability

Examples in Kenya of interest in the current study are the Green Bonds programme (see below) and the Green Climate Fund's on-lending through domestic banks. It is not known how much of the green finance is invested in the food system.

The Green Bond Programme in Kenya is coordinated by Kenya Bankers Association (KBA), Nairobi Securities Exchange (NSE) and Climate Bonds Initiative (CBI) in conjunction with the Sustainable Finance Initiative. The Green Bond programme is endorsed by the Central Bank of Kenya, Capital Markets Authority and National Treasury. This programme aims to accelerate the take-up of green bonds as a tool for Kenya to tap into international and domestic capital markets to finance green projects and assets.

KBA, a lobby group for banking institutions in the country, has recently been steering sustainable finance transformation in the sector. The initiative aims to raise awareness on both environmental and social (E&S) risk management in the banking sector and business opportunities linked to sustainability. It intends to encourage banks to comprehensively address E&S risks in their lending and investment practices, and engage on a sector-wide E&S initiative to build capacity within Kenya's financial institutions (FMO 2021).

### C. Upscaling

According to the Green Economy Strategy and Implementation Plan (GESIP 2016-2030), Kenya needs around US\$ 17bn to implement green projects in the country by 2030. The food system is not specifically mentioned, but the Plan covers the following thematic areas: sustainable infrastructure, building resilience social inclusion, and sustainable livelihoods, applicable at different levels of the supply chains. The Government also plans to issue its first sovereign green bond and speeds up the formation of a Kenya Green Investment Bank. Under the draft green fiscal incentives policy, the bank will be responsible for developing credit guarantee instruments and schemes to enhance access to finance for green investments (ZAWYA, 2023) for government and private projects such as investments in renewable energy, energy efficiency, green transport and waste-water treatment.

## Key take-aways for up-scaling strategy and role of finance

Financial institutions are developing green finance criteria that conform to global or national taxonomies. Farmers and other business owners in the food system are becoming more inclined to invest in green measures as it allows them to grow and provides them with financial incentives through loans with lower interest rates.

Farming in general, and informal agro-food MSME enterprise (including smallholder farmers), are not easily financed by formal financial institutions, hindering the reach of green finance in the food system. Nonetheless, farmers and informal enterprise may be reached indirectly, through their

relations with formal companies, such as agribusinesses or food processors, who are eligible for green finance. These companies can play a pivotal role by investing in sustainable farming practices, providing technical assistance and establishing supply chain relationships that indirectly benefit farmers and informal enterprises. This indirect approach becomes particularly relevant when considering different labels or certifications, as formal companies can leverage green finance to support their suppliers in meeting the requirement associated with those labels, promoting sustainable and inclusive practices throughout the food system. The financial sector supports these investments with green loans and green bonds, which can help green and climate-friendly food practices to scale up.

## CASE 2: BLENDED FINANCE

	<b>Instrument: Blended finance</b>
	Type/sub-type: Blended finance

### Background and definition

Blended finance (BF)<sup>6</sup> is a financial instrument that combines public, philanthropic and private capital sources with the aim to leverage the strengths of each source of capital and reduce risks for private investors, while unlocking private capital to achieve development objectives at scale. The World Economic Forum and the Organisation for Economic Co-operation and Development (OECD) officially define BF as 'the strategic use of development finance and philanthropic funds to mobilise private capital flows to emerging and frontier markets' (OECD/World Economic Forum (2015).

### History

The term 'blended finance' was first used in the early 2000s, but has become internationally acknowledged as an investment approach since 2015, when multilateral development banks endorsed it as a tool to mobilise private funding for development purposes (World Bank/International Monetary Fund (2015).

The majority of investments in Agriculture, Forestry and Land Use (AFOLU) are financed by grant and debt instruments, primarily from public sources, with limited private investments (Wattel et al. 2023). Multiple barriers hinder private investments in AFOLU sectors, including perceived risks, upfront and transaction costs, small tickets sizes, long pay-back periods, and low returns (CPI, 2021). To bridge the gap between public and private finance in AFOLU sectors, BF has emerged as a promising innovative financial mechanism to mobilise private investors into these

sectors (CPI, 2022). BF provides an opportunity to increase private sector involvement in AFOLU sectors. In fact, BF has become an important instrument to support the 2030 Agenda for Sustainable Development, and have gained momentum in AFOLU sectors accounting for 28% of total BF deals in 2020, compared to only 16% between 2015-17. The energy and financial services sector are also active sectors for BF, with 35% and 26%, respectively (Convergence, 2021).

### Volume

The annual blended finance volumes remained relatively constant between 2015 and 2019 around US \$11bn globally. It declined by more than 50%, to US\$ 4.5bn in 2020, in the context of COVID-19 (Convergence 2022). Compared to mitigation activities, climate adaptation efforts have represented a minority share in climate blended finance, with the exception of global transactions where 50% of allocations are for adaptation and 25% for mitigation activities. Particularly, Sub-Saharan Africa, Latin America and South Asia have been allocated notably low percentages of funding for adaptation compared to other regions. However, these regions have seen the highest percentages of funding allocated to mitigation efforts (Figure 5). The largest volumes of financing have flowed to transactions with a global focus (US\$ 5bn), then SSA (US\$ 4.5bn), followed by Latin America (US\$ 4.4bn). Conversely, the lowest volumes of financing have been allocated to transactions in East Asia and the Pacific (US\$ 1.3bn), the Middle East and North Africa (US\$ 960m), Europe and Central Asia (US\$ 220m).

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<sup>6</sup> "BF" is used as an abbreviation for Blended Finance in this case study.

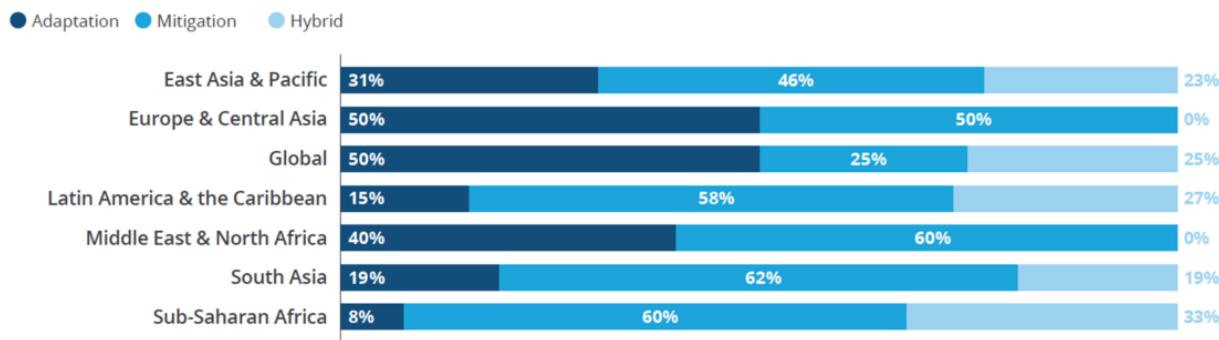


Figure 5. Proportion of climate blended finance transactions, 2019-2021.

Source: Convergence (2022a). State of blended finance 2022.

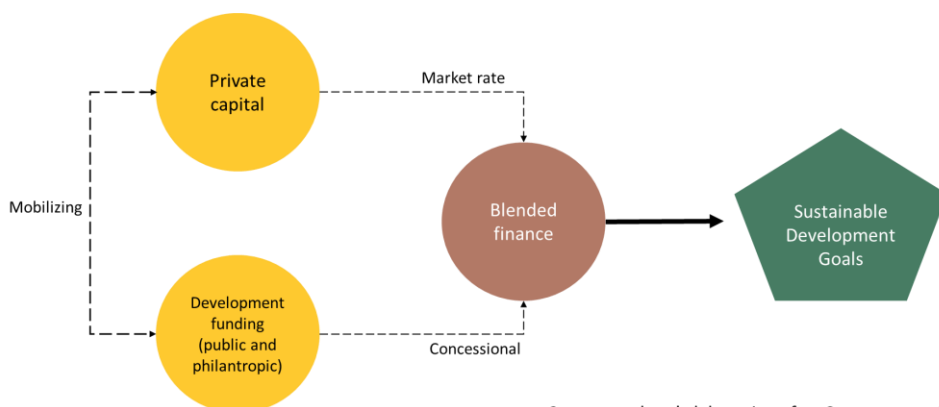
### Where in case countries and food systems

In a recent brief by Convergence (2022b), an analysis of 127 transactions focused on the agriculture sector was conducted and classified according to the food value chain stage they targeted. The study identified five stages: growing, processing, storage and transport, trading and market access, and vertically integrated value chains. The results showed that Sub-Saharan Africa, Latin America, and South Asia were the most targeted regions by blended transactions across the food value chain. However, the study found that financial institutions were under-targeted as direct beneficiaries, instead, MSMEs and project developers were the primary beneficiaries of most transactions along the food value chain. The brief also revealed that concessional debt and equity were the most commonly used BF instruments, with technical assistance being prominent in processing (56%) and vertically integrated (57%) solutions. In an earlier data

brief on blended finance for agriculture, Convergence reported the increasing importance of transactions targeting climate-resilient/sustainable agriculture, with 18% of the transactions for agriculture. Convergence interpreted this trend as a consequence of the increased pressure for sustainability in the companies' supply chains.

### Profile of the instrument

BF uses a combination of financing sources such as development finance, from public and philanthropic sources to mobilise additional commercial capital, primarily from private sources, to help the international development community achieve Sustainable Development Goals (SDGs) (Figure 6).



Source: authors' elaboration after Convergence, 2022a

Figure 6. Blended Finance structure.

BF transactions have consistently prioritised several SDGs. Among these goals, SDG17 (Partnerships for the Goals), SDG8 (decent Work & Economic Growth), SDG9 (Industry,

Innovation, & Infrastructure), and SDG1 (No Poverty) have been the most frequently targeted in blended finance transactions (Convergence, 2022a).

## Operating rationale

When public or philanthropic investors provide funds on below-market terms or as credit enhancement (through guarantees or insurance, for example), they lower the overall cost of capital for businesses while providing an additional layer of protection to private investors. BF is often used to leverage private capital and to fill the gap between the cost of the project and the amount of public funds available. There are three conditions that need to hold to justify the use of BF, according to IFC (2020):

(1) BF should have the potential to unlock additional capital and add value beyond what is already available in the market (additionality rationale), (2) BF should have clear objectives and measurable impact indicators to ensure that the development challenge is being addressed (development rationale), and (3) BF requires an assessment of whether concessional terms can overcome barriers that hinder investment and limit development outcomes (concessionally rationale).

## Actors

BF activities engage a wide range of actors/providers, each with their own unique priorities, expertise, and available resources for investment. These actors work with one another, leveraging their respective strengths towards a common goal. The provider is typically a private sector, in collaboration with a government or a philanthropic organisation. Development finance institutions, governments, and multilateral groups are the most frequent public investors, and private sector parties interact with government and philanthropic organisations given their priorities and available resources in providing a fund. Convergence states that asset/wealth managers and private equity/venture capital firms are the most common private investors. The recipient is the organisation or individual receiving the funds. The beneficiary is the person or community that will benefit from the project. The intermediaries are organisations that facilitate the blending

of private and public funds to achieve the project's objectives, they often provide capacity building and technical assistance in order to ensure the success of the project.

## Investments financed

As mentioned in section 1, mitigation BF constitutes the largest proportion of climate BF. Over the last decade, about 50% of the annual climate deal count captured by Convergence is mainly focused on mitigation (Convergence, 2022). While the majority of adaptation financing continues to be provided by the public sector (towards agriculture projects), private finance plays a significant role in funding renewable energy projects within the mitigation space. According to data from Convergence (2022), 67% of climate BF transactions launched between 2019 and 2021 were aimed at supporting the achievement of the SDG7, which focuses on ensuring universal access to affordable and clean energy. This is followed by SDG8, with 49% of transactions dedicated to decent work and economic growth, and SDG9, with 41% targeted towards industry, innovation, and infrastructure. Mitigation activities, which mainly focus around reducing GHG emissions, tend to be more clearly defined and quantifiable compared to adaptation efforts, making investments in mitigation activities more attractive for private sector financing.

## Conditions

The conditions of BF vary depending on the specific terms and conditions of the financing agreement, the actors and interests involved, the regulatory and operating environments, and the investment phase, among others. Generally, BF agreements involve a combination of debt, equity, and/or grant financing. This can take different shapes, as observed in the table below (Table 1).

Table 1. Conditions of blended finance structures.

Blended finance structures	Objective/Condition
Grants	<p>In the case of private sector investments, these grants cover specific costs and activities in order to decrease overall project costs and increase chances of success. They are usually part of a larger package and are used mostly to purchase or upgrade existing fixed capital, such as tools or facilities. Some specific forms, such as interest rate subsidies, can help lower the costs of finance resulting from underdeveloped local financial markets.</p> <p>In the case of blended finance operations implemented by governments, the grants could also be used for creating wider enabling conditions.</p>
Technical assistance (TA)	<p>It can do the investor's homework, thus lowering the high transaction costs and risks for investors linked to new projects or in uncharted territories. It can also help improve the quality of the project, for example, by funding impact studies, thus increasing the likelihood of success - for instance, a study of the potential increase in project productivity with the provision of a new tractor and storage space to attract private investors. TA can be combined with other investments or serve as stand-alone funding.</p>
Loan guarantees	<p>Protect investors against losses and/or improve the financing costs (government guarantees reduce borrowing costs), e.g. the new equipment attracts private investors, but they still think the risk is too high, so the public sector provides a guarantee of payment should the expected increase of productivity not materialise or should the recipient fail to repay for other reasons.</p>
Equity investment	<p>Equity investors take a percentage of the ownership of the company or project. The money provides funding for the project, demonstrates viability and provides other comfort for investors (for example, investors could see this as a guarantee of the quality of the project, or of a reduction in risks that the host government might interfere). For instance, the public sector buys 20% of a company in the hope that private investors will see this as a sign of confidence and follow suit.</p>
Funds	<p>Public or philanthropic investors provide funds at below-market rates to decrease the overall cost of capital or to provide an extra layer of protection for private investors (ex: IDH Farmfit fund).</p>

Source: OECD-WEF (2015).

## Accessibility and affordability

### Farmers' perspective

In the context of food system transition, farmers seeking to innovate, often face challenges in accessing BF. For example, farmers looking to integrate reforestation and agroforestry practices into their existing activities may require long-term loans and grace periods. However, accessing long-term financing for these farmers is challenging due to the limited availability of this type of finance and high interest rates, reflecting the perceived higher risks and capital requirements. To effectively utilise BF and make it more accessible and affordable for farmers, several key elements need to be considered. The public component of BF can play an important role in enabling private investors to offer long term loan durations (or concessional finance) to recipients, including farmers. However, whether these longer-term loans are transmitted

to farmers depend on the intermediation chain of the BF, and careful consideration should be given to ensure that farmers can benefit from these. For instance, domestic banks can have an easier reach to farmers, access to local knowledge, and currency to provide appropriate lending programmes, that is through their existing client bases, and infrastructure. Bankability of recipients and projects is also important, this includes having formalised enterprises, transparent financial statements, a track record of successful operation, and creditworthiness. Additional, building trust relationships with financial institutions is crucial to gain access to BF. Farmers often need to be aggregated into larger portfolios to gain access to BF. This can be achieved through farmer organisations or (non-)financial services providers, such as off-takers, input providers, digital platforms. Aggregating farmers allows for better risks management and increases the chances of securing BF, as it provides economies of scale and mitigates risks associated with individual small-scale farmers.

## Others actors' perspectives

Providers of BF, including development finance institutions, impact investors and other stakeholders, may face challenges in finding viable investment opportunities that align with their risk profiles and transaction costs. Blending their capital with public funds can be address this challenge. Nonetheless, building up BF pipelines and portfolios requires providers to adopt a proactive and impact-oriented approach. This can involve conducting market assessments, engaging with local partners, seeking out innovative and sustainable projects that may have higher perceived risks, with social and/or environmental impacts. Providers should also actively monitor and measure the impact of their investments to ensure that they are meeting their intended objectives.

## Applicability for MITIGATE+ goals

How can blended finance be applied to achieve reduced GHG emissions, increased carbon sequestration and other SDG co-benefits? Mitigation projects may have relatively

easier access to finance compared to adaptation projects due to the potential measurable, reportable, and verifiable (MRV) outcomes. MRV benefits can provide investors with a level of assurance, making mitigation projects more attractive for financing. However, reaching smallholder farmers, even indirectly through intermediaries such as farmer organisations or cash crop commodity systems, can still be challenging. Existing literature on contract farming has highlighted limitations in the scalability and inclusivity of such systems, which may not effectively reach and benefit all smallholder farmers (Ton et al. 2015). As a result innovative approaches such as digital platforms, non-financial service providers, and targeted interventions may be needed to improve the bankability and creditworthiness of smallholder farmers, thereby expanding their access to BF for mitigation and adaptation projects. Nonetheless, to achieve sustainable development in the food system, it is important to address the needs and challenges faced by different actors at each level, including actors like producers, processors, distributors retails and consumers. Blended finance can play a role in facilitating investment at these different levels to improve the overall sustainability and resilience of the food system.

## Examples from MITIGATE+ focus countries

<b>Example box 2.1</b>	<b>BLENDED FINANCE</b>
	<b>Kenya</b>
	<i>Blended finance actors:</i> International Fund for Agricultural Development (IFAD), Private sector, Alliance for a Green Revolution in Africa (AGRA), Government of Kenya (GOK)
	<i>Type of blended finance instruments used:</i> concessional loans, credit guarantees and technical assistance
	<i>Target group:</i> smallholder farmers, small farmer co-operatives, and agro-input suppliers
	<i>Amount:</i> -US\$ 83.22m, of which US\$ 29.91m were IFAD loan and grant funds; US\$ 2.75m contribution from AGRA, US\$ 0.56m from GOK, and US\$ 50m from the private sector through risk sharing facility
	National
<b>A. Description of mechanism</b>	
Without access to financial services, smallholder farmers cannot reach their productive potential. To address this issue in Kenya, The Programme for Rural Outreach of Financial Innovations and Technologies (PROFIT), running from 2010-2019, has implemented a blended finance instrument to allow small scale rural enterprises to become more profitable and more capable of attracting private investment. It incentivises commercial and microfinance banks to increase the volume of their agricultural lending, diversify their services and products to rural areas, and increase their focus on innovation to reduce the costs of services and technical assistance to producer groups.	

## B. Accessibility and applicability

The programme includes a risk-sharing facility to boost rural and agricultural lending by commercial financial institutions by using concessional development finance from IFAD. Technical assistance is provided by the Alliance for a Green Revolution in Africa (AGRA) to support the participation of financial institutions as well as business support services. A complementary credit facility was set up to provide liquidity to commercial finance and Microfinance institutions (MFIs) that lack the funds to disburse loans to rural and agriculture portfolios. On the ground, it supports the development of a range of innovative financial products and improves the access of poor rural households to these services. It also helps programme participants manage their assets, market their produce and increase their employment opportunities.

## C. Upscaling

The programme has shown promising results in improving access to financial services and increasing the productivity and profitability of small scale rural enterprises. It aims to upscale and increase its impact by increasing the volume of agricultural lending, diversifying financial products (such as remittance services) and improving technical assistance provided to producer groups. Various M&E tools are used to monitor the development outputs of the intervention, including a log-frame matrix, reporting formats, M&E poverty score cards, performance and beneficiary assessment, and database for recording progress.

<b>Example box 2.2</b>	<b>BLENDED FINANCE</b>
	<b>Vietnam</b>
	<i>Blended finance actors:</i> IFC Private company
	<i>Type of blended finance instruments used:</i> Concessional loan
	Total cost US\$ 74m – US\$ 15m as loan by IFC
	Bac Ninh province – Thuan Thanh district, Cuu Yen village, Ngu Thai commune

## A. Description of mechanism

Vietnam is facing waste management challenges due to its rapid urbanisation and population growth. Bac Ninh province, with 1.4m people and 16 industrial parks, generates over 1,000 tonnes of municipal solid waste daily, with only 50% treated through inefficient incinerators without energy recovery or robust emission control (GGGI, 2020). To address this issue, the Waste to Energy project (W2E) project was implemented in 2021 in Bac Ninh province, introducing a waste-to-energy plant that incinerates and generates electricity from 230 tonnes/day of municipal solid waste, which has been disposed of as landfill. The plant also incinerates and generates electricity from 120 tonnes/day of municipal solid waste and 150 tonnes/day of industrial solid waste, previously treated through inefficient incineration. This scheme enables the proper waste treatment and the supply of electricity without the use of fossil fuels. It also reduces methane emissions from landfill sites and greenhouse gas (GHG) emissions by replacing grid electricity. Vietnam's commitment to sustainable waste management and renewable energy extends beyond individual projects. The country has actively pursued power projects with support from the Asian Development Bank (ADB). ADB's involvement includes offering technical assistance for Public-Private Partnerships and managing private sector PPP portfolios. In 2018, he ADB signed a US\$ 100m loan facility agreement with China Everbright International Limited to develop the first W2E PPP project in Vietnam.

## B. Accessibility and applicability

IFC as implementing entity of the Finland Blended Finance Climate Program provides up to US\$ 15m in the form of a Senior Loan ("blended concessional finance co-investment") to T&J Green Energy Company, a company jointly invested by local company Thuan Thanh Environment JSC (TT) and by JFE Engineering Corporation (JFEE) of Japan (a joint venture between Thuan Thanh Environment JSC, a Bac Ninh-based recycling company, and JFE Engineering Corporation, a Japanese company in the construction and operation of waste treatment facilities).

## C. Upscaling

The Global Green Growth Institute (GGGI) in Vietnam, through its Vietnam Program, has identified and tested at least four solutions for potential to scale. Of these, 1 solution successfully demonstrated commercial viability (municipal solid waste to energy), 1 solution is still in progress (rooftop solar) and 2 solutions proved unsuccessful initially (wastewater treatment and biomass energy). It is noteworthy that Vietnam's local commercial banks have recently taken concrete steps to support project developers in the green infrastructure. Consequently projects that have environmental benefits are now eligible to access these lending facilities with more preferential terms and financing options. In-line with these developments, GGGI Vietnam plans to scale up the waste to energy investment in Vietnam by setting up an investment-ready project through a financing facility. The financial facility can be on a regional scale supported by regional Development Finance Institutes (DFIs) and covering additional Mekong countries.



<b>Example box 2.3</b>	<b>BLENDED FINANCE</b>
	<b>Colombia</b>
	<i>Blended finance actors: Public finance, private investment, philanthropic funding</i>
	<i>Type of blended finance instruments used: Concessional loan, interest rate reduction</i>
	Amazon region
<b>A. Description of mechanism</b>	
<p>Recognising the urgent need to address deforestation and land degradation in the Amazon, Vision Amazonia and the Sustainable Productive Transformation Instrument (ITPS) provide an innovative financial instrument that uses blended finance to promote sustainable practices in the cattle sector, main driver of deforestation in the region. The purpose of this financial instrument is to promote the transformation of agricultural production systems that are developed in areas of high ecosystem value. The instrument consists of three components: a) credit, b) a group of incentives for its successful implementation in areas of high ecosystemic value, where special conditions are required for producers to access financial resources and to reduce the level of investment risk for financial intermediaries, and c) a group of complementary services that support the transformation and ensure the improvement in productivity of sustainable productive systems.</p>	
<b>B. Accessibility and applicability</b>	
<p>By providing financial incentives, technical assistance, and connections to commercial allies, this initiative aims to drive positive change in the cattle sector and contribute to the conservation and restoration of the Amazon rainforest. The unique feature of this BF mechanism is the interest rate component, specifically landowners who voluntarily participate in the initiative and commit to adopting sustainable land use practices can received interest rate reductions or waivers on their loans.</p>	
<b>C. Upscaling</b>	
<p>The ITPS was initially applied to the pilot in the Amazon region, it is however designed to be implemented in different regions of the country.</p>	

### Key take-aways for upscaling strategy and role of finance

Blended finance (BF) enhances financial accessibility and applicability in food systems. BF achieves this by incentivising banks to increase lending to farmers in remote areas, providing technical assistance to financial institutions and businesses, and creating complementary credit facilities to improve liquidity for loans. Donor governments

have a significant role to play in the upscaling of BF initiatives. Their concessional finance for de-risking is crucial in setting the right incentives and creating an enabling environment for scaling. By reducing financial risks, concessional finance encourages private sector involvement, spurring increased investment and innovation within food systems. Moreover, the public sector can effectively utilise its resources to blend and leverage private sector financing by de-risking the sector through structured value chains and risk sharing mechanisms.

### CASE 3: CARBON CREDITS

	<b>Instrument: CARBON CREDITS</b>
	Category: Private incentives

#### Background and definition

Carbon credits consist of a diverse range of sources of carbon mitigation supply (carbon credits) that can be bought by companies or countries on carbon markets to offset carbon taxes, legal requirements to reduce carbon or voluntary commitments to reduce carbon footprints and pledges made to reduce carbon.

#### History

Carbon credits were globally introduced as a direct result of the UN Kyoto Protocol (1997). Carbon credits are sold on two types of markets, compliance markets and voluntary markets. Compliance markets are global, regional, national

or subnational systems. The two main mechanisms are the clean development mechanism (CDM, Kyoto Protocol) and the Emission Trading systems (ETS). In ETS markets, governments at national, regional or subregional levels cap (or limit) CO<sub>2</sub> emissions (for companies) in the jurisdiction; emission reductions under this limit become tradeable. Voluntary carbon markets emerge from individual projects or companies who first establish a carbon baseline. Any verifiable carbon reduction compared to this can be converted into a carbon credit and becomes registered and tradeable. Some schemes also accept contributions to maintaining the status quo, for example by halting deforestation through conservation efforts (Toitu Envirocare 2022). Carbon markets started around 2000 and became institutionalised around 2007. These markets are now consolidating (see Figure 7 for a historical overview).

## Evolution of the voluntary carbon market (VCM)

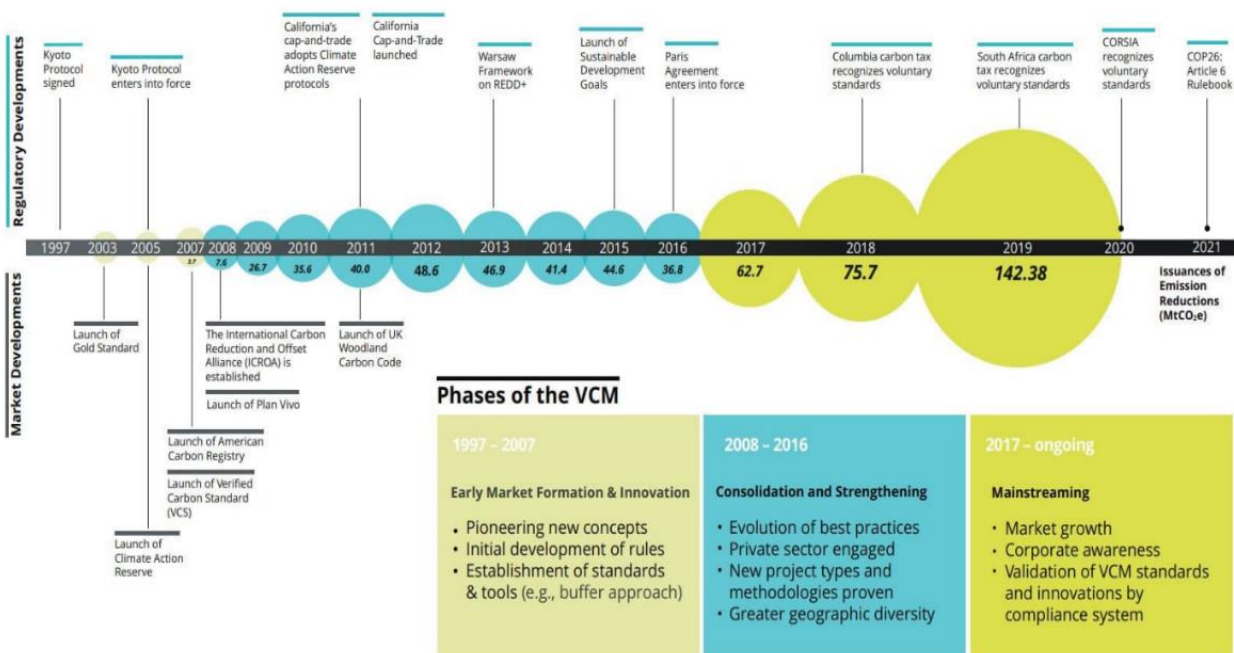


Figure 7. Evolution of the voluntary carbon market.

Source: Toitu Envirocare, 2022.

## Volume

The global carbon market is estimated at around US\$ 56bn for the ETS markets, and US\$ 1.4bn for the voluntary market (World Bank 2022a).

Starting with 3.7 MtCO<sub>2e</sub> emission reductions issued in 2007, the total amount of credits issued in 2022 was some 475 MtCO<sub>2e</sub> (World Bank 2022a), not including the ETS market as these markets trade emission allowances and not credits. The World Bank forecasts a demand of 1.5-2 GtCO<sub>2</sub> by 2030 considering all pledges and targets made. This outlook provides good prospects for the AFOLU sector carbon credit developments, but we also collected examples of carbon credits at processing and even consumer levels (figures about other food systems levels are not available). Last year's AFOLU related carbon credit supply almost doubled, although it is still a small proportion

of all carbon credits. On the supply side, most carbon credits are assigned to the energy sector, which heavily relies on offsetting carbon credits. Only 5% of credits are bought by companies in the agro-food sector (World Bank 2022).

This case study looks into Voluntary and compliance markets in Colombia, Kenya and Vietnam. From these countries only Colombia has a large operable voluntary carbon market and a national ETS system (RENARE) expected to be *operable in 2026* (see country case in Example Box 3.1). The annual voluntary market (ASOCARBONO, 2023) comprises about COP 423bn (US\$ 106m) in carbon taxes (2022) and about 7000m ha conservation area (afforestation). As long as it is cheaper for companies to buy carbon credits instead of paying carbon taxes, there is an incentive for carbon markets to grow.

Table 2. Volume of carbon market in Colombia, 2017-2022.

Year	#Months	Taxes paid in Colombian Pesos/per corresponding volume			Taxes off-set with carbon credits	Total (1)	% paid as carbon tax	% off-set with carbon credit
		Total carbon tax revenue (Pesos)(1)	Carbon tax (Pesos per tonne CO <sub>2e</sub> )	Tonne CO <sub>2e</sub>	Tonne CO <sub>2e</sub>	Tonne CO <sub>2e</sub>	%	%
2017	6	476,862,000,000	15,000	31,790,800	7,706,800	39,497,600	80.49	19.51
2018	12	294,073,000,000	15,764	18,654,720	11,913,604	30,568,324	61.03	38.97
2019	12	451,045,901,000	16,422	27,465,954	14,941,769	42,407,723	64.77	35.23
2020	12	294,901,764,100	17,211	17,134,493	10,121,619	27,256,112	62.86	37.14
2021	12	334,309,261,000	17,660	18,930,309	23,423,011	42,353,320	44.70	55.30
2022	12	423,903,886,000	18,829	22,513,351	20,760,934	43,274,285	52.02	47.98
TOTAL	66	2,275,095,812,100		136,489,628	88,867,737	225,357,365	60.57	39.43

(1) Total demand is equal to the volume corresponding tax payments plus the volume of non-earmarked credits.

Source: ASOCARBONO 2023.

Given the large size of the agrarian sector in Kenya, the AFOLU sector is considered a main source of carbon and many projects are issuing carbon credits since 2014 using the CDM (see Example Box 3.2). Also, Kenya's national ETS is at an advanced stage of preparations already allowing companies and organisations to buy Emission Allowances (Reuters 2021) with tax incentives in place (Kenya's Finance Act, Number 22,2022; Wamue, 2022). Carbon credits in Vietnam is being explored, but not yet operational (see Example Box 3.3). The most recent (January 2022)

regulations and roadmap for implementation of a national ETS, will be piloted in 2026 and a full system is anticipated for 2028 (Kanlayakorn 2022).

### Profile of the instrument

Carbon credits are a recognised instruments to allow individuals and companies "to invest in implementing approved emission reduction activities" (World Bank 2020, p. 47). They are an instrument to transfer liquidity from

those stakeholders who cannot reduce carbon to those who can.

### Operating rationale

Credits are measurable, verifiable removals, reductions or avoidances of GHG emission units that can be traded on carbon markets. Most credits traded are carbon emissions, but some include broader values such as improved livelihoods, enhanced biodiversity, clean water and protection of cultural values. The (voluntary) carbon market is an important instrument to allow money to flow towards those individuals, companies and projects that can mitigate carbon. Once a carbon project has proven to remove GHG

emissions (often by certification), it is considered in an active state and carbon credits get issued. Active carbon credits can be passed on to other owners, which means that project participants do usually not know the owners of the credits. Companies who want to offset their carbon footprint - voluntary or because of compliance or tax regulations - can buy carbon credits from farmers that implement carbon-reducing measures. When a buyer wants to compensate carbon emissions, the carbon credits need to be retired, so that no one else can claim the carbon offset. The shaping of carbon markets is supported by recent economic scholars (Ryan Collins 2019) supporting the idea that sustainability can better be achieved by stabilising and shaping new markets than by price fixing through tax incentives.

## Carbon as a commodity (carbon markets)

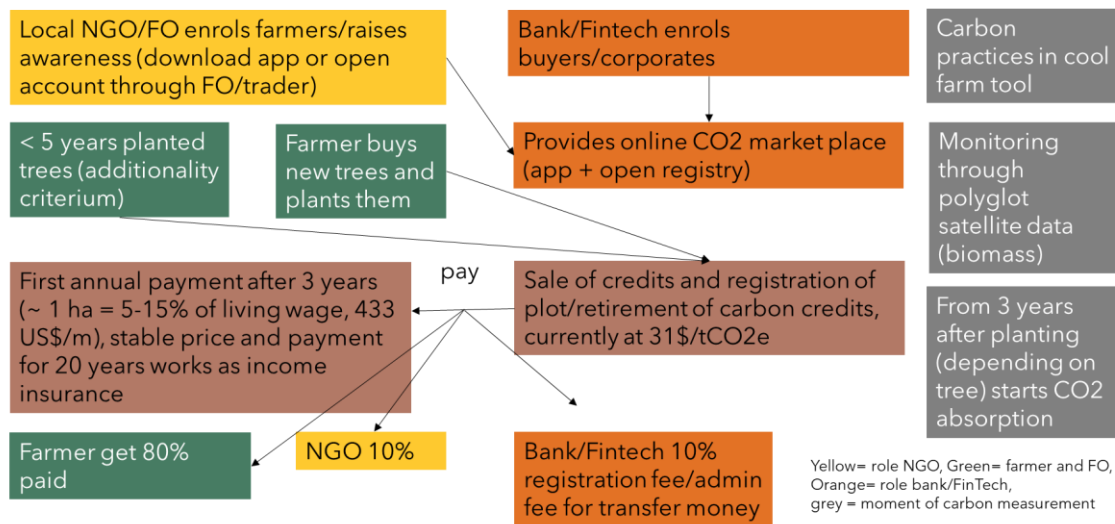


Figure 8. How carbon credits work (example Solidaridad 2022).

Carbon markets work either with a governmentally set limit of carbon emission or a carbon baseline. Any carbon reduction below the limit or baseline can be converted into a tradable carbon credit subject to a specific carbon certification process as for example described in Figure 8, such as the Gold Standard or Verra, before it becomes available for sale on a designated trading platform.

### Actors

Carbon markets consist of a diverse range of sources of carbon mitigation supply (carbon credits) and demand (offsetting emissions). The main suppliers in the AFOLU sector are local, regional or national producers or producer

communities implementing projects where carbon is sequestered or mitigated through new plantation or livestock intensification. These projects need to be certified by one of the existing standards to issue carbon credits. Demand is driven by carbon tax regulations and offsetting regulations or voluntary commitments to reduce carbon footprints. The main buyers of carbon credits are companies wanting to reduce their carbon footprint or wanting to offset carbon taxes and countries using carbon markets to fulfil their requirements under the Kyoto and Paris agreement. Intermediaries maintain markets and provide platforms for trading CO<sub>2</sub> at global, domestic or international level usually for a certain fee to cover operating costs. These fees range from 10-50% of the carbon value depending on the number of intermediaries

involved. Open carbon registries ensure the registration of retired carbon credits, so that they cannot be sold double. Due to the high integrity standards of these markets standardisation and certification societies play a large role in these markets using science based standards to develop mitigation hierarchies aligned to carbon farming, forestry or conservation efforts. Also 'financial actors are increasingly involved at the implementation phase of carbon projects, providing capital and risk-hedging mechanisms to project developers who previously had to rely primarily on equity and grants for their upfront investments' (Filmanovic, 2022).

### Investment financed

World Bank data about the largest volumes transacted, per sector, exhibit very small volumes for AFOLU outside REDD+. Most credits concern deforestation and land use conversions, but also projects removing atmospheric emissions (such as afforestation, carbon sequestration in agriculture, and improved forest management) are gaining momentum. The market is evolving to highlight other benefits of credits beyond GHG emissions mitigation and to develop tools to verify them, including more advanced baseline measurements. For example, co-benefits that purchasers value relate often to the Sustainable Development Goals (SDGs) as a proxy (Lou,2022). Investors in the market move towards adapting long-term strategies in larger corporations to secure carbon credits for the future

which changes the dynamics of the markets regarding capital providers and developers of carbon projects (Filmanovic 2021).

### Conditions

Certification is the main condition for carbon credits. Certification assures the buyer of a certain amount of carbon reduction. The most well-known standards for certification in the voluntary carbon market are the Verified Carbon Standard (VCS), the Gold Standard and Plan Vivo. The Clean Development Mechanism (CDM) standard is used both in the voluntary and in the compliance market. Certifications are costly, but necessary for transparency and integrity of the markets. Carbon credits are developed by traders, aggregators, farmer organisations and development organisations.

Table 3 shows volumes and prices as provided by the World Bank (2022). The number of initiatives in the ETS market has risen slightly with 4 initiatives in just one year, while prices have risen sharply in the last 3 years. To levels above US\$ 80/tonne. This is in contrast to voluntary markets where the number of projects and credits almost double in the last 5 years. While the voluntary market is small and prices are slightly lower, demand is strong and expected to increase given all the pledges made at the recent COOP. Unfortunately, no volumes corresponding to the AFOLU sector have been found.

Table 3. Number of carbon initiatives using carbon credits, revenues, prices and volumes traded.

	# of initiatives		Revenues in US\$		Volume traded in US\$ since 2007		Global average carbon credit price/tCO <sub>2</sub> in US\$	
	2020	2021	2020	2021	2020	2021	2020	2021
ETS	31	37	26bn	56bn	13bn	15bn	2,49	3,82
Carbon tax	30	34	27bn	28bn				
Voluntary market			327m	478m		362m		
Of which:								
Gold standard		51 (43,5 MtCO <sub>2</sub> e)						3,9
Verified carbon standard		110 (4,2 MtCO <sub>2</sub> e)						4,2
AFOLU (CDM, mostly Gold Standard/ Plan Vivo)		32 (10 agriculture, 20 forestry)						

Source: Worldbank (2022).

## Accessibility and affordability

### Farmers' perspective

Reducing the costs of data collection, certification and registration of carbon credits as well as aggregating farmers' carbon claims is imperative for the future of carbon credits in the AFOLU sector.

In Colombia, Kenya and Vietnam the potential for contribution to carbon markets of the agricultural sector is recognised. Farmers however do not see carbon farming as a viable business model. In many cases certification costs of US\$ 200-400 per organisation/farm are unaffordable and not economically sustainable as the costs are not recovered through higher market prices or carbon prices. Usually, certification is done at the level of farmer organisations or by traders. Farmers deliver the relevant data or receive an x number of trees to plant. The use of carbon credits is hardly visible to them (Interview FEDECACAO, Solidaridad, 2022). Offering carbon as a separate product might for some farmers be a viable option, if registration costs and data delivery can be provided at low costs (e.g. if free digital data collection and carbon calculation tools are accepted for verification). Selling carbon credits as a separate commodity can also work risk reducing as the carbon price is not linked to the commodity price anymore, e.g. the falling price for cocoa (Interview Solidaridad 2022).

Agricultural sectors are mostly excluded from national and international ETS and carbon tax systems, maybe with the exception of producers of fertilisers. However, voluntary markets are increasingly connecting to forestry or land use mitigating measures on farm level.

### Other actors' perspectives

Voluntary carbon markets are currently only a fraction of the amount of carbon traded in ETS, but they are becoming more important as buyers want to fulfil different needs, ranging from prioritising prices, quality, impact or integrity of credits to protect reputation, and to realise additional co-benefits at the same time. This is in strong contrast with compliance markets, which have been limiting the sale and buy of credits to territorial benefits requiring 50-80% offsetting within the jurisdiction (World Bank 2022).

Forest and land use credits receive particular attention given their importance and difficulty in acquiring baseline accuracy and monitoring of carbon emission targets. In particular, the moratorium on Reducing Emissions from Deforestation and Forest Degradation (REDD+) projects is scrutinised. Major efforts are underway to protect the integrity of voluntary carbon market. As noted by the WB, *"market actors need to collaborate more to support and develop high standards and protect environmental integrity and credibility of carbon markets at its underlying standards as well as deepen liquidity for carbon measures. Market governance leads to the formation of specialised government bodies, new financial service delivery models and new technological infrastructure to support solutions to scale up markets and ensure its integrity"* (Guardian 2023).

### Applicability for MITIGATE+ goals

How can carbon credit be applied to achieve reduced GHG emissions, increased carbon sequestration and other SDG co-benefits? For government around the world ambitious carbon targets at low costs remain a political challenge and ambitions are often set too low to meet national, regional or international reduction targets. While scientific models to measure carbon sequestration are developed and improved, governments are in great need to develop enforceable monitoring strategies in compliance markets as current models allow companies to go beyond (legal) carbon limits and confuse consumers with regard to carbon neutrality claims (Guardian 2023).

Increasing energy costs and food prices resulting from other political crisis, such as the war in Ukraine, directed political attention towards more pressing needs and might slow down the creation of viable carbon markets (World Bank 2022). This has been shown in earlier crisis, when carbon markets suffered heavily from the 2008 financial crisis, with carbon prices dropping due to a lack of demand, which gave rise to the perception that carbon credit are not much more than "hot air" (Carbon market watch 2021).

Voluntary carbon markets experience strong demand as multiple pledges [were?] made during COP 26 and [are?] now gradually effectuated. (World Bank 2022) *"The flexibility provided by the Article 6<sup>7</sup> rules gives the voluntary carbon market more scope to scale quickly, but carries risks.*

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<sup>7</sup> A key outcome of the COP26 climate summit in Glasgow was the approval of Article 6 – the Paris Agreement's rulebook governing carbon markets. Article 6 allows countries to voluntarily cooperate with each other to achieve emission reduction targets set out in their NDCs. This means that, under Article 6, a country (or countries) will be able to transfer carbon credits earned from the reduction of GHG emissions to help one or more countries meet climate targets. Within

Article 6, Article 6.2 creates the basis for trading in GHG emission reductions (or "mitigation outcomes") across countries. Article 6.4 is expected to be similar to the Clean Development Mechanism of the Kyoto Protocol. It establishes a mechanism for trading GHG emission reductions between countries under the supervision of the Conference of Parties – the decision-making body of the UN Framework

Unless consumers and investors can navigate terminology and differentiate project claims, the market's flexibility could facilitate greenwashing" (Macquarie, 2022). Inherent to carbon markets is that all stakeholders benefit from the maximum volume of credits being placed on the market, which puts great importance on the accuracy in measuring baselines and carbon removal scenarios. (Carbon market watch 2022). Effective delivery mechanisms require in addition to accuracy a reduction of registration and certification costs. New financial carbon delivery models allow for more variation and registration of carbon credits and give flexibility to include co-benefits. The use of satellite technologies and fintech has substantially reduced the

implementation costs of carbon credits in the agricultural sector. It allows small-scale producers in the cocoa sector, who are worldwide 75% of the number of producers, to cash in on their efforts to sequester carbon emissions on their farmland (about 20-30% of global GHG) for which they could not be rewarded in the past (GSMA, 2022). Barriers to carbon investments include challenges regarding aggregating lands for projects and the impact of historical and current land tenure conflicts. Also, potential inflow of private capital for land acquisition to convert land to carbon credits might increase land prices and cause speculation (Climatefocus, 2022).

## Examples from MITIGATE+ focus countries

Example	CARBON CREDIT
box 3.1	Colombia
	Providers: RENARE; Solidaridad/Acorn/Rabobank; Fundación Cataruben/USAID
	Size: About 2bn Carbon credits in Colombia
	Region: Amazon; Orinoquia

**A. Description of mechanism**

In particular Colombia is championing the nationwide development of carbon credits through broader policy initiatives including carbon taxation, knowledge development, the Partnership of Market Readiness (PMR), annual carbon caps, the RENARE registration platform, the National Environmental Fund (FONAM) and the sustainable landscape programme. Approx. 27% of Colombian emissions were offset in 2022 at a prices of 4.96 US\$/tCO<sub>2</sub>e. According to IETA (2022) the carbon tax and the offset mechanism led to a reduction of 42.8 MtCO<sub>2</sub>e of offsets (COP 1.42bn), which amounts to 360m tCO<sub>2</sub>e in carbon credits in about 108 mitigation initiatives and 3,523 offsets.

**B. Accessibility and applicability**

Deforestation represents a major source of emissions for Colombia. The agriculture, forestry and land use (AFOLU) sector combined account for roughly 60% of Colombia's emissions (IDEAM et al., 2018).

The National Registry of Reduction of Emissions and Removal of GHG (RENARE), that enables transactions in carbon markets through an ETS system will be launched in 2024 and should be fully operational in 2030. Earlier in 2021, Colombia implemented a carbon tax (Decree 926) which allows offsetting of carbon taxes (introduced 2016) through domestic carbon credits with vintages not older than 5 years. Additionally, it may recognise tonnes of emissions that that have been paid for via the carbon tax as allowances acquired at auctions (IETA, 2022).

Many development organisations are currently developing voluntary and compliance carbon markets in Colombia such as the initiative led by Solidaridad and Rabobank (Solidaridad, 2022), the Selva de Matavén indigenous reservation, between Colombia's Orinoquia and Amazon regions, which is currently under scrutiny (ojo-publico, 2023) and the USAID and Fundacion Cataruben let projects for small scale producers, Co2Bio or Cultivo. These are in addition to many Redd+ projects spread over all Colombia. Programa biocarbono is another programme which involves many departments in Colombia focusing on livestock.

Convention on Climate Change. Article 6.8 recognizes non-market approaches to promote mitigation and adaptation. It introduces cooperation through finance, technology transfer, and capacity building, where no trading of emission reductions is involved. The agreement on Article 6 established an accounting mechanism known

as "corresponding adjustment," to ensure that double counting does not occur.  
<https://www.worldbank.org/en/news/feature/2022/05/17/what-you-need-to-know-about-article-6-of-the-paris-agreement>

### C. Upscaling

Carbon credits is becoming an essential part of the national CO<sub>2</sub> reduction strategies and might raise farm incomes by 5-15% (source: Interview Solidaridad). Working with smallholders is often subject to high administrative costs and therefore reducing implementation costs is a key constraint.

Example	CARBON CREDIT
box 3.2	Kenya
	Providers: ACES; ICS; local community driven
	Size: Blue forest project Vanga: 9,198 tCO <sub>2</sub> e (2021), Mikoko Pamoja Mangrove project US\$ ~25,000 in carbon credits, Lifestraw Carbon: 2,7m tCO <sub>2</sub> e; Rangeland carbon project US\$ 3.2m in carbon credits (2021)
	Regions: Vanga, Mamoja, national and Northern planes

#### A. Description of mechanism

Carbon credit initiatives are largely community based initiatives running in Kenya since 2014. The main objective is to reduce costs of carbon friendly farming and cooking practices and to increase the income of local communities through agroforestry in Mangrove forests, therefore protecting the environment.

#### B. Accessibility and applicability

Examples include the blue forest project in Vanga (Oceanographic Magazine, publication unknown), verified by Plan Vivo with carbon credits available through the Association for Coastal Ecosystem Services (ACES) with 4,692 tCO<sub>2</sub>e saleable emission reductions available by the end of 2021 of a total of 9,198 tCO<sub>2</sub> (Plan Vivo, 2022), the community led Mikoko Pamoja mangrove project which sold and registered almost US\$ 25,000 in carbon credits by the end of 2020 with ACES (Climate Tracker, 2022) or the LifeStraw Carbon for Water programme that finances water filters replacing boiling water as purifying method and finances the provision of the life straw filters from carbon credits at a rate of an annual 2.7m tCO<sub>2</sub>e (UNFCCC, 2013). Also the ICS (Improved cook stove project in rural western Kenya) is an early stage REED Gold Standard approved project, using carbon credits to reduce the price of efficient cooking stoves, which resulted in rather ambiguous carbon reduction results and researchers asked for better implementation and control mechanisms for carbon credits (Wang et al. 2014). Finally, the Northern Kenya Rangeland Carbon Project started in 2012 with the primary aim to generate additional revenues for farmers in 14 community through conservancies from grassland soil cultivation. It removes and stores 50m tCO<sub>2</sub>e over 30 years. Northern Rangeland Trust (NRT) sells carbon credits on behalf of the 14 communities certified by VCS (Verified Carbon Standard). By 2021 a total of 3.2m verified carbon credits became available for purchase (NRT-Kenya 2023).

#### C. Upscaling

Newly implemented Kenyan laws provide incentives for private voluntary carbon trading and can -together with existing community initiatives - potentially increase the volume of carbon credits traded, therefore supplying the much needed demand. However, it needs to be noted that trading carbon credit only serves the purpose to redirect much needed liquidity towards those parties who can effectively and cost efficiently reduce carbon, which allows other companies to continue GHG emissions at current levels or more.



Example box 3.3	CARBON CREDIT
	Vietnam
	Providers: IRR/GIZ; DFAT; national government
	Size: 700,000 carbon credits in biogas/livestock
	National

**A. Description of mechanism**

Vietnam operates an international carbon market under the CDM (clean development mechanism) in the Kyoto Protocol selling credits from local enterprises in 11 REDD+ projects, to enterprises in developed countries in the energy and waste sectors. The country is currently exploring the developments of a national ETS system in addition to the sector. The national reduction strategy includes carbon reduction measures for the AFOLU sector, in particular in replacing rice farming with other crops, livestock intensification and afforestation efforts, as well as the exploration of biogas, which could increase the income of in particular small scale farmers.

**B. Accessibility and applicability**

IRRI and GIZ and the Australian Government Department of Foreign Affairs and Trade (DFAT) are exploring possible private sector projects and support programmes for scaling carbon credits in rice production (The BPP, 2022). The partnership is designed to simplify and de-risk carbon market access for rice producers in Vietnam by developing a framework and platform to harness the rice sector's potential to reduce methane emissions. Once developed, this will have global scalability. The Ministry of Agriculture and Rural Development is developing a project to develop 1m ha of low-emission high-quality rice in Vietnam which will be among Vietnam's efforts in realising the country's commitment at COP26 for net zero emissions by 2050. In addition, over 700,000 Gold Standard carbon credits (GS VERs) have been issued by May 2020 in the Biogas Program for the Animal Husbandry Sector in Vietnam producing more than 2.3m carbon credits for the voluntary carbon market (SNV, 2022).

**C. Upscaling**

With most of its developments still in the development stages, it is difficult to say whether current delivery mechanisms are scalable. However, current consortia could learn from developing low cost pricing mechanisms and certifying efforts from the aforementioned initiatives in Kenya and Colombia, although taking into consideration that the climate financing landscapes are very different. They could greatly benefit from additional research in the finance and service delivery models of other initiatives.

### Key take-aways for up-scaling strategy and role of finance

The financing and delivery models for carbon credits apply three different crediting mechanisms on two different types of markets and vary greatly in their design and cost-effectiveness. The different crediting mechanisms are governmental, private and independent (e.g. CORSIA) crediting mechanisms. Markets are divided in voluntary and compliance markets. The differences in approaches and measurements provide a reason for further research and independent verification of results for being able to be scaled and mainstreamed. With demand exceeding supply of carbon credits and a positive outlook towards 2030, there is much potential for developing carbon credits in the AFOLU sectors. In all three countries major policy changes are on the way to intensify carbon market activities and regulate carbon emissions.

### Business model farmer

At current prices for carbon measurement, credit certification and registration of carbon credits, farmers do not see carbon farming as an economically sustainable activity as long as it is tied to commodity-based certification. However, there seems to be economic potential in the AFOLU sector for the first pilots with carbon as a separate commodity offered through carbon credits on voluntary markets. The use of carbon credits as an instrument for carbon reductions and a business model for carbon farming could further benefit from the use of digital carbon tools and training of farmers as well as delivery support for small scale farmers; these improvements can make carbon farming less costly. Having carbon as a separate product following price developments on carbon markets rather than commodity markets with falling prices such as cocoa and coffee can also reduce the risk of price fluctuations for farmers.

## Role of finance in the scaling pathway

The development of carbon markets in combination with financial incentives to reduce carbon seems to positively affect smallholder farmers' incomes, while also increasing the supply of carbon credits worldwide. With current strong demand exceeding supply, there is potential for the AFOLU sector to become a major supplier of carbon credits with a reduction potential of GHG estimated to be around 23%, while also increasing capacity of carbon credits through the clean energy mechanism. The deployment of the recently

introduced markets and new technologies to measure, trade and finance carbon farming has the potential to help scale up the carbon credit market and break down silos between registries while providing traceability, liquidity, security, and trading efficiency. Imperative for scaling is the collaboration of all actors to develop more accurate baseline and carbon emission scenarios to define the value of carbon credits on markets and make the markets transparent and credible additions to carbon mitigation strategies of farmers.

## CASE 4: PAYMENTS FOR ECOSYSTEM SERVICES

	<b>Instrument: Payments for ecosystem services (PES)</b>
	Type/sub-type: Private and public incentives

### Background and definition

The Millennium Ecosystem Assessment (MA, 2006) first defined the concept of ecosystem services as services comprising all kinds of benefits that nature provides to humans by the natural environment and healthy ecosystem. Examples of these services are fresh air, fresh water, healthy soil, pollination of crops, extreme weather mitigation (for example flood protection), cooling the atmosphere and opportunity for recreation and increasing physical and mental health.

The four identified categories of ecosystem services are regulating, provisioning, cultural, and supporting services, all of which are very prominently present in the AFOLU sector and overall food system activities. Purification of water and air, carbon sequestration and climate regulation are part of regulatory services. Other essential services provided by the AFOLU sector are food and crops provided, which are part of provision services, while cultivation of indigenous land, land use and providing recreational experiences is part of cultural services. Water management, soil formation and habitat protection is part of supporting services. From all 24 services identified,<sup>8</sup> only 3 are usually remunerated and addressed in payments for eco-system services. These are forest and land use for carbon sequestration, watershed services and biodiversity conservation.<sup>9</sup>

### History

Payments for ecosystems services is an increasingly popular instrument in development and conservation finance. As explained above, the Millennium Ecosystem Assessment (MA 2006) first defined the concept of ecosystem services. Conservation of nature and animals has been considered a

public task for decades. Since 2007, PES has been noted to be a tool of rural development (Byerlee 2008).<sup>10</sup>

Reducing emissions from deforestation and forest degradation under the REDD+ framework transformed PES into a significant climate mitigation instrument. The Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC) of 2015 includes forest-based emissions reductions to mitigate climate change (UNFCCC 2015). REDD+ is the mechanism developed to finance forest-based emission reductions to support developing country governments in decreasing human activities that cause deforestation and forest degradation, increasing greenhouse gas emissions. REDD+ incentivises multiple land use actors and forest owners to engage in sustainable landscape management through payments for reducing forest-based emissions, through REDD+ credits transacted in voluntary carbon market (see Case 3 for the details of voluntary carbon markets). This can be seen as multitier payments for environmental services (PES) transferring carbon mitigation credits and tasks from international buyers to forestland owners.<sup>11</sup>

### Volume

Finding the most updated data on 'ES's market size is difficult. To our knowledge, the most comprehensive study on the global market size of PES is by Salzman et al. (2018), reports the total global volumes of transactions for 2015 and 2016 for watershed, biodiversity offsets, forest and land use PES (Table 4) separately. The study estimates in 2014-2016 period the global PES transactions per year is about US\$ 36-42bn. The watershed related PES market is the most mature PES, about 58-69% of the total PES market, while biodiversity related PES is 20%-23% and forest and land use for carbon sequestration is 21-25% of total PES market.

<sup>8</sup> According to Ferrari and Geneletti (2014) the 24 eco-systems services are: (1) (intensity and quality of) agricultural production, (2) (Intensity of) hunting production, (3) (Intensity of) fishing production, (4) (Intensity and quality of) mushroom production, (5) (intensity of) honey production and nectar value, (6) (amount of) inorganic matter extraction, (7) timber production, (8) fuel wood production, (9) water supply from surface water network, (10) water supply from groundwater, (11) water quality regulation, (12) water flow regulation, (13) air quality regulation, (14) macro-and micro-climate regulation, (15) hazard protection capacity, (16) flood prevention capacity, (17) cultural heritage, (18) scenic beauty, (19)

hunting, (20) fishing, (21) mushroom collection, (22) honey collection, (23) outdoor recreation, (24) leisure.

<sup>9</sup> Particularly since the Glasgow agreement (COP26) on biodiversity, efforts are also made to include more services into the basis for payments for ecosystem services provided to farmers, such as pollination services, soil restructuring etc. (e.g. UK parliament, 2022).

<sup>10</sup> For example, ecosystems services are remunerated in pillar III of the new EU- CAP agricultural subsidies. Re-purposing of agricultural subsidies is the subject of Case 6 in this report.

<sup>11</sup> Please see a more detailed discussion on these in Wunder et al. (2020), Verdone and Seidl (2017).

Table 4. PES market size and number of countries by ecosystem service targeted.

Ecosystem service	Market size, year	Number of countries
Watershed	US\$ 24.7bn, 2015	62
Biodiversity	US\$ 8.4bn, 2016	36
Forest and land use for carbon sequestration	US\$ 625.6m in 2016 for forest and land-use carbon offsets	75
	US\$ 8.3bn in 2014 through REDD readiness and public sector payments	31

Source: Estimated from Salzman et al. (2018).

For the MITIGATE+ focus countries, the examples of PES used, including subsidies and carbon credits, are numerous.

- **Colombia:** In Colombia, there have been 9 different REDD projects targeting forest and land use for carbon sequestration and ongoing or ended since 2008, which have covered about 11.6m hectares and 9 watershed PES projects active or in development since 2005.<sup>12</sup>
- **Kenya:** In Kenya, there have been 4 watershed PES projects, active or in development since 2008. In addition to this, there have been 24 different REDD+ projects ongoing or ended since 1998, covering about 2.8m hectares.<sup>13</sup>
- **Vietnam:** In Vietnam, Since 2008, there have been 9 different REDD+ projects ongoing or ended, covering 0.7m hectares of land and one watershed PES project in development.<sup>14</sup>

### Profile of the instrument

PES are incentives offered to farmers or landowners in exchange for managing their land to provide some ecological service. They have been defined as "a transparent system for the additional provision of environmental services through conditional payments to voluntary providers" (Tacconi, 2012). PES is a market-based

mechanism, similar to subsidies and taxes, to encourage the conservation of natural resources (FAO, 2012).

### Operating rationale

PES occur when the beneficiaries or users of an ecosystem service make (a series of) payments to the providers of that service (Fripp, 2014) The business model is critical as payments only occur when there is a win-win situation for buyers and sellers of services. Thus at least one buyer needs to recognise the need for resource protection and be willing to pay for it (true demand, Savy and Turpie 2004). Alternatively, they can be seen as part of a bundle of incentives the government places to achieve targets such as net-zero or 55% reduction of GHG emission.

Different types of buyers can fund a PES scheme. These include government-funded programmes, private agreements between beneficiaries and service providers, and public-private partnerships that combine government and private funds to compensate land or resource managers. These buyers can be international (such as the REDD+ programme, which pays developing countries to reduce emissions from deforestation and degradation), national (such as the Environmental Stewardship programme, which provides government-funded payments to farmers and land managers for environmentally-friendly farming practices), catchment schemes that involve downstream water users paying for upstream watershed management (often financed

<sup>12</sup> REDD+ project numbers are from Simonet et al. (2020). For some REDD+ projects, the area covered by project activities are not included. We did not include them to our total land size calculation. Other PES project numbers are from ecosystem markets map in <https://www.forest-trends.org/project-list/#s>

<sup>13</sup> REDD+ project numbers are from Simonet et al. (2020). For some REDD+ projects, the area covered by project activities are not included. We did not include them to our total land size calculation. Other PES

project numbers are from ecosystem markets map in <https://www.forest-trends.org/project-list/#s>

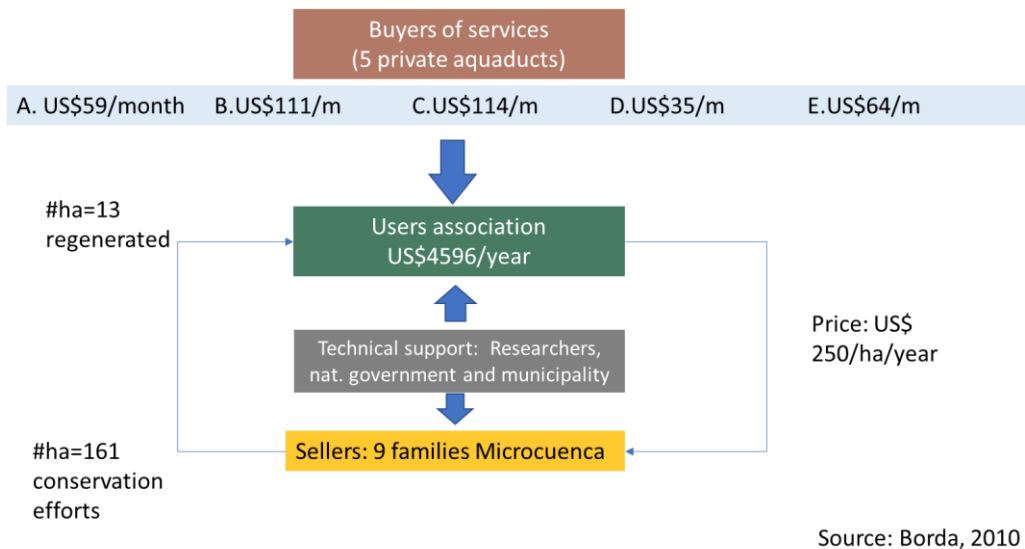
<sup>14</sup> REDD+ project numbers are from Simonet et al. (2020). For some REDD+ projects, the area covered by project activities are not included. We did not include them to our total land size calculation. Other PES project numbers are from ecosystem markets map in <https://www.forest-trends.org/project-list/#s>

by water utilities), or local and neighbourhood schemes that involve residents pooling funds to support an environmental organisation in managing local green space for biodiversity, landscape, and recreational purposes (Smith 2013).

The following ecosystem services are most common:

1. carbon sequestration and storage
2. biodiversity protection/bundled services (highly efficient but very difficult to organise and maintain)
3. watershed protection

## PES model Microcuenca de Chaina, Colombia



Source: Borda, 2010

Figure 9. PES example : the micro watershed of Chaina, Colombia (see Example Box 4.1, later in this chapter).

Source : Borda et al. (2010).

### Actors

Payments for ecosystem services are usually made to people managing natural resources, such as farmers, forest owners or conservationists and NGO's, paid from public and private sources. They provide these services through, for example, replanting trees, keeping living trees standing or using different agricultural techniques. Some PES programmes involve contracts between consumers, citizens, users of recreational facilities, suppliers, and intermediaries, such as non-government organisations, surrounding communities, non-agricultural sectors competing for public resources (e.g. water), private businesses wanting to reduce their environmental footprint and governments (local and central) wanting to achieve political targets (Viszlai et al. 2016).

### Investments supported

In some cases, the beneficiaries of the environmental services, such as water users and hydropower companies, make direct payments. In other cases, national or local governments pay on behalf of their citizens, who are

indirect beneficiaries. Investments are made through public payment schemes through which the government pays land or resource managers to enhance ecosystem services on behalf of the wider public, private payment schemes, or self-organised private deals, in which beneficiaries of ecosystem services contract directly with service providers.

### Conditions

For all PES, the buyer must be identified, the market conditions understood (including any conditionalities), and the service provider legally and institutionally recognized. The party supplying the environmental services typically holds the property rights over an environmental good that provides benefits to the demanding party in return for compensation, which has been mentioned as a crucial factor and barrier to PES in developing countries.

The Defra PES Best Practice Guide (Department for Environment, Food and Rural Affairs, 2013) mentions that PES contracts should be subject to several conditions:

stakeholders have entered the agreement voluntarily, payments are made following an apparent demand or need, the service qualifies as “additional” service not remunerated otherwise, the specific land or resource management actions must increase the supply of eco-system services, payments are dependent on the delivery of ecosystem service benefits and ensured permanently, while also avoiding leakage.<sup>15</sup> The collective management efforts must also be considered appropriate and recognized as aligning with conservation goals.

## Accessibility and affordability

### Farmers’ perspective

PES differ in scope (regional, global or local), nature and consequences and should therefore be priced differently. Market prices are satisfactory when markets exist for these services (e.g. carbon markets). For farmers, prices received for ES activities must cover at least the costs and the least cost option should be chosen to provide a satisfactory service for both sides. They need to be based on trust and transparency. In this regard, ecosystem services differ from certification as certification is a marketing instrument design to help the supplier to influence the price, while ecosystem services can also be under-priced. In the absence of market prices, PES can either be performance-based payments, for example, the payment depends on the amount of carbon sequestration, or input-based, for example, payment for a specific management practice used or the creation of buffer zones alongside rivers (Engels, 2008). Farmers seem to prefer performance-based pricing to show how much they are doing for society. In the absence of real prices, several techniques have been developed to capture the value of eco-system services and to monetise them, such as functional quantifying the relative importance of different species in terms of their efficiency and abundance or stabilising effects, avoidance of costs, replacement costs, factor income, travel costs or contingent valuation to name a few. While the valuation of services matters, the continuation of the service payments is vital to farm income as initial investments often need to be recovered. In particular, farmers have been hackling the lack of continuity as payments have been piloted and stopped after research results were obtained or new funding needed to be found.

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<sup>15</sup> Avoiding leakage: PES schemes should be set up to avoid leakage, leakage referring to the situation where securing an ecosystem service

## Other actors’ perspectives

Payments for eco-system services are common good services offered by farmers. Beneficiaries of these services, including private or public organisations, consider these as contributions to achieve climate- and nature-related targets, and they often treat those payments as subsidies, which does not sufficiently do justice to the sustained and reciprocal character of these services. Timber logging is often realized through government procurement and provided and exploited by large international companies. Smallholders and indigenous communities seldomly benefit from real conservation efforts. There are two opposing ways of thinking: on the one hand, governments stress that PES are relatively cheap options for carbon mitigation and nature conservation compared to publicly funded conservation efforts. On the other hand, PES can be considered as a type of subsidy making farmers dependent on public means and reducing resilience.

## Applicability for MITIGATE+ goals

How can PES be applied to achieve reduced GHG emissions, increased carbon sequestration and other SDG co-benefits? Mitigation of GHG has been the subject of most PES over the last decades and systems are gaining maturity. Introducing the Clean Development Mechanism has been an essential step to sophisticating PES. Still, a new business model must be developed for any new service provided to deliver a win-win situation for all stakeholders. Therefore, research into the commonalities and effectiveness of successful PES are ongoing and imperative.

Pfaff (2012) investigated REDD initiatives world-wide on their impact on reducing deforestation and forest degradation. The initiatives using PES showed typically that objectives were only partially achieved, due to limits on how key drivers of forest loss were addressed, typically applied to areas where the treat was low or concessions were made on the details of the contract and the use of voluntary commitments. Land owners mainly were offering their least productive land for forestation. Contracts can specify the use of environmentally sensitive methods, but enforcement has been poorly capturing revenue and impact and have provided little protection to habitat and illegal logging. PES often have the character and effect of subsidies and can lead to market price distortions and land use issues, for example, when biofuels are promoted as fossil fuel reductions leading to changes in land use and market prices. Thus parties are encouraged to improve behavioural change towards climate-friendly actions and make

in one location leads to the loss or degradation of ecosystem services elsewhere.

enforcement work. Bitzer et al. (2008) noted that the use of standards and voluntary codes of conduct in combination with certification could improve the use of PES for GHG

mitigation and also, recent developments of digital tools have the potential to improve transparency.

## Examples from MITIGATE+ focus countries

<b>Example box 4.1</b>	<b>Chaina micro-watershed PES scheme</b>
	Colombia
	Provider: private local initiative of the Chaina villages with support of the Alexander von Humboldt Institute and CIFOR 2005-2007

### A. Description of mechanism

In Colombia, in the micro-watershed of Chaina (Department of Boyacá) PES scheme has been implemented, including different environmental services complementary to other conservation instruments such as establishing protected areas and land purchase. In addition, the PES scheme supported the integration of different stakeholder interests, contributing to the strengthening and construction of social capital in the region.

To reduce current and future sedimentation and favour seasonal flow regulation, users of five private rural aqueducts located in the lower part of the Chaina basin paid contributions the families who own the upper part of the watershed for the revegetation of the watershed. The contributions came exclusively from the users, and are channelled and administered through an association comprising the five water boards (see Figure 9). Payments to landowners are made through binding contracts conditioned on compliance with the conservation actions agreed upon, the amounts of which were negotiated based on opportunity costs resulting from previous studies.

The Chaina micro-watershed is made up of 12 private properties, ranging in size from 4.6 to 215 ha. Five of the twelve properties are between 10 and 20 hectares in size. Livestock activity was carried out on most of the properties in the micro-watershed. Most farms in the micro-watershed had a stocking capacity of 1.5 animals per hectare, primary feeding and use of salt, management of anti-foot-and-mouth disease vaccines, and with productions between 1.5 and 2.5 liters/cow/day. The processing of by-products for sale, such as curd and cheese, generates average net benefits of US\$ 252.8/ha/year (Rodríguez, 2005) (see Table 2).

### B. Accessibility and applicability

The total number of registered water points is 1,002; of these, 524 correspond to households of rural origin (52%) and 478 (48%) to "linked" (non-native) households. In addition to the permanent beneficiaries of water from the micro-watershed, estimated to be approximately 2,000 people, corresponding to the peasant population, there are also the "floating" users, whose number is close to 2,000. The number of "floating" users is estimated at about 2,300 people (Borda et al. 2010).

The opportunity cost was estimated using the cost-benefit flow methodology. Based on primary information - collected from household surveys - and secondary information -from the Agricultural Technical Assistance Office (UMATA) of the municipality of Villa de Leyva (Rodríguez, 2005). The opportunity cost per hectare was estimated as the average net benefit per hectare. In addition, tenants and landowners were asked about the annual cost per hectare for land use. Annual cost of using the land through leasing as a proxy of opportunity cost (Hoffmann et al. 2006). As a proxy of opportunity cost (Hoffman 2008), under which several properties were located at the beginning of the process.

### C. Upscaling

These watershed programmes are localised and designed according to local context and difficult to upscale with the same model everywhere. They should be checked case by case study, and designed according to the local context.

## BOX Examples from MITIGATE+ focus countries

<b>Example box 4.2</b>	<b>MIKOKO PAMOJA Mangrove conservation for community benefit</b>
	Kenya
	Providers: Mikoko Pamoja Community Organizations registered by Association for Coastal Ecosystem Services (ACES) and officially accredited by Plan Vivo Foundation
	Size: US\$ 185,061 between 2013-2022
	Region: Residences of Gazi bay area including two largest villages in the area. About 5400 persons who rely most on natural resources, particularly fisheries.

### A. Description of mechanism

The Kenyan government owns mangrove forests and has assigned the Kenya Forest Service (KFS) to manage them. Mangrove Pole and Charcoal Outgrowers (MPCO), a government-registered community organisation established a Gogoni Gazi Community forest association and signed a local tenure ship agreement with KFS through the association. Since then, the team has facilitated community co-management and conservation of the mangroves in the project area (including forest protection and restoration), with a Project Coordinator overseeing day-to-day activities and reporting to the community members through village meetings and notice boards.

The funding conservation efforts of MPCO generates from carbon credit. Carbon credit mechanism is discussed in in Case 3 above.

### B. Accessibility and applicability

Farmers and farming communities benefit from the funds generated through the sale of carbon credits. These are utilised to finance community development initiatives in education, health, water and sanitation, and environmental conservation, as well as to provide other benefits such as increased biodiversity, protection of shorelines, and livelihood opportunities in beekeeping, mangrove ecotourism, and other nature-based endeavours. The team implements initiatives developed through a consultative process that used appraisal surveys to rank priority community projects, identify risks, form implementation committees,

The community generated about US\$ 185,000 from 2013 to 2022. In the first three years about 68% and later over 90% of the revenue were received by the community, and the remaining funds are spent on administrative costs, PlanVivo and ACES fees, and reforestation activities.

### C. Upscaling

The community wants to upscale the project as of 2022, sharing their wish to expand mangrove operations in Gazi with an additional 200ha of mangrove forest in Gazi Bay.

## BOX Examples from MITIGATE+ focus countries

<b>Example box 4.3</b>	<b>Carbon &amp; Biodiversity (CarBi) Programme</b>
	Vietnam
	Providers: Individual and groups of farmers and communities in the Quang Nam and Thua Thien-Hue provinces of Vietnam
	Size: About US\$ 229,000 from 2013 to 2014. 184 households and communities.

### A. Description of mechanism

The project has helped the Vietnamese government to implement and expand a Payment for Forest Environmental Services (PFES) programme in the Quang Nam province, covering 27,800 hectares of target forests. Under the programme, hydro-electric companies pay a fee to the government-managed Forest Protection and Development Fund (VNFF), 90% of which is distributed to local communities contracted to protect and manage surrounding forests. The project provides training to these households, who, on average, protect and manage between 10 to 15 hectares of forest and receive between VND 3 to 5m (US\$ 143 to US\$ 238) per year (Please see WWF (2015) for more information).



## **B. Accessibility and applicability**

The project farmers are offered savings accounts to receive payments for afforestation, regeneration, and Community Forest Management (CFM) activities, such as planting indigenous species, boundary clearance, and marking and protecting regenerated trees. Withdrawals from the savings accounts are only permitted at specific intervals, and a third-party service provider manages these accounts for the farmers and farmer groups. Regular support is provided to ensure that the contract obligations are being met, and formal checks are done before each payment is released, with further follow-up checks. Certain farmer groups have been supported to manage and sustainably maintain rattan as part of the regeneration activities.

The project also came across challenges in terms of accessibility. People participating in the project are unfamiliar with the project payment system that focuses on saving money. As a result, they prioritise jobs other than those related to CarBi when they need money quickly, especially during events such as Lunar New Year. This has led to encroachment on potential restoration land where acacia and rubber plantations have been established. Moreover, poorly executed previous projects in the same villages have caused some members of the community to be unsure whether CarBi will bring any benefits.

In Vietnam, local communities are responsible for managing and protecting forests, and they receive payment through the PFES scheme. However, other ongoing projects solely pay based on the area managed, without considering the quality of the management or its effectiveness. To improve this situation, CarBi is prioritising quality assurance and performance-based payments. They are collaborating with government counterparts to establish a more thorough evaluation system.

## **C. Upscaling**

There is now a phase 2 project called Carbi2. Please remember that this project is mainly supported by WWF, which involved an important amount of fixed investment cost to train the farmers and government officials on the system. It has also been shown that it is impossible to finance these ecosystem services in voluntary carbon markets through REDD+ scheme as the carbon markets earnings are limited and do not cover the costs. This shows that a public support is required to implement such kind of PES schemes.

## **Key take-aways for upscaling strategy and role of finance**

- PES can use a carbon mitigation mechanism and livelihood development instrument, especially when there is potential to trade the carbon offset through preserved and restored forests in the carbon markets.
- Payment for ecosystem services (PES) should be priced differently based on scope, nature, and consequences, and farmers prefer performance-based pricing to showcase their contribution to society. At the same time, valuation techniques such as functional quantifying, avoidance of costs, and contingent valuation can help monetise ecosystem services, but the continuity of service payments is vital to farm income.
- PES are incentivised contributions for governments to achieve climate targets, but they can be treated as subsidies and lack sufficient recognition for the sustained services provided; while PES have successfully mitigated GHG emissions, new business models are needed to deliver a win-win situation for all stakeholders.

## CASE 5: TAX INCENTIVES

<b>Instrument: TAX INCENTIVES</b>
Category: Public incentive

### Background and definition

Tax incentives can be defined as “all measures that provide for a more favourable tax treatment of certain activities or sectors compared to what is granted to general industry” (Klemm 2009). Alternatively, it can be defined as “any tax law/regulation that targets tax relief (lower tax burden) to a certain subset of activities” (Clarke 2012).

### History

In general, to encourage climate change mitigation efforts to adopt desirable production techniques, public policies may take the form of taxing externalities on either inputs that generate pollution (i.e., energy tax), or GHG outputs (i.e., carbon tax) or on consumption (e.g., give food related GHG emissions a price by increasing VAT tariffs). Often, these taxes and tax exemptions are combined with other regulatory restrictions and voluntary actions. Currently, most attention is given to tax energy use, which comprise for example fuel excise taxes, and are the largest source of environmental tax revenue worldwide. In this analysis we are not focussing on emissions trading schemes (ETS) since this is elaborated on in the case study on carbon credits. The main difference is that a carbon tax sets the emission price while an ETS sets the total emission quantity.

### Volume

Among OECD countries, energy taxes raise an average of 1.1% of GDP, and over the past decade a few European countries have raised these taxes to more than 3% of GDP. As a share of GDP, energy tax tends to be significantly lower in developing economies. However, it also reflects lower levels of energy use (for example lower private automobile ownership) as well as policymakers’ concerns about the effect of fuel taxes on economic activity and the poor. Global proceeds of energy taxes are estimated at around US\$ 80b (Matheson, Accessed: 31 August 2023).<sup>16</sup>

<sup>16</sup> In contrast, global energy subsidies widely exceed the volume of energy taxes. The volume of so-called pre-tax subsidies on energy – by selling energy below cost - is estimated at US\$ 296bn (Matheson, Accessed: 31 August 2023). This does not include the so-called post-tax

There are 27 countries with significant carbon tax and include among others the European Union, Colombia and China (for example in Sweden with the highest carbon tax the tariff amounts 137 US\$ per metric ton of CO<sub>2</sub> Equivalent). Numerous other countries are likely to implement a carbon tax (e.g., Vietnam, Kenya). Current carbon pricing initiatives across the globe on various regional, national, and sub-national levels have been estimated to cover 21.5% of global greenhouse gas emissions in 2021 (GCC FinTax, 2022). Global proceeds of carbon taxes are estimated at around US\$ 28bn (World Bank 2022a).

For the MITIGATE+ focus countries, the agricultural support pattern has been as follows:

- Colombia is taxing 37% of its carbon emissions from energy use (OECD, 2021a).
- Kenya is taxing 18.9% of its carbon emissions from energy use (OECD, Accessed: 31 August 2023).
- Vietnam tax statistics of its carbon emissions from energy use are not published by OECD.

### Profile of the instrument

#### Operating rationale

Carbon tax is a policy instrument that puts a price on GHGs so that externalities are priced and operationalises the Polluter Pays Principle. By internalising externalities associated with GHG emissions, carbon tax can facilitate cost-effective abatement and promote low-carbon innovation (Aldy and Stavins 2012). So this tax policy will provide ways of allocating the costs of pollution prevention and control to polluters to encourage the rational use of scarce environmental resources. Note that energy taxes increase the price of energy regardless of emissions but is easier to operationalise. Any of these taxes can be combined with an exemption (i.e., rebate) whereby those that use or emit less carbon are implicitly subsidised (see IEA (Accessed: 31 August 2023) for explicit subsidies of fossil fuels).

subsidies, which stand for taxing fuel by less than the full social cost of carbon emissions, local air pollution and vehicular externalities (estimated at US\$ 5,200bn (ibidem)).

## Actors

Governments are the actors that determine how externalities are taxed and set the tariffs. Often this is on specific inputs that generate pollution (i.e., energy tax). If additional measures are needed to meet national goals GHG outputs are taxed (i.e., carbon tax). Depending on the context farmers, agro-food companies, and consumers are the actors that are directly or indirectly taxed. In case tax exemptions are in place actors are those beneficiaries who are eligible.

## Investments supported

Taxing externalities and providing exemptions will encourage adoption of desirable production techniques that lower emissions. Whether specific investments are directly or indirectly supported depend on the context of who is subject (i.e., actors), which objects (i.e., energy inputs or GHG outputs) to the tax, and whether it is measurable (e.g., GHG outputs).

## Conditions

A tax system is the main condition for collecting tax and providing exemptions. Tax exemptions are only applicable for those actors that pay taxes. Note that the burden to taxed entities is however transmitted (partly or fully) to those purchasing the product (or service), including the informal sector and the households.

## Accessibility and affordability

### Farmers' perspective

Farmers in the Global South are taxed marginally and may only benefit indirectly. Taxing smallholders directly, or indirectly by upstream actors in the agricultural value chain, will most likely adversely affect the poor and vulnerable smallholders. Mitigation of GHG emissions commonly faces an essential problem that private returns are commonly negative for smallholders (Matheson, probably 2020). Smallholders also tend to be those that are disproportionately affected by climate change.

However, farmers who implement low-emission practices can indirectly benefit from tax incentives. As elaborated on in the carbon credit case study smallholders can sell carbon credits as a separate commodity and generating additional

revenue streams while at the same time it is a risk reducing strategy as the carbon price is not linked to the commodity price (Interview Solidaridad 2022). Voluntary carbon markets are increasingly connecting to forestry or land use mitigating measures on farm level. Moreover, farmers can sometimes benefit from incentives provided by banks when investing in sustainable practices (e.g., lower interest rates or more lenient rules for depreciation of investments).

## Other actors' perspectives

How can tax benefits be applied to achieve reduced GHG emissions, increased carbon sequestration and other SDG co-benefits? The prospects of adoption depend on the cost of carbon reduction in the AFOLU sector (i.e., additional cost of investments in technological improvements or other actions taken to mitigate carbon emissions) and the benefits received (i.e., reduced tax). Measures for mitigation in the AFOLU sector are relatively expensive compared to other sectors. IPCC (Accessed: 31 August 2023) estimates that in the AFOLU sector net lifetime costs of adopting carbon reduction measures are in the range of 20- US\$ 100 per tonne of CO<sub>2</sub> equivalent reduction (with the top three measures with the highest potential contributing to net emission reduction for reduced conversion of forests and other ecosystems, carbon sequestration in agriculture and ecosystem restoration, afforestation and reforestation). The most cost-effective measures are expected in the transport sector (often net lifetimes costs are lower than the current reference). Cost-effective measures with high potential are expected in the energy sector (renewable energy by using more solar and wind energy).

The impact of carbon tax hinges on the integrity of the market in acquiring baseline accuracy and monitoring of carbon emission targets. Taxing inputs that generate pollution (i.e., energy tax) are more easily to be operationalised and its impact depends on the level of the tariffs. Labandeira et al. (2017) estimate that an efficient fuel taxation is about 3.8% of global GDP.

## Applicability for MITIGATE+ goals

Not a direct source of financing for mitigation- and co-benefit-oriented actions. Rather a long-term and large-scale strategy to achieve a turn of trend towards low-emission food systems. A more direct link is foreseen in carbon credits and carbon markets (see case study on carbon credits for applicability for MITITGATE+ goals).

## Examples from MITIGATE+ focus countries

Example	CARBON TAX
box 5.1	Country: Colombia
	Who/provider: Government
	Size: Colombia is taxing 37% of its carbon emissions from energy use
	Regions: National

### A. Description of mechanism

The main taxes on energy use in Colombia are the following (OECD, 2022a):

- The National Gasoline Tax (Impuesto Nacional a la Gasolina) applies to gasoline, diesel and all other liquid motor fuels that are used in vehicles and in stationary combustion engines. The tax is adjusted annually to inflation.
- The Surcharge on Gasoline and Diesel (Aceite Combustible Para Motores - Sobretasa a la Gasolina y al ACPM) applies to the same fuels subject to the National Gasoline Tax.
- The National Carbon Tax (Impuesto Nacional al Carbono) is set at approximately US\$ 5 per tonne of CO<sub>2</sub> equivalent, which is adjusted annually to inflation plus one percentage point.

In Colombia tax rates can differ across energy products and users, for example within the transport sector, gasoline is taxed at a higher effective tax rate than diesel. Colombia priced about 37% of its carbon emissions from energy use and about 17% were priced at an Effective Carbon Rate (ECR) above EUR 60 per tonne of CO<sub>2</sub> (OECD, 2021a). The ECR is the price on carbon emissions and is the sum of tradeable emission permit prices, carbon taxes and fuel excise taxes.

The Colombian government installed a carbon tax in 2016 (OECD, 2022a). The income from the carbon tax goes to the general tax revenues: it is used for diverse purposes (e.g., peacebuilding and Payments for Ecosystem Services (PES)). The fuel companies have to pay the carbon tax in case they cannot prove to be carbon-neutral. Emitters have the option to meet their carbon tax liability by using offset credits generated from domestic projects. In the latter case they should measure their carbon footprint and buy sufficient carbon credits to compensate for their carbon footprint. This is called the "no causación": the actions leading to emission reduction or carbon sequestration take away the ground (cause) for the carbon tax. "No causación" is regulated and supervised by the Ministry of Environmental Affairs (MADS, Accessed: 31 August 2023).

Over the period 2017-2022, over COP 2.2bn in carbon tax was collected, corresponding to 136m tonnes of CO<sub>2</sub>e. Another 89m tonnes of CO<sub>2</sub>e was realised through certified carbon reduction projects, under the carbon tax rebate ("no causación"). In total, 225m tonnes of CO<sub>2</sub>e was compensated through the carbon tax, of which 61% through carbon tax payments and the remaining 39% in the form of certified projects. Certified projects represent an increasing share (from 20% in 2017 to 52% in 2022) (Asocarbono, 2022).

It is expected that the carbon tax will be reformed on initiative of the new Colombian government as stipulated in the National Development Plan:

- Broaden the taxable base (including more energy sectors, e.g. thermal coal)
- Increase tariff (and make it progressive)
- Changes to the approved destinations for the revenues of the carbon tax (social priorities, e.g. for poverty alleviation, conflict-affected regions, vulnerable communities) (Departamento Nacional de Planeación, 2023. Congreso, 2023).

Until 2021, Colombia was known as a typical example of tax incentives for greening the economy (Villada Duque et al., 2017; Cabrere, 2021; Dempsey, 2022) However, the recent government issued a large tax reform in 2022, which eliminated most of these tax incentives, from a perspective of social and economic justice (Ministry of Environment and Sustainable Development, 2022; Pardo, 2022).

### B. Accessibility and applicability

The carbon tax has stimulated a local market for carbon credits. As long as the carbon credits are cheaper than the carbon tax, the fuel companies have an incentive to purchase carbon credits. The system is supported by MRV mechanisms (monitoring, registration and verification) and several domestic verification standards exist, e.g., BioCarbon Registry (PMR Colombia, 2020).

### C. Upscaling

The taxable base has grown and also the carbon tax tariff ((MADS, Accessed: 31 August 2023, PMR Colombia, 2020).

Example box 5.2	<b>ENERGY TAX</b>
	Country: Kenya
	Who/provider: Government
	Size: Kenya is taxing 18.9% of its carbon emissions from energy use
	Regions: National

**A. Description of mechanism**

Kenya does not have an explicit carbon tax. However, it does collect energy taxes and excise taxes apply to petroleum products. Moreover, there is a levy on electricity consumption (passed on to the Energy and Petroleum Regulatory Authority) and a levy on rural electrification (passed on to the Rural Electrification Authority). Both levies are classified as electricity excise taxes. There are negligible fuel and electricity subsidies (OECD, 2022b).

In total, 18.9% of GHG emissions in Kenya are subject to a positive Net ECR in 2021. Fuel excise taxes, an implicit form of carbon pricing, cover 18.9% of emissions in 2021. In 2021, fuel excise taxes amounted to EUR 15.88 per tonne on average (OECD, Accessed: 31 August 2023).

**B. Accessibility and applicability**

Kenya has low effective carbon rates relative to the OECD average. Compared to other emerging economies the ECR is relatively high for fuel oil, diesel, kerosene and gasoline and similar on coal, LPG and natural gas (OECD, 2022b).

**C. Upscaling**

According to the OECD, Kenya’s tax revenue potential from carbon price reform, if ECRs were raised to the benchmark rate of EUR 30 per tonne of CO<sub>2</sub>, is an increase of revenue worth 0.2% of GDP (OECD, 2022b).

Note that newly implemented Kenyan laws provide incentives for private voluntary carbon trading. The amendment sets the tax rate for a company operating a carbon market exchange or emission trading system at 15% for the first 10 years from the year of commencement of its operations. The new tax rate is significantly lower than the ordinary corporate tax rate of 30% (see case study on carbon credits) (Wambua and Kaniu Gitonga, 2022).

The Kenyan government will explore the viability and design of a carbon tax in Kenya as stated in the draft national green fiscal incentives policy framework (National treasury and economic planning, 2022).

Example box 5.3	<b>ENERGY TAX</b>
	Country: Vietnam
	Who/provider: Government
	Size: Vietnam tax statistics of its carbon emissions from energy use are not published by OECD
	Regions: National

**A. Description of mechanism**

Environmental protection taxpayers are specified in Article 5 of the Law on Environmental Protection Tax 2010 (Environmental protection tax, 2010) and Article 3 of Circular 152/2011/TT-BTC ([Ministry of Finance, 2011](#)).

Energy tax, of which fuel taxes stand out, generates a substantive stream of revenues for the government budget, of approximately 1.5% on average for the period 2012-2014 (UNDP, 2018).

**B. Accessibility and applicability**

Taxable subjects are gasoline, oil, grease and coal (Environmental protection tax, 2010, [Ministry of Finance, 2011](#)).

**C. Upscaling**

See the case study on carbon credit for more information and upscaling opportunities of a national ETS system in Vietnam.

## **Key take-aways for up-scaling strategy and role of finance**

Taxing inputs that generate pollution (i.e., energy tax) or consumption (e.g., give food related GHG emissions a price by increasing VAT rates) are more easily to be

operationalised and its impact depends on the level of the tax. However, in the Global South increasing taxes will most likely adversely affect the poor and vulnerable smallholders and consumers. A more promising pathway for up-scaling mitigation efforts is foreseen in carbon credits and carbon markets (see case study on carbon credits for applicability for MITITGATE+ goals).

## CASE 6: RE-PURPOSING AGRICULTURAL SUBSIDIES

	<b>Instrument: REPURPOSING AGRICULTURAL SUPPORT AND SUBSIDIES</b>
	Category: Public incentive

### Background and definition

Re-purposing of agricultural support can be defined as the reorientation of the current level of agricultural support “to deliver better economic, environmental, social, nutritional and climate outcomes” (Gautam et al., 2022). Agricultural support can include price and trade incentives as well as subsidies and other forms of fiscal support. Repurposing refers to “the reduction of agricultural producer support measures that are inefficient, unsustainable and/or inequitable, in order to replace them with measures that are the opposite” (FAO-UNDP-UNEP 2021).

### History

Agricultural support and subsidies have been around for many decades. A famous historic example is the British Corn Laws in the 19<sup>th</sup> century, protecting British land owners from cheap imports of corn by installing an import tariff. In Europe agricultural support received strong impetus after World War II, because of the quest for food sovereignty and European cooperation. As these were mostly price subsidies, they triggered overproduction and trade dumping and were subsequently converted into income subsidies for farmers (1990s) combined with production quota (for example for milk and later for phosphate/manure). Discussions about the European agricultural policy were dominated by a mix of economic and social motives, with environmental aspects hardly playing a role until recent times.

Subsidy competition between the EU and USA has been a source of several trade conflicts at WTO level, with the USA applying support levels similar to the EU but through different support instruments (Steinberg et al. 2003).

The discussion about repurposing agricultural subsidies towards sustainability and climate objectives has only recently gained momentum (Vos et al. 2023). In Europe it has become a centrepiece of the discussion around the revised Common Agricultural Policy, through the Green Deal and the related Farm to Fork strategies for the budget period 2021-2027. Some progress is being made in greening the European agricultural subsidy regime, f.i. by

reserving setting an ambitious target for organic farming (to grow from currently 6.7% to 25% of farmland by 2030), supported by subsidies of the EU rural development and R&D windows. But this progress has been held back by the strong lobby from agribusiness companies and larger farmer organisations, supported by political forces from the centre-right. The largest stream of agricultural subsidies, direct payments to farmers, remains unchanged, although the EU now allows countries to switch up to 15% of their CAP allocations back and forth between the rural development window and the facility for direct payments to farmers.

Agricultural support in the EU, USA and China influences world food markets, with multiple consequences for countries in the Global South and their domestic food markets. At the same time, countries in the Global South also support their own agricultural sectors, in pursuance of goals such as of food security, agricultural and economic development and social equity (Bouët and Laborde 2017).

### Volume

Agricultural support can take the form of price incentives (import and export measures, domestic price regulation) or fiscal incentives (farm output subsidies, farm input subsidies, production factor subsidies, public goods provision) (see Figure 10). Agricultural subsidies are globally estimated at around US\$ 540bn, of which US\$ 294bn through price incentives and US\$ 245bn through fiscal incentives (FAO-UNDP-UNEP 2021).

Globally, agricultural producer support represented on average 15% of the total agricultural production value, between 2005 and 2018 (FAO-UNDP-UNEP 2021).<sup>17</sup> The most stable portion originated from input subsidies (3%) and subsidies based on factors of production (4%). A more volatile share comes from price incentives, on exports, imports and domestic trade. Remarkable is the difference between richer and poorer countries: for high-income countries the total agricultural producer support represented between 20% and 30% (on average) of their total agricultural production value, with a long-term downward trend. This contrasts sharply with low-income

<sup>17</sup> Figures quoted on this page represent the nominal rate of assistance as a percentage of production value. This is a combination of the nominal

rate of protection (price incentives) and the fiscal subsidies for producers.

countries showing negative support regimes (between +5 and -20% on average), with a long-term upward trend towards a ~0%. Middle-income countries show an

intermediate 8-14% bandwidth, with a long-term upward trend (FAO-UNDP-UNEP 2021).<sup>18</sup>

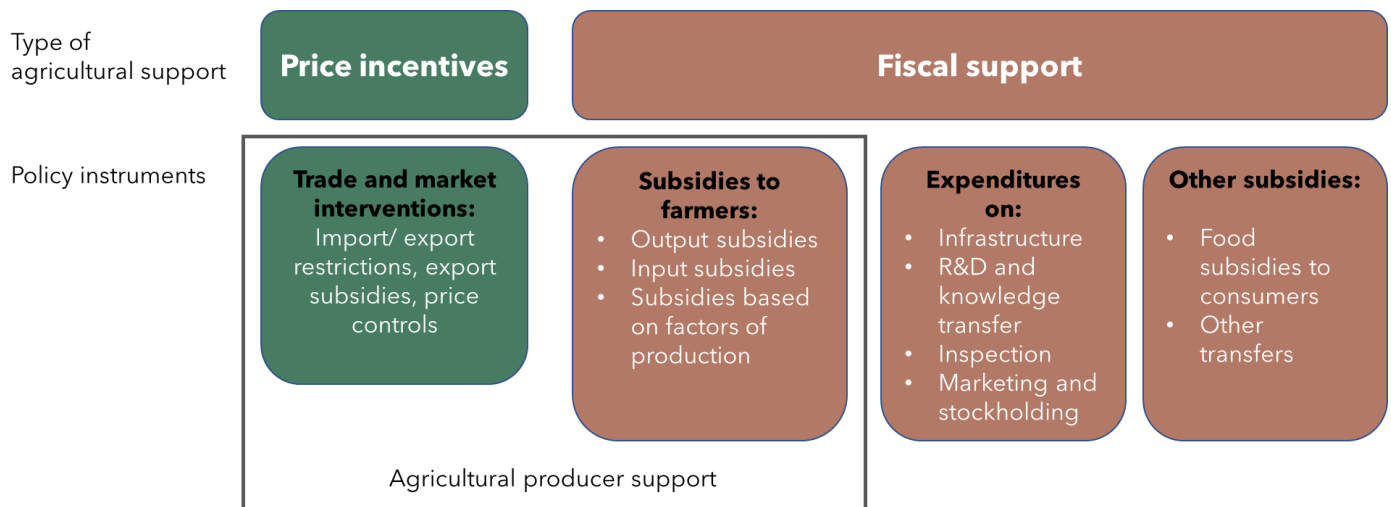


Figure 10. Schematic overview of agricultural support instruments.

Source: authors' elaboration after FAO-UNDP-UNEP 2021.

For the MITIGATE+ focus countries, the agricultural support pattern has been as follows:

- **China** moved radically from negative support in the 1980s, in the order of -30% to -40% of the total agricultural production value, towards a positive support in the 2010s around 20%. This was mainly due to price incentives; subsidies constitute a smaller but slightly growing portion, mostly subsidies on factors of production and on inputs (FAO-UNDP-UNEP 2021).
- **Colombia**: 25-30% (2013), mainly price incentives and smaller portions for different kinds of subsidies (FAO-UNDP-UNEP 2021).
- **Kenya**: 20-25% (2013), mainly price incentives (FAO-UNDP-UNEP 2021).
- **Vietnam**: 0-5% (2013), mainly price incentives and subsidies based on factor of production (FAO-UNDP-UNEP 2021).

### Profile of the instrument

Repurposing agricultural support is defined as follows: "Agricultural support that is harmful to nature, climate, nutrition and health should be removed or reduced. But to ensure a beneficial outcome overall, any fiscal savings should be repurposed towards agricultural support that is

healthier, more sustainable and equitable, while also minimising any potential trade-offs from the elimination of specific kinds of agricultural support" (FAO-UNDP-UNEP 2021).

### Operating rationale

For our objective of low-emission food systems, there are two fundamental argumentations for re-purposing agricultural subsidies. The first one is that agricultural subsidies may create a bias in favour of high-emission agriculture, e.g. not only by lowering the relative price of fossil and inorganic inputs in comparison with organic and renewable inputs ("substitution effect"), but also by stimulating agricultural production and incomes in general ("income effect"). This argument is put forward by many authors (Feng et al. 2022, FAO-UNDP-UNEP 2021, Nisbett 2022). FAO-UNDP-UNEP (2021) explores this argumentation empirically by modelling the food system effects of eliminating existing agricultural subsidies, for example on land use and GHG emissions.

The second line of argumentation can be found in transition theory (see Figure 11). Large transitions, such as the change from high-emission to low-emission food systems, require not only the build-up and scaling of new low-emission innovations, but also the break-down of old high-emission

<sup>18</sup> In view of the recent Russia-Ukraine war and the discussion about the influence of their wheat and sunflower oil exports on developing

countries, it is interesting to note that Ukraine hardly supports its agriculture in net terms, whereas Russia shows a 15% level of support.



patterns. If this is not done, the new innovations will suffer from the counter current of status-quo food systems which can exploit their dominant position in the competition for markets, resources (e.g. land) and public support. Also the

resources to support these innovations will remain too small as the public budgets and private portfolios will find their way more easily to status-quo investments and support.<sup>19</sup>

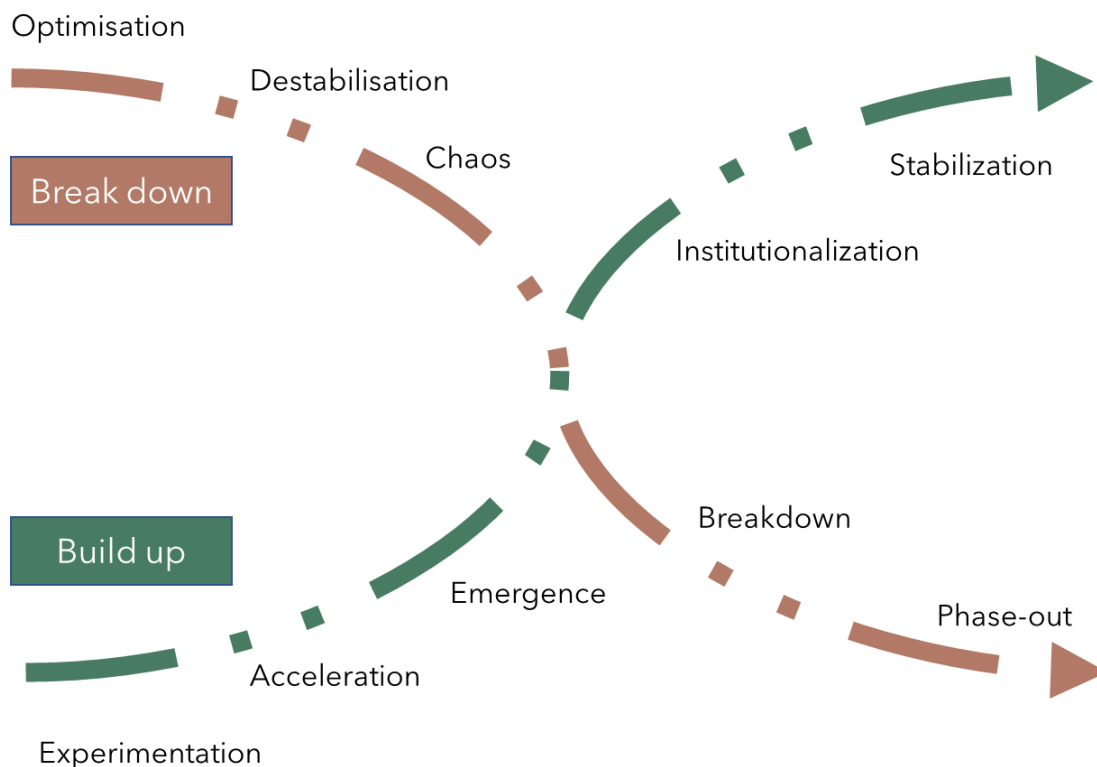


Figure 11. The X-curve of social transitions.

Source: Silvestri et al. (2022), based on Hebinck et al. (2020).

FAO-UNDP-UNEP (2021) pleas for a step-by-step nuanced approach to repurposing agricultural support, signalling that the elimination and replacement of subsidies and other types of support can have multiple and contradictory effects, also on GHG emissions, and therefore need to be researched and weighed carefully. As an illustration, they argue that a (hypothetical) global removal of existing price incentives will have a larger effect on GHG emissions than the removal of fiscal subsidies, and that both measures will lead to shifts between cropland and pastureland, as well as to displacement of trade and production between high-income countries, BRIC countries and lower-income countries. Also the effects on other development goals, such as farmer incomes, social and equity indicators, food consumption, nutrition and health are complex and multi-dimensional and therefore need to be investigated carefully

for specific policy proposals and contextual situations. Therefore they also make a plea for (temporary) cash transfers to mitigate short-term negative implications of repurposing for vulnerable producers, consumers and poorer countries.

**Actors**

- Governments (central and local)
- Direct and indirect beneficiaries of agricultural support (farmers, agro-food companies, input and equipment companies, consumers)

<sup>19</sup> This argument from transition theory could equally be applied to the greening (= re-purposing) of financial investment portfolios and capital flows. Greening financial portfolios is not only about building up green

finance portfolios, but equally (and maybe more) about phasing down grey and brown investment portfolios. See also Case 1 (Green Finance) in this report.

- Stakeholders of the environmental and climate effect of agricultural support (e.g. nature, climate, surrounding communities, non-agricultural sectors competing for public resources and environmental footprint quota).

## Investments supported

Some examples of agricultural support<sup>20</sup> (traditional and re-purposed) are presented in Table 5:

Table 5. Some examples of agricultural support, traditional and re-purposed

	Traditional	Re-purposed (examples)
Price incentives - international	Restrictions on food exports Export subsidies	
Price incentives - domestic	Food price regulation	
Subsidies output-based	Price subsidies	Minimise output /volume based subsidies (FAO-UNDP-UNEP 2021). Incentives for healthy food (e.g. diverse diet, nutrient rich) Incentives for production and consumption of sustainably produced food.
Subsidies input-based	Fertiliser subsidies  Fossil fuel subsidies	Subsidies for (use of/ production of) organic fertiliser, compost or compound fertiliser Subsidies for renewable energy
Subsidies factor-based	Income subsidies per hectare Cheap loans for agriculture Subsidised water and energy Irrigation subsidies	Subsidies subject to environmental standards, to environmental outcomes (positive impact), to efficient resource use (water, energy), or to explicitly biological or organic agriculture (EU 2021-2027) Payments for ecosystem services and/or farmland restoration (WRI 2021) Subsidies for innovative food system solutions (start-ups, SMEs)
Other	State-financed infrastructure for agro-food (markets, warehouses, ...)	Support for nature-based infrastructure (Cutler and Calvo 2022)

## Conditions

Price incentives and price regulations are most often not tied to specific conditions, other than the specifications of the traded product itself. This is different for subsidies, which usually require farmers to be registered and to comply with the requirements related to the registration. In higher-income countries, such requirements are often related to the "licence to operate" and sometimes to certain environmental regulations or certifications. In lower-income countries, subsidies are sometimes targeted to smaller farmers, but the contrary can also be the case.

## Accessibility and affordability

### Farmers' perspective

A re-purposing of agricultural support and subsidies, towards more sustainable and climate-friendly purposes, will pose a potential threat to the current beneficiaries of this support. They will see their benefits shrink, unless they decide themselves to move towards a more sustainable production practice. So it is important to analyze who stands to lose and who stands to gain from a re-purposing reform.

Some of the traditional agricultural subsidy programme in low-income countries are targeted at small farmers. An example is the fertiliser and seed subsidies programme (FISP) of the Ministry of Agriculture in Zambia: farmers - with

<sup>20</sup> Subsidies to other parts of the food system are not covered in this case example. Examples of this may be subsidies on the consumer side (vouchers, food stamps, subsidised food banks) (Nisbett, 2022).

a maximum of 5 hectares - need to be organised into farmer associations to gain access to the input subsidy (IAPRI 2020). Other examples are the on-farm investment subsidies for smaller farmers in Mexico and Chile (OECD-FAO 2019).

But sometimes the contrary is the case: in some countries, subsidies tend to flow towards farming sectors with larger political leverage, which are usually larger and more wealthy producers (examples: grains, beef, dairy). Also, insofar subsidies in richer countries are coupled to production volumes, they might cause excess production which can distort international commodity markets and harm the interests of producers in poorer countries (Bouët and Laborde, 2017).

Subsidies may also create unequal effects among different types of farming. For example, input- or output-based subsidies may provide a positive bias towards intensification of agriculture, which may pull resources (land, water, labor) away from lower-intensity or regenerative agriculture.

### Other actors' perspectives

World Bank and IFPRI studied the potential impact of re-purposing agricultural support (Gautam et al. 2022). They state that the current (traditional) form of agricultural support gives very low value for money as a way to help farmers and that simple reductions or re-arrangements of this support will not lead to substantial reductions in global emissions. They plea for two important changes. First, to be aware of the trade-offs contained in environmental

conditionalities, between economic, social and environmental goals. And second, to make concerted efforts to turn part of the current (traditional) support into incentives for green innovations that reduce both emissions and costs.

Wright et al. (2023) argue that re-purposing agricultural subsidies towards more healthy and sustainable diets could have positive environmental effects as well as fiscal savings for governments.

### Applicability for MITIGATE+ goals

How can the re-purposing of agricultural subsidies be applied to achieve reduced GHG emissions, increased carbon sequestration and other SDG co-benefits? Re-purposing agricultural support cannot be considered a direct source of financing for mitigation- and co-benefit-oriented actions. It is more in the long run - and after substantial policy reform - that re-purposing may liberate resources for more sustainable and climate-friendly forms of agriculture. Therefore it is rather a long-term and large-scale advocacy strategy to achieve a turn of trend towards low-emission food systems.

The effects of re-purposing on mitigation and developmental goals are not simple and linear, but run through complex systemic causalities and trade-offs. Effects are also highly diverse, per country but also contextual in terms of crop sectors, agroecologies, value chain structures and agro-food governance regimes. As such, it is not a technical topic only, but highly influenced by political economy and power relations.<sup>21</sup>

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<sup>21</sup> “The current subsidy regime is complex, both in terms of the many forms of subsidies, their objective, and the variation between countries. However, they seldom relate to healthy diets or planetary health. This reflects their development over decades in support of

other objectives. This situation is unlikely to change without sustained political will. The challenges and difficulties around reforming subsidy policies need to be recognised and addressed head on.” (GPAFSN (2022).

## Examples from MITIGATE+ focus countries

<b>Example box 6.1</b>	<b>RE-POSITIONING AGRICULTURAL SUBSIDIES</b>
	China
	Provider: Central government
	Nominal rate of assistance (% of country's production value): <ul style="list-style-type: none"> <li>Negative support of -/- 30-40% in the 1980s</li> <li>Positive support of ~ +20% in the 2010s</li> </ul>

### A. Description of mechanism

Agricultural subsidies to reduce the income gap. After China's fundamental reform and opening up in 1978, its income distribution gap has significantly widened. This was mainly due to income differences between rural and urban citizens, and to the fact that agriculture was being heavily taxed rather than supported. This trend has been reverted: fiscal expenditure on agriculture is now being seen as a tool to narrow the rural-urban income gap and to increase the efficiency and competitiveness of Chinese agriculture. Fiscal expenditure on agriculture has been increasing, mainly after 2004, including subsidies on inputs and machinery, tax reductions, and expenses on food security and poverty alleviation as well as environmental protection. These subsidies were initially coupled to production volumes (minimum purchase prices, temporary purchase and stocking), but after 2010 they were decoupled, among others to comply with WTO regulations (Zhang 2022a). The increase in agricultural support has contributed to a small improvement of the rural-urban income gap, but the income gap still remains substantial (Mao et al. 2022).

First steps towards greener policies. The above policies succeeded in improving grain production and farmer incomes, but also exacerbated the excessive use of chemical fertiliser and pesticides. Therefore the government started in 2015 with greener and more sustainable policies, to reduce the use of chemical fertilisers<sup>22</sup> and pesticides and to recycle agricultural waste resources (e.g. straw) (Feng et al. 2022).

- Elimination of preferential energy prices and VAT tax benefits for the fertiliser industry.
- Environmental subsidies were introduced for cultivated land protection, grassland ecological protection and management, fishery resource protection and manure treatment (livestock, poultry).
- Pilot subsidies were introduced for the demonstration and use of biological pesticides and organic fertilisers; and for the utilisation of straw as fertiliser and animal feed.
- Ecological compensation policies, with subsidies for returning farmland to forests, returning farmland to grassland, and grassland ecological compensation policies.

The next step of re-purposing: towards carbon neutrality. Researchers at IFPRI and Chinese universities are making proposals for a next step of policy reform, to contribute to the goal of carbon neutrality in 2060 (Feng et al. 2022; Zhang 2022b). These policy recommendations encompass the following:

- To enhance the use of the following technologies: slow and controlled-release fertilisers, organic-inorganic compound fertilisers, machine deep placement of fertiliser, integrated soil-crop management, system of rice intensification (SRI), alternate wetting and drying (AWD) for rice, feed supplements technology and improved feed conversion efficiency.
- To further reform the agricultural subsidies and R&D systems towards a green, low-carbon and sustainable direction.
- To stimulate active farmers' participation and the role of social service organisations in the green agricultural development.
- Promote carbon market mechanisms for agrifood systems and mechanisms for distributing the benefits of GHG emissions reduction.

### B. Accessibility and applicability

The applicability of the re-purposing instrument to goals of climate mitigation is envisaged in the new proposals to reorient the Chinese agricultural subsidies in favour of carbon neutrality.

### C. Upscaling

By nature, subsidy policies in China are rolled out at large scale. In some cases, pilot subsidies are introduced to be tested and applied at a larger scale in later phases.

<sup>22</sup> China is still using 2.8 times as much fertiliser per hectare as the USA.

<b>Example box 6.2</b>	<b>RE-PURPOSING AGRICULTURAL INPUT SUBSIDIES</b>
	Sub-Saharan Africa (including Kenya)
	National governments
	Agricultural input subsidies, expressed in % of national public budgets for agriculture (2011-2014) (HAPA 2022): <ul style="list-style-type: none"> <li>• Lower end - 11-18% - KE/SN/ML/BF/NG/TZ</li> <li>• Higher end - 37-58% - GH/MW/Zambia</li> </ul>

### A. Description of mechanism

Much has been written recently about the need for a re-purposing of agricultural subsidies, but few examples have been documented about an actually implemented re-purposing in Sub-Saharan Africa. There are 12 countries in Sub-Saharan Africa that have operated a smart-subsidy programme for input subsidies (HAPA 2022). Kenya started its programme in 2007 and is recognised as one of the more market-friendly programmes; it spent an annual US\$ 40-77m on this programme in the period 2011-2014. While this is substantial, it represented only 18% of the total agricultural budget, which is much smaller than in some other African countries (e.g. Ghana, Malawi, Zambia). In 2020 the government piloted an e-voucher pilot in a limited number of counties; the Ukraine-Russia crisis - with a price peak of fertiliser as one of its immediate consequences - induced the government to introduce a price ceiling for fertiliser and to deploy the e-voucher programme at a larger scale (The Star 2022).

Several multi-country studies have been done about agricultural input subsidies in Sub-Saharan Africa (e.g. Balzer and Hansen 2011; Nisbett 2022). Input subsidies account for the largest share in agricultural subsidies. Balzer and Hansen's evaluation on four African countries (GH, TZ, ZM, MW) concludes that the agricultural input subsidy programmes in these countries have indeed boosted agricultural yields and food production but did not constitute an appropriate use of scarce fiscal resources. Even with so-called smart subsidy designs, these programmes suffer from similar implementation problems as the older generation of universal input subsidy programmes. The programmes are costly and inefficient, programme benefits accrue to less-poor and politically well-connected households and to large input supply companies, they do not address the underlying failures of the input markets, and the exit strategies tend to be problematic.<sup>23</sup>

In a study on agricultural input subsidies in the Sahel, Southern and Northern African countries, Nisbett (2022) signals that agricultural subsidies are often focused on a limited set of crops. Most of the subsidies flow to the production of grains and meat, with only a small portion going to production of dairy, oil, fruits, vegetables and sugar. This can result in a high diet dependency on nutrient-poor, calorie-rich products, for example maize, wheat or rice. Nisbett (2022) stresses that turning such existing subsidies into greener subsidies could support environmental outcomes, more diversified farming and nutrition, and improved soil management. But changing the existing subsidies into greener ones requires public pressure and public action to influence policy reform.

Fertiliser subsidies in Africa are often given generically, whereas agroecological, weather and market conditions can vary greatly, influencing farmers' certainty that using inorganic fertiliser is indeed profitable. McCullough et al. (2022) designed a tool to distinguish more precisely in what regions fertiliser use would be robustly profitable - in good and bad years - and in what regions fertiliser is only profitable in years with advantageous conditions. Such a tool would enable policy makers to make better decisions as to where a fertiliser subsidy would make sense, and could therefore liberate public resources for other social or environmental purposes.

### B. Accessibility and applicability

The above studies show that it is quite difficult to phase down the existing agricultural subsidies, in view of the vested interests around them. It requires substantial public pressure and public action to achieve such a reform.

Also, if current agricultural subsidies were to be phased out, one could wonder whether they would necessarily be replaced by greener or climate-friendly subsidies, or rather by other competing claims for public government budgets. To achieve an actual re-purposing towards mitigation goals and SDG co-benefits would require a concerted advocacy effort of many parties involved. Perhaps MITIGATE+ could establish or document some inspiring small-scale examples - involving multiple stakeholders including the (central or local) government - of how a subsidy instrument can be re-shaped to respond to greener objectives.

<sup>23</sup> A more recent modernisation of the Zambian input subsidy system, with e-vouchers, operated for a few years (2017-2019) but was subsequently phased down to a smaller scale because of the difficulties with the government pre-financing and the collaboration with local input suppliers (IAPRI 2020).

### C. Upscaling

Almost by definition, the agricultural support programmes are operated at a national scale. Often times, new programmes (e.g. e-vouchers) are tested on a smaller scale, for example a few districts or counties, before being rolled out at national level. Some of the agricultural support programmes are implemented by county governments or by agricultural development projects, rather than the national government. In the latter case, they tend to be temporary for the duration of the project.

#### Key take-aways for up-scaling strategy and role of finance

- Even if agricultural subsidies can be substantial, price incentives are in many countries the larger instrument of agricultural support; this is also the case in the focus countries of MITIGATE+. Price incentives can take the form of regulations for imports, exports and domestic trade of agricultural products.
- Eliminating or re-orienting agricultural subsidies is a highly sensitive and political subject. Agricultural subsidies are linked to food sovereignty and affordable food, to farmer incomes and - due to the Ukraine crisis - also to the repression of inflation. Nonetheless, some important steps are being made in China (and Colombia in the area of taxation), showing that it is not impossible when there is commitment at the highest levels.
- As agricultural subsidies are often national in nature, they are not easily packaged into smaller pilots at local level. Nonetheless, structured subsidies for mitigation or co-benefit purposes could be piloted at local government scale.
- To achieve an actual re-purposing of existing subsidies towards mitigation goals and SDG co-benefits would require a concerted advocacy effort of many parties involved.

# Early take-aways across the cases

Although each financial instrument and country context has its own dynamics, a few early take-aways can be extracted across the six financial instruments. These early take-aways are listed below and are based on the individual take-aways for each case, as well as a reading across the different cases on the criteria of accessibility, affordability and applicability. A more systematic comparative analysis would require additional research, beyond the scope of the present report.

## Scope

We have studied six financial instruments, out of a broader variety. The choice of these instruments emerged from a high-level inventory with the MITIGATE+/WP4 country coordinators, who identified the relevant financial instruments in their respective countries in relation to the MITIGATE+ goals of scaling up low-emission food system practices. Out of the variety of instruments mentioned, the six case examples represent instruments that can be considered relevant across several focus countries of the project.

We focused the cases on getting a general understanding of the instrument and more specifically about its applications in some of the focus countries of the project. We looked at the applicability of the financial instruments, in view of the MITIGATE+ goals (mitigation, adaptation, SDG goals) and the project's target groups (smallholder farmers, value chain and wider food system actors). We decided not to study the effectiveness and impact of the financial instruments, as this would go beyond the scope of the current exercise.

## Accessibility

Direct or indirect access: Farming in general, and informal enterprise (including smallholder farmers), are not easily financed by formal financial institutions. This limits the direct reach of green and blended finance into the food system. Nonetheless, farmers and informal enterprise may be reached indirectly, through their relations with formal companies who are eligible for green and blended finance. Similarly, access of smallholders to carbon credits may be indirect access rather than direct access, because of the challenge of aggregating small farmer carbon actions into larger tradable portfolios. This is slightly different in the case of Payments for ecosystem services (PES): farmers do have to aggregate by forming a community around the

ecosystem, but such communities do not need to represent tradable portfolios at a larger scale. This communal aggregation addresses the informality problem, and also factors in the public good character of ecosystem services.

Importance of MRV: Practically all the instruments described are subject to Measurement, Reporting and Verification (MRV) protocols - including certification - to verify if the incentives arrive at the right eligible object, and sometimes to the right eligible target group, and also to monitor if the respective policy goals are really achieved. What is monitored depends on the specific instrument at hand: for example, carbon gains in the case of carbon credit, eligible green investments in the case of green finance. MRV requirements can be easier in some financial instruments, and more difficult or heavier in others: for example, energy taxes are easy to implement and therefore quite generally applied; carbon taxes require more MRV efforts. Aggregators play an important role in implementing the MRV protocols, and translating them towards small farmers with whom they collaborate.

## Affordability

Cost of certification: Certifications are costly and therefore farmers do not always see carbon financing as a profitable activity. Solutions can be digitalisation, pooling of data in shared data platforms, training of farmers and delivery support for small-scale farmers. Separating carbon as a separate commodity, rather than packaged into an agri-commodity certificate, could increase the profitability potential for the farmers. Also, agro-food companies and investors could step in with incentives or financing instruments to facilitate the certification for farmers in their supply chains.

## Applicability

Applicability: PES are mainly used for forest conservation and restoration, and are less applied to other food system areas. Regarding carbon credits, applications to the AFOLU sector are still a minority, but the strong demand for carbon credits could represent an opportunity for the AFOLU sector to become a major supplier of carbon credits. Green finance and blended finance are more suitable for capex investments, whereas PES and carbon credits are more applicable for incentivising the annual revenue stream. Subsidies and taxes can be used for both purposes.

**Continuity:** For the success of carbon credits and PES, the long-term continuity of the collaboration is a vital condition. This also implies that the ecosystem payments need to be reliable over the long term, as an additional source of revenues for the communities, in order to keep the communities motivated and remunerated to keep up the ecosystem services. Similarly, the price of – and revenues from – carbon credits need to represent a reliable source of income over a long period.

**Pilots and scaling:** Tax incentives and agricultural subsidies are often national in nature. This implies that they are not easily packaged into smaller pilots at local level. Nonetheless, structured subsidies for mitigation or co-benefit purposes could be piloted at local scale, as long as the pilot truly mimics an application that can be replicated by public agencies at a larger scale.

**Maturity of the instrument:** The financial instruments described are fully deployed in certain focus countries, but still quite incipient in others. An example is carbon credits, which is quite developed in Colombia but still incipient in Vietnam.

**Dual purpose:** in the context of low-emission food systems, financial instruments with dual purposes of mitigation and adaptation seem more scalable than instruments focused on mitigation alone. The adaptation and other developmental co-benefits may attract the farmers' interest, whereas the mitigation components may raise the appetite of the financiers.

**Concerted efforts:** Financial instruments aimed at mitigation and co-benefits often require a concerted effort by multiple stakeholders in the same domain or territory. This is

illustrated by the case of re-purposing agricultural subsidies: downscaling the traditional subsidies and re-directing them towards low-emission purposes requires a concerted advocacy effort of many parties involved.

## Connections and synergies between instruments

Finally, we observed several examples where different financial instruments are linked with each other, to achieve greater synergies and impact. A few examples of such synergies are:

- The Colombian carbon tax, where a fuel company can get carbon tax reductions if it supports carbon projects with generate certified carbon credits.
- Overlaps between green finance and blended finance portfolios. Green finance portfolios can be partly blended, and blended finance portfolios can be partly green. Green bonds can be a financing source of green loan and investment portfolios.
- PES can be financed from different sources (e.g. subsidies, project grants, carbon credits, payments by downstream companies). It can be seen as a performance-based subsidy or incentive.
- Different financial instruments can be applied in the same territory. For example, in Colombia the same territory or target group can benefit simultaneously from carbon credits, PES and investments from the proceeds of the carbon tax. However, regulations prohibit the double financing of the same practice by different incentives.



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# Acronyms

Alliance BI-CIAT	Alliance of Bioversity International and the International Centre for Tropical Agriculture
ACES	Association for Coastal Ecosystem Services
ADB	Asian Development Bank
AEF	Access to Energy Fund of FMO
AFOLU	Agriculture, Forestry and Land Use
B2B2F	Business to Business to Farmer
BF	Blended finance
CGIAR	Consultative Group for International Agricultural Research
CBI	Climate Bonds Initiative
CDM	Clean Development Mechanism
CPI	Climate Policy Initiative
CORSIA	Carbon Off-setting and Reduction Scheme for International Aviation
CSA	Climate-Smart Agriculture
DFI	Development Finance Institution
ESG	Environmental, Social and Governance
ETS	Emission Trading System
E&S	Environmental & Social risk management
FAO	Food and Agriculture Organisation
FEDECACAO	National Federation of Cocoa Farmers, Colombia
FMO	Dutch Entrepreneurial Development Bank
FO	Farmer Organisation
GBP	Green Bond Principles
GCCA	Global Climate Change Alliance
GCF	Green Climate Fund
GGGI	Global Green Growth Institute
GHG	Greenhouse Gas
GIF	Green Investment Fund (ADB)
GIM	Green Incentive Mechanism (ADB)
GIZ	German Society for International Cooperation
GSS	Green, Social and Sustainability Bonds
GtCO <sub>2e</sub>	Billion metric tons of carbon dioxide equivalent
IDF	Infrastructure Development Fund of FMO
IFC	International Finance Corporation (World Bank Group)
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
IPCC	Intergovernmental Panel on Climate Change
IRRI	International Rice Research Institute
KBA	Kenyan Bankers' Association
KfW	Kreditanstalt für Wiederaufbau
LCA	Life Cycle Assessment
LMIC	Low and Middle Income Countries
MDB	Multilateral Development Bank
MFI	Microfinance Institution
MITIGATE+	CGIAR Research Initiative on Low-Emission Food Systems (the Project)
MSME	Micro, Small and Medium-sized Enterprises
MtCO <sub>2e</sub>	Million metric tons of carbon dioxide equivalent
NGO	Non-Governmental Organisation
ODI	Overseas Development Institute
OECD	Organization for Economic Co-operation and Development
PES	Payments for ecosystem services

REDD+	Reduces Emissions from Deforestation and Forest Degradation, plus the sustainable management of forests, and the conservation and enhancement of forest carbon stocks
RENARE	National Registry for the Reduction of GHG Emissions, Colombia
SDG	Sustainable Development Goals
SME	Small and Medium-sized Enterprise
SSA	Sub-Saharan Africa
tCO <sub>2</sub>	Metric tons of carbon dioxide
tCO <sub>2</sub> e	Metric tons of carbon dioxide equivalent
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
US\$A	United States Department of Agriculture
VCM	Voluntary Carbon Market
WP4	Work Package 4 (Scaling low-emission food systems) of the Project
WRI	World Resources Institute
WUR	Wageningen University & Research

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