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THE SOCIAL AND ECONOMIC IMPACTS OF CARBON MARKETS

on local communities in low- and middle-income countries

A realist systematic literature review

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Agora Global

institute of development studies

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Responsibility for the information and views set out in this publication lies with the authors. FSD Africa and FCDO cannot be held responsible for any use that may be made of the information contained or expressed herein.

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EXECUTIVE SUMMARY

Carbon trading in both the compliance and voluntary carbon markets is one of the policy frameworks for reducing carbon emissions globally. Low- and middle-income countries (LMICs) are increasingly involved in these markets to attract climate finance and as part of their climate commitments. Most LMICs are engaged in the voluntary carbon markets through carbon offsetting. To receive payments, carbon projects must demonstrate their effectiveness in reducing, avoiding, or capturing and storing carbon dioxide, thereby helping to lower the amount of carbon in the atmosphere.

These projects generate various outcomes for local communities, which can be positive or negative. It is important to understand the social and economic impacts of carbon projects on local communities in LMICs to determine how they contribute to or hinder developmental goals. This literature review maps available and published evidence on these impacts and analyses the enabling and contributing factors to positive and negative outcomes. The review:

Contributes to the debate about how carbon markets can become more inclusive and beneficial for local communities

Identifies key knowledge gaps that need to be addressed to fully understand social and economic impacts

This research seeks to guide buyers, project developers, and other actors in the ecosystem, such as regulators and verification agencies, on how, where, and under what conditions carbon markets can avoid the negative social and economic impacts and maximise the positive outcomes, which is critical for Africa.

Although the carbon market has recently been the subject of high-profile criticism for not delivering on its sustainability promises,[1] this review finds that, even though the current impacts might not be optimal for many local communities, diverse and clear positive impacts are possible with the right design and governance systems. Carbon markets have high potential to generate additional social and economic benefits for low-income communities in addition to their principal objective of global environmental benefits. However, currently, these benefits are not universal and, indeed, many carbon projects have resulted in negative impacts on local communities, attributable primarily to the type, design, and governance of the project.

The research findings are principally based on available evidence from smaller carbon projects participating in voluntary carbon markets, within which evidence is primarily based on forestry. It maps out different project types but recognises that less evidence was available for localised impacts of non-forestry carbon projects, putting forth a methodological limitation in generalising based on a limited number of quality data points.

[1] See for example BBC Panorama (https://www.bbc.co.uk/programmes/m001zd68) and The Guardian (https://www.theguardian.com/environment/2023/jan/18/revealed-forest-carbon-offsets-biggest-provider-worthless-verra-aoe).

Key Findings

With that caveat, the findings show that **forest conservation projects have fewer positive economic outcomes for local communities, as they often face restricted access to vital natural resources.** On the other hand, renewable energy and clean cookstove projects, generally, do not commit as much to revenue sharing.

Economic Impacts

Low overall prices in voluntary carbon markets often result in small revenues for local communities. Payments received from personal or communal land are small if disaggregated among individual households. Therefore, most project developers prefer to design their projects to share revenues through communal funds. This approach allows local governance systems to decide how these funds are used to benefit their local communities.

Although carbon projects also generate direct and indirect job opportunities, these are few in number and not accessible to everyone. There is discussion over whether job creation is a good measure for the economic outcomes of such projects because the number of jobs created does not show the quality of work, job security, and the nature of work replaced. There is insufficient evidence on who gets the jobs and decision making processes surrounding those work allocations, which are likely to be contextually specific. It is clear from the evidence that involvement in these projects increases the unpaid workload of local communities, while the carbon payments generated by this work are not secure and are often paid late. However, it is also clear that such developmental impacts can be overcome through improved project design.

The literature highlights that **communities participating in carbon projects often receive delayed payments, which can negatively affect their participation and compliance. This issue is more pronounced in LMICs where household liquidity is very low.** Therefore, projects that structure advance payments or invest in local communities beforehand, for example, by providing extension services, technical assistance, and training, demonstrate higher community participation in carbon sequestration over an extended period. This is in contrast to projects that make payments at a later stage. As such, there is a delicate balance between expectations from project developers and participating local communities to keep carbon sequestration at a high level for a prolonged period of time, which often relates to revenue sharing structures and how that is communicated to local communities.

A major challenge is that **inclusive and pro-poor carbon projects have higher transaction and implementation costs, which limit the potential for greater revenue sharing.** Balancing costs and revenues poses a significant challenge, particularly at the current low carbon prices. Purely market-based projects- those that depend solely on buyer payments for their carbon sequestration- specifically nature-based projects, often struggle to provide sufficient and timely benefits to local communities to ensure continued participation. On the other hand, evidence suggests that projects that secure additional funding with an explicit developmental objective improve social and economic outcomes for local communities and increase their commitment to sequester carbon, at least in the short term. The sustainability of such projects is a concern if the aspects of the project most critical to community benefit are not a core part of the market mechanism.

Evidence indicates that the objective of enhancing local communities' incomes through carbon offsetting projects should not only focus on carbon payments. It should also encompass economic activities that increase farm productivity and create local entrepreneurship opportunities through ecotourism and organic food markets for fruits and coffee. However, these income-enhancing opportunities for local communities attract additional costs as local communities need long-term commitment and support to enter new markets or increase productivity. While agroforestry and other agricultural projects related to enhanced soil management could increase farm productivity, local communities need technical assistance, extension services, and other capacity building activities, adding to development costs.

Participation in carbon offsetting projects is not only about generating new or improved revenue streams for local communities...

...but also enhancing empowerment and agency, particularly for marginalised groups.

However, this needs to be embedded in the project design by integrating pro-poor strategies and inclusive governance structures.

For example, this could be done by:

Ensuring active involvement of women in decision-making processes

Ensuring technology and knowledge transfers

Ensuring fair revenue sharing

Social Impacts

Forest conservation projects are often linked to food insecurity. While this issue can be mitigated by increasing the incomes of participating community members through improved economic activity, the literature reviewed does not provide sufficient evidence on how income changes from carbon markets have affected local communities' food security. Limited paid opportunities and low revenues from carbon sequestration remain an issue in this regard.

Evidence shows that projects designed to encourage meaningful participation from local communities generate better social and economic outcomes for those communities. However, strict safeguards are required to avoid negative impacts, which could reduce conflicts and tensions both within and between communities, as well as between project developers and local communities.

Environmental Impact

Carbon projects are linked to improved soil quality, particularly related to agricultural projects such as agroforestry. Studies also refer to improved biodiversity but often without showing much evidence. **Additionally, the few studies that researched waste management projects highlight improved air quality.**

Conclusion

Evidence from 52 selected studies shows that **agricultural carbon and energy efficiency projects (mainly based on clean cookstove projects) demonstrate the highest potential for economic and social impact at the community level. On the other hand, purely forest or nature conservation projects have less potential to contribute positively to local livelihoods.** The evidence implies that while forest conservation projects that allow local communities to practice agroforestry activities could be less attractive for project developers, they can be more successful in generating social and economic impacts, reducing the risks of tensions and conflicts.

The evidence further shows **that local communities attain higher benefits through inclusive governance systems, land reforms, access to additional funding, higher carbon prices for projects that deliver social impacts, and stringent standards and regulatory processes.**

This review concludes that three inter-related dynamics determine social and economic outcomes for local communities participating in carbon projects:

The intended project outcome

Incomes from carbon payments, jobs, incomes from products of carbon projects etc.

The type of project

Afforestation, reforestation, agroforestry, clean energy, waste management.

The project design and implementation

Who gets paid, when, how much, what is expected in return, related to transaction and implementation costs.

Therefore, **project developers need to consider the adaptive capacity of local communities, social and cultural norms, and existing inequalities at the design phase.** Potential social and economic impacts for host communities in LMICs could be delivered through capacity building, supervision of business practices, promoting development projects, consideration of local power relations, and active involvement of non-state actors as mediators between local communities and the national and international levels.

This review gives rise to some optimism that improved and innovative approaches can benefit local communities in LMICs and contribute to sustainable development. Importantly, these findings show potential for LMICs governments to identify and plan more strategically for carbon trading opportunities at a larger scale.

Article 6 of the Paris Agreement[2] at COP29 provides an important stepping stone for improved quality standards and governance systems to protect local communities (do no harm) while promoting co-benefits and leveraging voluntary and compliance markets. While it is true that impact will hinge on strong implementation that delivers measurable benefits for people and nature, Article 6 agreement represents a historic opportunity to elevate carbon markets as a tool for meaningful climate action in LMICs. Furthermore, the findings of this review can inform discourse on how to realise these opportunities.

[2] Paris Agreement Crediting Mechanism. https://unfccc.int/process-and-meetings/the-paris-agreement/article-64-mechanism

1. INTRODUCTION

This section presents global carbon markets trends and highlights specific features of Africa's growing carbon market. The section further introduces the objectives, methodology and conceptual framework underpinning this review and key concepts used in carbon markets.

1.1. GLOBAL CARBON MARKET TRENDS

Carbon markets have faced significant criticism from media and academics in recent years due to concerns that these market-based solutions for the climate crisis are not delivering on their sustainability promises (Leah & Scoones 2015, Streck 2020, Pan et al. 2022).[3] This criticism has affected the global carbon prices, particularly for carbon avoidance and reduction credits, which many low- and middle-income countries (LMICs) depend on to address substantial climate finance gaps (World Bank, 2024; Pagop & Savard, 2024; Turner et al., 2024) (see also Box 1). As such, corporations are now investing in long-term offtake deals to exercise greater control over the projects from which they purchase credits (World Bank, 2024).

Box 1: Some key trends and facts

The compliance market is far bigger than the voluntary market (US$ 900 billion versus US$ 2 billion in 2022).

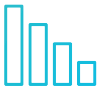
Since 2023, the average credit price in voluntary markets is down to **US$ 6.97 per ton.**

For many years in a row, the issuances outpace the retirement of carbon credits in the offset market, resulting in an oversupply.

The price of carbon capturing and storage is higher than for avoidance and reduction credits.

Credit issuances declined by 7% between 2021 (peak year) and 2023, while retirements dropped by nearly 25% over the same period.

Decreases in REDD+ and renewable energy volumes particularly have driven a drop in issuances and retirements in the voluntary carbon market in 2023 – they have fallen nearly 20% as a share of total issuances from 72% in 2021 to 53% in 2023.



↓20%

90%

Reduction and avoidance credits

Reduction and avoidance credits account for 90% of all credits on the voluntary carbon market. Only 3% of credits are from technological removal credits, but this market is expanding. However, the velocity of removals market takes mainly place in forward purchasing, and do not yet appear on the registries.

sources: Carbon Direct, 2023

[3] See for example BBC Panorama (https://www.bbc.co.uk/programmes/m001zd68) and The Guardian (https://www.theguardian.com/environment/2023/jan/18/revealed-forest-carbon-offsets-biggest-provider-worthless-verra-aoe).

While LMICs, particularly the least developed countries (LDCs), have participated in carbon markets for some time, the financial returns are still modest compared to larger sources of funding like development aid, foreign direct investment and remittances. In 2023, the market value of carbon credits from LDCs was about US$403 million, only about 1% of total bilateral development aid (UNCTAD, 2024). According to a Geneva-based non-profit, the Gold Standard, only 11% of the global carbon credits issued globally between 2016 and 2021 originated from African countries, based on a total of 624 projects.[4]

Governments and corporations around the world have demonstrated their commitment to achieving net-zero emissions. However, reducing emissions requires a fundamental transformation of the global economy, including massive investment in low-carbon innovation and deployment – underpinned by comprehensive and credible long-term policy signals (Sullivan et al. 2021). Carbon trading, both in the compliance and voluntary market is an important policy tool for reducing carbon emissions on a global scale. Such trading is part of carbon pricing instruments designed to facilitate a rapid shift away from fossil fuels and incentivise a transition to low-emission economic growth. Notably for LMICs, these markets can attract additional financing for mitigation projects.

Given the important role local communities play in carbon projects, it is relevant to understand how current and future carbon markets can support the economic development of LMICs through associated co-benefits that directly and indirectly benefit local communities.

Carbon markets in LMICs are organised in a top-down manner and are Western-oriented. In several instances, audits and monitoring and evaluation activities for carbon projects are conducted by experts from high-income countries, resulting in high implementation costs. Another critical consideration is the need to understand local perceptions and the ways in which communities value different aspects of their livelihoods. Some local communities might not value the expected social and economic impacts expressed in the literature and debates about carbon markets. As such, market-based solutions might not always align with local priorities and values, even when there are strategies and approaches in place to seek active participation with local communities.

1.2. CARBON MARKET TRENDS IN AFRICA

The voluntary carbon market in Africa has experienced substantial growth, and transaction volumes reached:

US$2 billion

in 2022

(Pagop & Savard, 2024)

However, the Kenya Institute for Public Policy Research and Analysis estimates that only:

2%

of the continent's maximum annual capacity for carbon credits has been tapped[5]

This means that there is vast untapped potential for climate action in Africa (and other LMICs), particularly in sectors like forestry and agriculture.

Carbon markets provide substantial opportunities to expand renewable energy to meet local electricity needs and improve energy access. They can also be leveraged to raise part of the necessary funds, providing a promising pathway to harness renewable resources, promote sustainable growth and modernise LMICs' economies. Forest carbon credit transactions constitute more than half of carbon trade volume (Lee et al. 2017), with Africa potentially

[4] Information retrieved from https://www.goldstandard.org/news/africa-can-harness-the-global-carbon-markets-to-advance-climate-and-development-goals

[5] Information retrieved from https://kippra.or.ke/accelerating-growth-of-carbon-market-in-africa/

estimated to generate billions of dollars in revenue specifically through carbon credit sales by leveraging its vast natural carbon sinks like the Congo Basin rainforest.

Experts indicate that the continent could raise up to:

US$82 billion

through carbon credit trading at a price of US$120 per tonne

Africa's carbon market is still developing and faces challenges regarding market access and ensuring equitable benefits for local communities. Carbon markets can contribute to financing the needed:

US$1 trillion ANNUALLY

to achieve the Sustainable Development Goals by 2030

(Pagop & Savard, 2024 and UNCTAD, 2024)

Although carbon markets alone cannot close this funding gap, they can provide additional financing.

Whilst there is no mandatory carbon market in Sub-Saharan Africa, African businesses, institutions and individuals can purchase carbon credits in voluntary carbon markets. The sub-Saharan African region is more active in the supply side of the carbon market. Carbon offset projects generate direct and indirect economic, social and environmental impacts for local communities.

Governments and institutions in Africa (and other LMICs) are preparing to scale up their participation in carbon markets. To achieve a more direct influence on the voluntary carbon markets, seven African countries are collaborating to establish the African Carbon Market Initiative (ACMI), which aims to scale voluntary carbon markets across the continent.[6] Effective carbon markets require capable institutions, financial resources, and networks to function effectively. These elements are critical to ensuring high-quality carbon programmes for which trusted carbon credits can be issued and traded.

Carbon credits must be linked to specific projects. These projects can be categorised based on their contributions to avoiding and reducing carbon emissions. While some projects can store carbon, some only reduce emissions. For example, although renewable energy and improved cookstoves projects do not store carbon, they reduce carbon emissions.

Nature-based solutions, specifically forest management, reforestation, and afforestation, can provide short-term carbon storage benefits. However, they do not store carbon permanently because factors such as forest fires and tree mortality result in the release of carbon back into the atmosphere. On the other hand, new technologies are used to remove existing carbon by capturing and safely storing or mineralising it.

[6] Kenya, Malawi, Gabon, Nigeria, Rwanda, DRC and Mozambique already have signed to participate in this initiative.

Sub-Saharan African countries have the potential to develop projects in all these categories. However, initial investments required for certain projects can be high due to the significant costs associated with carbon removal and renewable energy technologies. Carbon credits generate revenues that could reduce the financial risks of these projects. However, avoidance and reduction credits that LMICs largely depend on cannot be traded in high-value compliance markets. LMICs with a lower development baseline rely more on avoidance credits as they might not be able to evidence reduction in carbon emissions (e.g. low entry level of carbon emissions could obstruct financing the energy transition).

1.3. OBJECTIVES OF THE REVIEW

This literature review examines the impacts of carbon credit payments, primarily from voluntary markets, on local communities in LMICS. Understanding the evidence base and the factors that make some projects more successful than others gives valuable insight into how the future of the carbon market can be shaped to contribute to sustainable and inclusive economic development. As such, this review takes the stance that the current "crisis" in the carbon market should not detract from the benefits that LMICs could receive from participating in carbon markets and that this evidence should be used to change the way the carbon ecosystem functions for better outcomes.

THE REVIEW:

Contributes to the debate about how carbon markets can become more inclusive and beneficial for local communities

Identifies key knowledge gaps that need to be addressed to fully understand social and economic impacts

Due to the diversity of project types, contexts, and timeframes indicated in the reviewed literature, the review does not make claims of representativeness.

1.4. METHODOLOGY

The study is based on a "realist" systematic literature review, which represents an approach that explains complex interventions. Our approach included the participation of a multistakeholder advisory group, encompassing a wide range of sectoral, thematic, and geographical expertise.

The literature review examined empirical academic research and robust evaluations of carbon projects in the context of LMICs, specifically in Latin America, Asia, and Africa. It focused on well-documented literature regarding localised community-based outcomes published between 2013 to-date, resulting in the analysis of 52 studies.

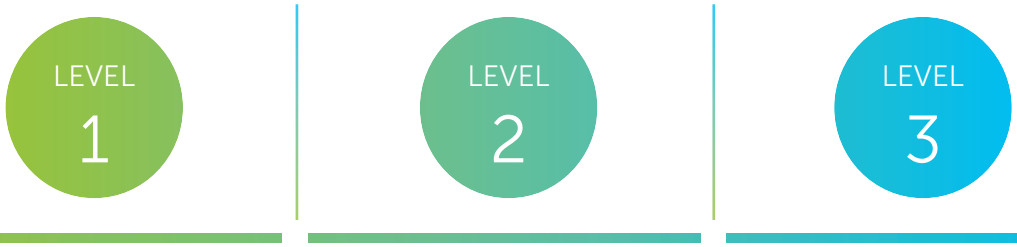
Search terms focused on the CMO framework, which states that for any observed outcome, there is one or more causal processes (or "mechanisms") that only become active in specific contexts.[7]

1.4.1. Methodological Limitations

- One limitation of the research is around the geographies and timeframes within which the impacts of carbon projects are realised. The review was limited to assessing impacts seen at and surrounding the project site during and immediately after the project's lifespan.
- The projects of significant relevance to the research question, specifically focusing on Africa and attempting to capture diverse outcome types, geographies, and project types, are relatively new and few.

1.5. CONCEPTUAL FRAMEWORK

The research employs the conceptual framework presented in Figure 1. This framework has three levels:



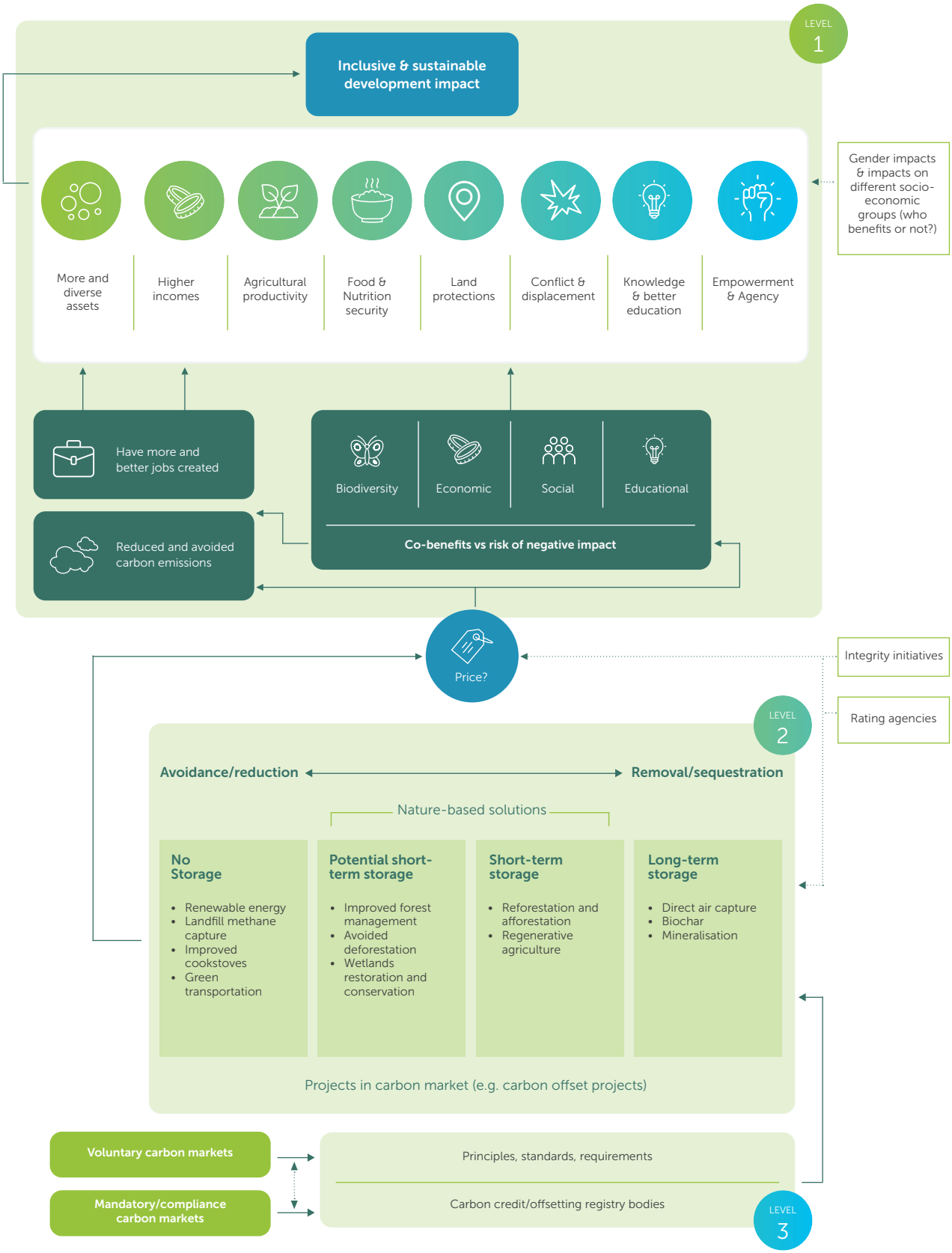
The top level shows how projects that receive carbon credits generate outcomes. Primarily, the outcomes relate to carbon emissions, but increasingly other localized outcomes (e.g. social, environmental and economic) are valued.

Carbon credits are always linked to specific projects. This is the second level of the conceptual framework. These projects can be categorised by their contributions to avoiding, reducing and removing carbon emissions.

Level 3 comprises the standards, requirements, regulations, and policies related to the functioning of voluntary and compliance carbon markets, including registry and standards bodies.

[7] For more information see: https://www.betterevaluation.org/methods-approaches/approaches/realist-evaluation

Figure 1. Inclusive Development Impact Pathway framework (source: author's own, 2024)



Central to the framework is the carbon price. The price is a reflection of how well carbon markets work to value better quality projects that can be linked to trusted programmes, standards, and verification systems. The conceptual framework shows that at each level, there are different impact pathways for carbon markets to contribute to inclusive development. This research focuses on the following critical areas for specific pathways.

1.

There is a distinction in the design, regulations, governance, and standards between the voluntary and compliance carbon markets, which determines the type of projects, price received, and ultimately the outcomes.

2.

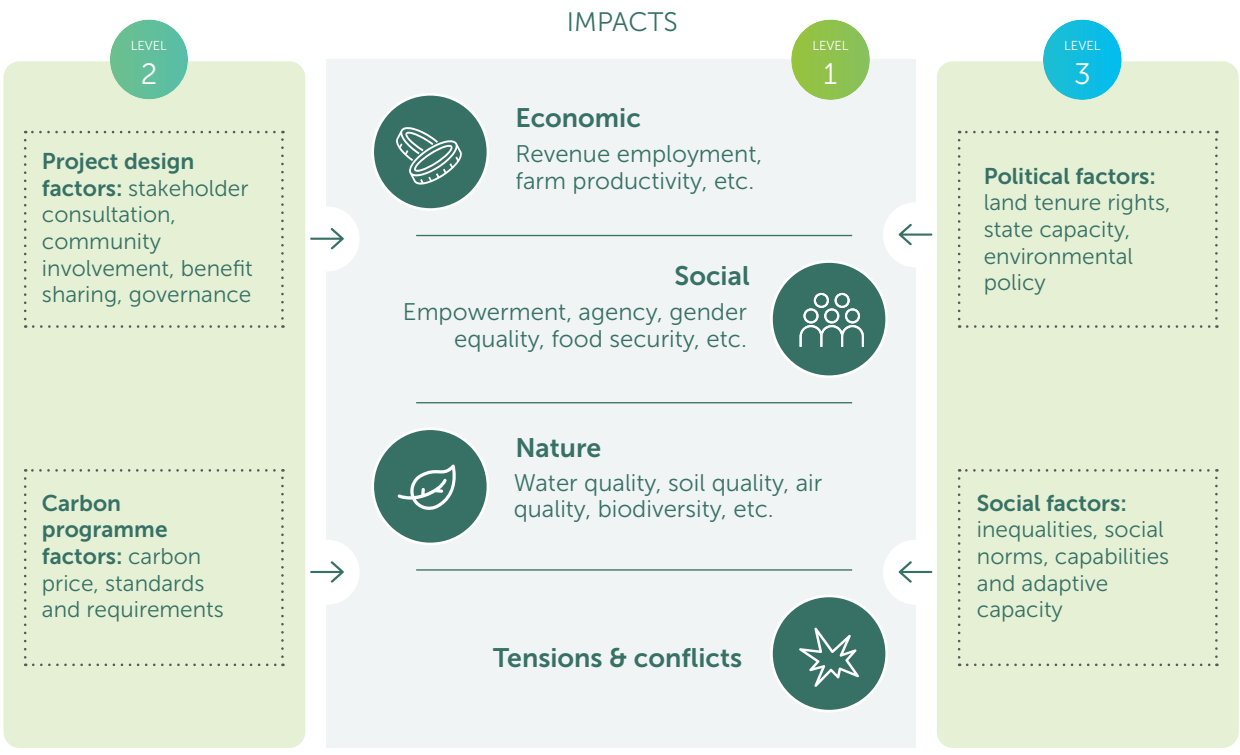
There is a distinction between carbon programmes and projects that only focus on carbon emission outcomes versus programmes and projects that have specific add-on certification schemes to achieve co-benefits.

3.

Impact pathways are distinctive based on various categories of projects differentiated by avoidance, reduction, and removal credits.

Figure 2 shows a simplified version of the conceptual framework, showing the enabling factors that contribute to the economic, social, and environmental outcomes of carbon projects. The economic, social and environmental impacts in this figure, including the impact on conflicts and tensions within and between local communities, correspond with level 1 of Figure 1 (and the 'Outcome' in our approach). The four factor levels in Figure 2 correspond to the variations of project design (level 2 in Figure 1, and 'Mechanism' in our approach). The social and political factors influencing participating local communities correspond to the functioning of carbon programmes (level 3 in Figure 1) and the 'Context' in our approach'.

Figure 2: Enabling factors for economic, social, and environmental impacts



1.6. CONCEPTS AND THEIR USE IN LOWER-INCOME COUNTRIES' CONTEXT

Carbon markets are created spaces that allow for carbon emission trading with the purpose of limiting climate change by creating a market with limited allowances for emissions. These include compliance and voluntary markets.

Carbon sequestration is the process of capturing and storing carbon dioxide from the atmosphere to reduce the amount of carbon in the atmosphere and slow global climate change. It can occur biologically or geologically.

Carbon credits are permits which allow a country or organisation to produce a certain amount of carbon and can be traded if the full allowance is not used. Carbon credits can be bought or sold in the carbon market after certification by a government or independent certification or standard body.

Carbon offsets work by compensating for emissions through investments in emission reduction projects. When an entity invests in a carbon offset programme, it receives carbon credits. These can be used to account for net climate benefits from one entity to another.

Standards and certification processes of carbon offset programmes stipulate the criteria for a project to be registered before carbon credits can be issued and traded.

Co-benefits of carbon offset programmes are the benefits beyond carbon reduction and avoidance, such as educational and biodiversity benefits, and social and benefits to achieve broader developmental goals, which could relate to inclusive development.

2. FINDINGS ON OUTCOMES

This section discusses the economic, social and environmental impacts of carbon projects on participating local communities in LMICs.

2.1. ECONOMIC IMPACT

2.1.1. Carbon payments and revenue sharing

The monetary benefits to local communities participating in carbon markets can be classified as:

Payments received from carbon credits and shared to local communities by project developers

Income opportunities generated by carbon projects

This is referred to as **"distributive justice"** for host communities for carbon offsetting projects. (Mathur et al. 2013)

The evidence on carbon credit payments received by local communities in the context of LMICs has a strong focus on reforestation and forest conservation projects.

Evidence shows that forestry projects increase biomass over time, resulting in carbon credits, which generate revenues that are shared with local communities (Holmes et al. 2017, Senadheera et al. 2019, Prawiranegara & Hidayat 2023, Cariappa et al. 2024). However, the evidence also shows that carbon payments related to such nature-based solutions or payment for ecosystem services do not generate significant monetary benefits at the household level (Siedenburg et al. 2016, Holmes et al. 2017, Mantey et al. 2024, Wong et al. 2024). Forestry and agricultural carbon projects, such as agroforestry and conservation agriculture, struggle to deliver carbon payments directly to individual households. In instances where this is achieved, these projects do not deliver timely payments, thereby increasing farmers' livelihood risks (Lee et al. 2016; Mathur et al. 2013).

Based on the project design, revenues from carbon payments can be shared among individual households, ploughed into communal funds, or both. Project developers prefer to allocate revenues to communal funds because it reduces transaction and implementation costs (Mantey et al. 2024). Communal land has the potential to sequester more carbon dioxide. However, this is dependent on the number of households in the community. A higher number of households generates meagre revenues per household, with communal funds or trusts often managing revenues (Atela et al. 2017). Average household plots are very small, therefore sequestering small amounts of carbon dioxide per year.

When revenues are ploughed into communal funds, such as forest cooperatives, a unilateral decision can be made to pay cash to the cooperative members, sometimes under the pretext of micro-credit services. One study from Ethiopia showed that this can result in controversies due to power relations within communities (Kemerink-Seyoum et al. 2018). According to the study, loan repayments were supposed to be made based on investment plans and according to the cooperative's by-laws, yet these criteria were hardly met. According to the study, some cooperatives' members claimed that only well-connected members benefited from the loan facility, leading to

inequities in revenue distribution. Contrary to this, Kemerink-Seyoum et al. (2019) indicated that one cooperative made equal payments of approximately US$51 to each member, which was close to the carbon revenue generated by that cooperative.

Participating households prefer direct payments. This is especially true for women who do most of the hard work and therefore feel it is more equitable to receive incomes per household instead of aggregated revenues for the whole community (Lee et al. 2015).

A study in Mexico shows that women did:

70% OF THE UNPAID REFORESTATION WORK

(Gay-Antaki 2016)

They take on these extra responsibilities because they expect carbon projects to give them additional income and food security.

Local communities lack clarity about when and how to get paid, reducing their motivation to continue participating in carbon markets (Mwageni et al. 2015). For example, Forgues et al. (2024) highlights a specific project in which participants misunderstood that the payments received during the active maintenance phase (first 7years) covered their trees' carbon value over the entire 25-year contract. Consequently, many participants expected future payments that they could not receive contractually.

A key challenge is that carbon revenues are supposed to finance the project costs and provide income for local communities. However, evidence suggests that market-based carbon revenues cannot finance the total investments in agricultural and reforestation projects due to high transaction and implementation costs. Therefore, several studies doubt the ability of market-based projects to operate solely on carbon revenues while seeking active inclusion of local communities (Clements & Moore 2015, Lee et al. 2016), reducing revenue sharing opportunities. Subsidised projects that use extra funding are more successful in sharing revenue with local communities, particularly over the first years because they can make advance payments to the participating communities (Miles 2020).

Agroforestry projects, which primarily involve smallholder farmers, have a higher risk for a negative net present value compared to larger non-agricultural reforestation projects (Netter et al. 2022). Non-agricultural reforestation projects can sell verified emission reductions from three previous years in addition to the emission reductions verified in the year of the certification (e.g. Gold Standard). Since agroforestry projects cannot generate revenues from previous years, they struggle to gain sufficient revenues from carbon credits in the shorter term, which could benefit smallholder farmers (Netter et al. 2022).

Studies also show that reforestation efforts that focus on planting timber species generate less revenue compared to projects that focus on planting fruit species (Forgues et al. 2024). The study of Holmes et al. (2017) asserts that some limited fruit species sequester the same or even more carbon than timber. However, such knowledge is often not available and neglected in project design.

2.1.2. Additional incomes

Given the small, delayed, and uncertain carbon payments, local farmer communities only deem the adoption of carbon practices to be a fair deal based on the associated co-benefits for farm productivity and food security (Lee et al. 2015).

Evidence shows that forestry projects that include smallholder farmers can adapt to various and changing local needs, combining forestry with other land uses to provide diverse products and income opportunities to the local community (Tamba et al. 2021). For example, a forestry project in Sri Lanka could increase local farmer income by approximately 10% per year due to value-added crops and multiple cropping cycles (Senadheera et al. 2019). Projects generate benefits to households from higher prices for sustainably cultivated products, and business opportunities for small local entrepreneurs, including ecotourism (Herr et al. 2019). However, local communities need extra support to connect to new markets, which is not guaranteed in most carbon offset projects.

Households that reforested exclusively with timber species are among the richest in the communities, while households that engage in agroforestry are among the poorest. This difference reflects the ability to withstand the long waiting period before timber provides returns to households (Holmes et al. 2017, Forgues et al. 2024). Plantation forests have opportunity costs through limited utilisation of food crops and coffee plants, making them less attractive for poorer households (Holmes et al. 2017). Forgues et al. (2024) studied a project in Panama where the community asked to shift the project to agroforestry after the first year as it resulted in more short-term benefits, additional income, and food security through fruit production. As such, it was provided entry to poorer farmers who did not have the flexibility of waiting 25years for returns on investments or the luxury of forgoing food production on their land.

Limited access to forests, particularly for forest conservation projects, significantly changes forest use patterns. Several studies show that local communities cannot collect firewood, fruits, and honey from the forests, or graze their livestock there. This is because projects that allow local communities to overgraze their land or increase timber production without replanting witness reduced carbon sequestration, which influences revenue. Instead, communities have to purchase charcoal and fresh food products from nearby villages (Mwageni et al. 2015). A study in Kenya mentions that due to delayed payments and pressure from livelihood expectations, project staff allowed community members to collect firewood from protected forests and graze animals there, especially during the dry seasons. However, this was recognised by project developers as a major source of loss of carbon credit revenues (Atela et al. 2015).

Hence, studies show that although carbon projects, to some extent, provide monetary benefits to poorer communities, they also reinforce or amplify income inequalities.

Evidence from the literature on renewable energy and energy efficiency projects (including clean cookstoves) suggests that households can save money by using more energy efficient technologies, thereby increasing disposable income (Karhunmaa 2016). Carbon finance facilitates the provision of subsidies and microfinance links, which can make improved cookstoves more affordable and accessible to low-income households, potentially leading to fuel savings and income benefits (Lambe et al. 2015). The literature further shows that while these projects generate income for carbon traders, local communities do not receive direct financial benefits from them (Gupta et al. 2023, Phillip et al. 2023).

2.1.3. Work and employment

Although few in number, agroforestry and reforestation projects such as nurseries, provide different employment opportunities for local communities. Most studies do not detail the type of employment opportunities created by carbon offset projects. Participating households feel that their unpaid workload increased as agroforestry and other reforestation projects are labour intensive, yet carbon payments are small and not secure (Lee et al. 2016).

A reforestation project in Indonesia generated one paid job position per household to nurse tree plants, plant them into the forest and maintain them. (Miles 2020). Family members could decide among themselves who received the employment. However, rather than sending their most able-bodied family members, households often gave this work to members who were unemployed so that it would complement their household's other livelihood sources. Even in the off-season, when more people were available to work, households still prioritised income

opportunities other than those from the carbon project. The reason for this was that the financial income from this work was perceived as akin to seasonal labour- inconsistent and unpredictable in the long-term (Miles 2020).

Studies also show that forestry projects can create more long-term jobs in ecotourism and forest conservation, specifically for forest rangers (Herr et al. 2019, Tapping 2020). However, very little is known about who gets these jobs and who is excluded.

Energy efficiency projects create employment opportunities for local businesses as the influx of carbon finance attracts international and domestic businesses to this sector (Wangl & Corson 2014, Lambe et al. 2015). A report by the Asian Development Bank (2017) states that several jobs were created in renewable energy and waste management projects across Asia, particularly in the construction, operations, and maintenance phases of these projects, while additional jobs were created by service providers involved in the manufacturing, distribution, and servicing of the plant and machinery deployed for these projects.

2.1.4. Increased Farm Productivity

Research shows self-perceived positive impacts on crop productivity for agricultural carbon projects, like agroforestry. While men primarily refer to productivity in relation to production increases, women refer to productivity as food available for household consumption (Lee et al. 2015).

After establishing carbon offset projects, farm crop productivity is mainly associated with improved soil and reduced land degradation and erosion. Studies refer to specific extension services and training for farmers to help them increase farm productivity (Sahoo et al. 2022; Mantey et al. 2024). However, there is no empirically verified evidence of crop productivity. One project evaluation cites that organic coffee practices combined with tree planting can yield "up to three or four times greater compared to a conventional coffee plantation, as well as doubling the production life of the crop" (Conservation International, 2012, p.17 – cited in Tapping 2020).

The literature on renewable energy projects shows evidence for modest improvement of productivity levels for home-based businesses due to time efficiencies and access to more reliable energy sources (Lambe et al. 2015, Phillip et al. 2023).

2.2. SOCIAL IMPACT

2.2.1. Gender equality

Unequitable benefit sharing in carbon projects can be attributed to poor recognition of land tenure rights. Many affected carbon sinks are located in areas where indigenous or local rights are minimal (Pan et al. 2022, Blanton et al. 2024). In instances where the economic distribution of proceeds from forest carbon projects depends on who owns the forest land, it is those who hold formal rights that primarily benefit from those schemes (Smid 2022).

Women do not receive equitable benefit sharing from carbon projects because they do not possess property rights, yet the structural conditions for participating in carbon offset projects are through land tenure.

Even if land ownership is not contested (e.g. women have land rights), landowners must provide formal land title documentation, which can be complex and require significant financial resources, often not fully covered by carbon payments.

This is also true for other non-nature-based renewable energy and waste management projects. A renewable energy project in Mexico showed that structural conditions of participation through land tenure effectively excluded most women and those with insecure property rights (Gay-Antaki 2016). There was no attempt from the wind company to include women in the main project, and the subsidiary projects aimed at women were only accessible to those whose husbands permitted their participation. Limited participation in carbon offset projects is also driven by the different channels used by women to access information about these projects (Lee et al. 2015).

The inclusion of women in carbon offset projects has created unwaged activities which Gay-Antaki (2016) refers to as gendered reforestation activities that effectively "subsidise" these projects. Projects do not leverage women economically, implying that they remain dependent on their male counterparts. Reviewed case studies on reforestation and renewable energy projects in Mexico show that these projects have consolidated gendered regimes of differential access to markets and economic opportunities while also reifying property tenure structures that may exacerbate these distinctions even more (Gay-Antaki 2016).

The projects that Lee et al. (2015) researched show that neither men nor women were included in strategic project design planning sessions. Even for projects registered with the VCS methodology, which has a great diversity of management practices that allow households relatively more freedom to decide which practices to adopt, women did not experience the same freedom as men. This can be attributed to existing gender norms. Although this is beyond the direct influence of projects, the literature shows a general lack of meaningful incorporation of women into project decision-making. The lack of representation has implications for equity in benefit distribution, as women do not have the same decision-making power as men. As such, benefit distribution is often biased towards men, particularly when money is kept at group level (Lee et al. 2015). As a result, carbon projects can exacerbate gender inequalities.

2.2.2. Empowerment and agency

Although carbon projects aim to enhance empowerment through community participation in decision-making processes, direct employment, training, and improved incomes, there is no verified empirical evidence of improved empowerment and agency.

Some projects involve local communities in community management of protected areas and in local planning (Herr et al., 2019, Prawiranegara & Hidayat 2023). However, the literature shows that meaningful participation is often lacking, which reduces the opportunities for enhanced empowerment and agency (Stuchi Cruz et al. 2017; Mathur et al. 2013). There is evidence that projects support self-organisation of local community groups such as cooperatives, which helps to address economic and social issues, and promotes locally self-sustaining projects. As a result, these projects are best equipped to empower local communities and marginalised groups. Some self-organised community groups set up micro-finance services, which benefit community members.

Some carbon projects also provided vocational training, workshops, and extension services for local communities, on agriculture, forest management, tree nurseries, and beekeeping (Senadheera et al. 2019, Mantey et al. 2024). The development and knowledge exchange of new technologies and methodologies are crucial for benefiting communities (Mantey et al. 2024). Improved skills are perceived by local community members as beneficial to change agricultural and entrepreneurial practices. Tapping (2020) mentioned that in Tanzania, over 2,000 people who participated in a carbon offset project attended 81 training events about sustainable cultivation of coffee and dragon fruit. In addition, over 5,000 hours of technical assistance was provided. As a result of this training, 98% of subscribers confirmed that they practiced at least two new organic management techniques on their farms. As such, skills are improved through the provision of environmental education programmes.

The literature also mentions that some projects invest in educational facilities, such as upgraded buildings, new resources, educational materials and e-learning facilities for adults and children. However, the reviewed literature does not clearly identify the impact of the skills-training and education on local communities.

Research indicates that access to modern energy services, including cookstoves and household solar energy systems, can lead to social empowerment, particularly for women, by freeing up time for education, income-generating activities, and social participation (Karhunmaa 2016). However, it is unclear whether this has implications on women's labour burden and autonomy.

2.2.3. Food security

Most studies that link food security outcomes in LMICs with carbon markets use simulation models based on data from REDD+ projects for forest conservation and reforestation. Most of these studies measure how conservation projects in LMICs affect the agrifood sector on a macro-level. For example, one study found that more than 15% of potentially available agricultural areas are protected from deforestation. This could result in an increase in the global real agricultural price increase and a decrease in global agricultural production, primarily affecting food security in Africa and South-East Asia (Tabeau et al. 2017). Tabeau et al. (2017) conclude that food access rapidly deteriorates for low-income populations in these regions in cases of high forest protection levels.

However, there is not sufficient evidence of the impact of carbon projects on food security at the household level. The literature shows that forest conservation and tree plantation projects lead to decreased subsistence crop yields (Sahoo et al. 2022). Hunting bans and restricted access to forest destabilises local communities' food security (Jindal et al. 2012). A study in Ethiopia shows that there was a significant decline in fodder supply in one area after a reforestation project, thereby increasing the price for fodder (Kemerink-Seyoum et al. 2018). The shortage of fodder forced farmers to reduce the number of cattle they owned, which had consequences on the daily household nutrition and their resilience to deal with unfortunate events (as livestock is an asset that can be sold when needed).

Households might compensate for this loss if they experience increased household incomes through job creation and carbon payments that can be used to purchase food (assuming that healthy and nutritious food is accessible). However, since monetary benefits from carbon projects are often insufficient and unreliable, this cannot compensate for the loss in subsistence farming, affecting mainly the poorer community members.

On the other hand, as was mentioned in section 2.1, agroforestry and other agriculture carbon projects can improve food security for local communities as food crops can be combined with tree planting (Sahoo et al. 2022). This creates the opportunity for subsistence farming for local communities by combining fruit and vegetable plants with planting trees on their own plots and communal land. Additionally, well implemented agroforestry projects can improve soil quality and reduce erosion, therefore generating enhanced crop productivity and opportunities to sell organic food products and cash crops, such as coffee beans, for higher prices at more distant markets. These additional income flows could increase rural communities' food security.

2.2.4. Health

Studies on clean cookstoves show positive health impacts, such as reduced chronic obstructive pulmonary disease, acute lower respiratory infections and lung cancer (Freeman & Zerriffi 2012, Eunice et al. 2023). Clean cookstoves reduce smoke inhalation mostly by women because they are responsible for the cooking in households (Wangl & Corson 2014). One study shows more nuanced outcomes of clean cookstoves, as it found evidence that the overall health impact was not conclusive due to limited adoption and an increase in concentrations in the air in the post-intervention season, because households kept using older cookstoves (Aung at al. 2016).

Some studies also highlight additional benefits of clean cookstoves, such as reduced risk of physical injury and sexual violence associated with fuelwood collection (Freeman & Zerriffi 2012).

2.3. ENVIRONMENTAL IMPACT

In LMICs, most projects that receive carbon payments are nature-based solutions, implying that these projects use nature for carbon sequestration, for which they obtain carbon credits. This assumes that these projects have environmental impacts on local communities. For example, some of the selected studies make reference to improved soil quality, particularly related to agricultural projects such as agroforestry. Studies also refer to improved biodiversity but often without showing much evidence. The few studies that researched waste management projects highlight improved air quality (Stuchi Cruz et al. 2017).

2.4. TENSIONS AND CONFLICTS

Economic, social and environmental impacts can contribute to local tensions between and within communities. The reviewed literature highlights several cases where local communities and indigenous people have been forced to leave their land or were evicted from the forest due to nature conservation efforts in carbon offset projects (Froese & Schilling 2019). These disputes about land rights and access to forests have led to social conflicts, impacting the livelihoods of local communities (Lyons & Westoby 2014, Streck 2022). Such impacts may lead to distress migrations, which spark tensions and conflicts in receiving areas over crop and grazing land as well as access to other resources such as water. Changes in land use may also have further consequences and lead to the disruption of migration routes of cattle herders and, as such, increase the risk of tensions with other land users (Smid 2022).

Projects enforce or reinforce intercommunal conflicts when opinions of community members are split between those who support an intervention and those who oppose it or between those who qualify to participate and those who do not. Some studies cite residents who were threatened with exclusion from accessing public services such as food assistance, fertilizer and seed supplies, and credit schemes if they undermined the implementation of the project (Kemerink-Seyoum et al. 2018).

Kemerink-Seyoum et al. (2018) highlight several forest projects in Ethiopia where conflicts emerged within forest dwellers' associations over the distribution of benefits among members, citing signs of elite capture. Specifically, the allocation of trees that members are allowed to harvest is contested, with well-connected, often wealthier, members receiving more timber than others. Another way in which wealthier, often well-connected members disproportionally benefit from the forest is through their engagement in livestock production. Members have exclusive rights to let their cattle graze in the forest. However, the number of cattle per member is restricted to avoid overgrazing. Nevertheless, wealthier members who have the capacity to get involved in livestock breeding for commercial purposes graze more cattle in the forest than permitted, without penalty (Kemerink-Seyoum et al. 2018).

Violent actions are less frequently documented than other forms of contestation. According to Smid (2022), the likelihood of violent conflicts was 2.5 times greater within a 25-kilometre radius after project implementation compared to before. In absolute terms, this is a 12% increase in the probability of violent conflict associated with the project. Furthermore, non-violent conflict was over eight times greater within a 25-kilometre radius after project implementation than before. In absolute terms, the probability of conflict associated with the projects increases by 32% (Smid 2022).

Although most studies on conflicts relate to forest projects with disputes about agricultural land and access to natural resources, some studies show that tensions and even conflicts have arisen from renewable energy carbon

projects, for example, large wind and solar parks that affected the livelihoods of local communities (Froese & Schilling 2019). This often relates to land disputes, such as land tenure, access, and land use by local communities.

Evidence from 52 selected studies allows the following summary of the types of impact that different types of projects have on local communities (see Table 1).

Table 1. Typology of impact by typology of project

	Agriculture and agroforestry	Forest plantation	Forest conservation	Renewable energy	Energy efficiencies	Waste management
Revenue sharing	🟡	🟡	🔴	🔴	🔴	🔴
Additional income	🟢	🟢	🔴	🟡	🟡	⚫
Work and employment	🟡	🟡	🟡	🟡	🟡	🟡
Productivity	🟢	🟡	🔴	🟡	🟢	⚫
Income equality	🔴	🔴	🔴	⚫	⚫	⚫
Gender equality	🔴	🔴	🔴	🟡	🟡	⚫
Empowerment	🟡	🟡	🟡	🟡	🟡	🟡
Food security	🟢	🔴	🔴	⚫	⚫	⚫
Health	⚫	⚫	⚫	🟢	🟢	🟢
Environmental	🟢	🟢	🟢	🟡	🟢	🟢
Conflicts	🟡	🔴	🔴	🟡	🟢	⚫

🟢 Potential for positive benefits 🟡 Mixed but mostly positive benefits 🔴 No positive or potentially negative impacts
⚫ No evidence could be found

The evidence shows that agricultural carbon projects and energy efficiency projects (mainly based on clean cookstove projects) demonstrate the highest potential for economic and social impact at the community level. On the other hand, pure forest or nature conservation projects have less potential to contribute positively to local livelihoods. While forest conservation projects that allow local communities to practice agroforestry activities could be less attractive for project developers, they can be more successful in generating social and economic impacts and reducing risks of tensions and conflicts.

3. FINDINGS ON ENABLING FACTORS

This section gives insight into the factors that enable positive economic, social and environmental outcomes of carbon projects.

3.1. PRO-POOR AND TRANSPARENT PROJECT DESIGN

Integrating a strategy to achieve co-benefits into project design with the explicit intention to avoid negative social and economic outcomes for local communities is a stepping stone for inclusive carbon markets. The literature shows that projects that were the most successful in sharing revenues with local communities had a clear vision and strategy embedded in the project design.

Atela et al. (2015) show that pro-poor strategies resulted in a revenue flow to local communities in a reforestation project in Kenya and promoted equity and rights in project implementation. The pro-poor benefits generated by the project, such as land tenure and access to water, increased the project's ability to protect the forest. Atela et al. (2015) notes that project developers partnered with local community members through community-based organisations. Through this, the community committed communal land to the project. The local community was entitled to all the carbon revenue from communal forests and received one-third of the carbon revenue generated by nearby large livestock farms (Atela et al. 2015). This extra share underscores the pivotal role local communities play in protecting forests while recognising that carbon payments for communal land do not generate enough revenues. The community share is part of a benefit-sharing mechanism in which the other two-thirds are equally divided between large livestock farmers and project operations. The community share of carbon revenue is invested in livelihood projects through an established trust fund (Atela et al. 2015).

Timely payments are important to enable local communities to appreciate the benefits of their work. The literature shows that projects that received early carbon payments were more successful in engaging with local communities in the short term (McAfee 2016). However, receiving ex-post payments for carbon sequestration based on long-term contracts that often span 15 to 25 years could pose a risk for project developers. This means that it is important to manage payment mismatches to keep local communities on board. This can be addressed by drawing up agreements with credit buyers. However, it is unclear if and how such agreements are made and under what conditions buyers are willing to pay developers upfront. One study shows that carbon verification and buyer-dependent projects tend to have extended payment terms of over three years. On the other hand, projects that depend on carbon verification but are independent of buyers were able to pay much earlier (Lee et al. 2016). In general, the literature shows that project developers can provide upfront monetary assistance to communities and offer technical assistance and other benefits, such as long-term services to compensate for the time differential between the reduction of carbon and the disbursement of revenue for it (Miles 2020).

However, the challenge for project developers is finding a market equilibrium price where carbon credits are low enough to attract buyers, but high enough to keep local communities participating in the project, while also delivering non-carbon benefits to them. Seeking meaningful participation and revenue sharing with local communities comes with a cost (McAfee 2016). Specifically, agricultural carbon projects are characterised by high transaction, institutional, and implementation costs, which reduce the opportunity for monetary benefits for the communities (Sahoo et al. 2021, Ebissaa et al. 2023, Mantey et al. 2024).

As Lee et al. (2016) show, project developers have taken three approaches to address the payment mismatch:

1.

Decreasing the transaction costs of establishing and running the project. Cacho et al. (2013) argue that this can be done by increasing the scale of the project, using community groups to do self-monitoring, and contracting local communities for work.

2.

Providing farmer associations with aggregated carbon revenues for public projects such as schools, health centres (this is to avoid too many small individual transactions and aggregate them into larger investments into the community).

3.

Focusing on the non-carbon revenue-related benefits, such as extension services and training.

In general, projects in which many local communities participate often face time lags between adopting the carbon projects and revenue distribution, knowledge gaps about voluntary carbon markets, and insignificant carbon payments at the household level. These challenges arise from complex governance structures and relate to different implementation stages and components (Mantey et al. 2024). The governance challenges cited by Mantey et al. (2024) are twofold. On the one hand, they relate to transparency, specifically carbon credits, which affect the effectiveness of working with local communities in these projects. Furthermore, power imbalances between stakeholders, low technical capacity of some actors and the overall complexity of these projects relate to this challenge. This lack of transparency can potentially affect trust and credibility among stakeholders, while the accountability of key decision-makers may not be enforced. On the other hand, Mantey et al. (2024) show that high transaction and implementation costs related to capturing and documenting quality data for carbon audits and monitoring purposes reduce investment opportunities in services to local communities, which are required for their longer-term motivation and successful participation.

A purely market-based carbon project will struggle more with delivering upfront services and early payments to local communities because it is unclear how much and when carbon payments will be received (Cacho et al. 2013). Most successful projects provide community co-benefits for which they receive some additional funding (or are subsidised), because they can use external funds to deliver technical assistance, training and upfront monetary payments to local communities (Miles 2020). However, most carbon offset projects in the voluntary carbon market are not subsidised, resulting in a trade-off. Sustained support services to local communities are less common in schemes that depend on state, multilateral, or NGO subsidies (McAfee 2016).

The literature on forestry projects indicates that revenues from sequestration reduce between the first years and the end of the project. This is mainly due to concessions to local communities to access and use reforested lands as a way of retaining participation in the project. Low replanting rates after tree harvests cause decreases in carbon sequestration, reducing revenue from carbon credits (Netter et al. 2022). Therefore, good management and emphasis on the replanting scheme for reforestation projects help to reduce the decline in carbon sequestration and thus positively affect carbon revenues.

Project design should also assess the motivations for local communities' participation in carbon projects to ensure that the project aligns with their interests. Local communities are diverse and have different development goals (Thapa 2019). It is therefore important that project developers harmonise between community preferences and project goals (Mwageni et al. 2015). For example, some communities participate in carbon payment schemes mainly for non-monetary benefits, emphasising self-organisation, technical assistance and training, which can lead to improved livelihoods and economic opportunities (Tamba et al. 2021). As such, developers should take this into account and seek to provide such services to local communities.

Whereas projects assess potential tensions and risks (due diligence), they often lack the awareness of how to superimpose existing social power relations and prevailing organisational configurations. This is especially so because most carbon market consultants are not locals, potentially aggravating conflicts over resources (Kemerink-Seyoum et al. 2018, Blanton et al. 2024).

3.2. GOOD GOVERNANCE AND IMPROVED HUMAN CAPABILITIES AND CAPACITIES

Studies show that local communities' commitment and participation are important to achieve carbon sequestration and secure payments (Boyd et al. 2007, Stuchi Cruz et al. 2017). Projects focusing on social capital facilitate greater participation among marginalised groups, potentially leading to a more equitable distribution of benefits (Clements & Moore 2015). Studies cite examples where recognising local organisations (as local contract providers or through engagement with village leadership structures) positively impacts socio-economic outcomes (Stuchi Cruz et al. 2017, Tamba et al. 2021).

Streck (2022) indicates that activity-based carbon rights can conflict with asset-based carbon rights, where governments hold the rights to land and forest resources, yet carbon project activities are implemented by communities, individuals, or private legal entities. Governance systems can clarify fair benefit-sharing arrangements and create equitable rights. Where there are different overlapping claims to benefits from sequestered carbon or reduced emissions, local land and service agreements can help to avoid conflict over responsibilities and benefits in relation to conservation projects (Streck 2022).

Studies also show that education and awareness drive social impacts, and knowledge asymmetries reduce social and economic outcomes (Mantey et al. 2024). Local communities tend to have limited knowledge of carbon markets and often do not have information about payment timelines or why carbon payment amounts differ. While payment terms are stipulated in the contractual agreements made between them and carbon buyers, the language can be confusing and obtuse. In instances where clear and trusted communication exists with local communities, they engage better with the projects and there are less tensions.

Engagement with community members is also important to promote technologies and monitoring adoption, because it enhances social capital and local empowerment (Tamba et al. 2021, Mantey et al. 2024). Where support in skill training and technical assistance is given to local communities, additional income could be achieved through innovation and improved market access. When these non-monetary benefits can be subsidised, they do not influence project costs.

3.3. PAYING A PREMIUM TO DELIVER SOCIAL IMPACT

Projects where credits are sold at a higher price are much more likely to achieve positive social and economic outcomes. The literature clearly indicates that the carbon price is an important factor for delivering inclusive carbon projects to achieve positive social and economic outcomes. There is a distinct relationship between the carbon price and the opportunity costs that projects face. Opportunity costs are the cost of forgoing the benefit of the original land use in order to support a carbon offset project. The literature that looks into the opportunity costs of carbon offset projects shows that economic activities that drive deforestation generate significantly more economic benefits for participants than reforestation or afforestation projects at the current low carbon market prices (Pan et al. 2022, Wong et al. 2016).

If communities receive much lower monetary benefits than expected, given the low prices in the carbon market, they are forced to explore other economic activities, such as expanding agricultural land use and timber production, which generate higher returns. According to Ebissaa et al. (2023), evidence of forest plantation projects in Ethiopia shows that carbon projects in Africa receive low prices compared to the opportunity costs to the local communities. Several other studies show that forestry is not a competitive land use in the tropics and needs to be augmented by policy and payment of US$9/tCO2 or US$33/tC for a plantation forest to be attractive (Ebissaa et al. 2023).

Additionally, carbon prices directly affect the cost-revenue ratio. Lower revenues from sequestration with the same costs means that market-based projects pay out less to local communities. Equitable and pro-poor benefit sharing are necessary but not sufficient for effective project implementation unless carbon pricing harmonises with local livelihood needs (Atela et al. 2015). Lowering the transaction and implementation costs of these projects is therefore, often mentioned as the only way forward for these projects to maintain long spells of low carbon prices. However, efforts to reduce project costs should not undermine the integrity and trust the market must have to value them appropriately.

Furthermore, carbon market prices are volatile, making it difficult to estimate the cost and benefits of a project. This increases the risk of delivering viable and sustainable projects and has implications for local communities' expectations about their revenue share (Pan et al. 2022). Generally, project co-benefits often seem to fall short of initial expectations and promised benefits under the success narrative and multi-win promises, which are worsened by sustained low carbon prices.

There are indications that the carbon market values higher quality projects that include co-benefits such as fostered corporate social responsibility, meaningful participation and social cohesion of local communities, positive environmental impacts, and revenue sharing. These projects are in high demand and are highly priced in the market (Lee et al. 2027). This suggests that developing co-benefits is important for strengthening the market competitiveness of carbon credits in the voluntary carbon market.

However, the trade-off is that the costs to run these projects are much higher than the extra revenues received due to the higher price, making it less economically attractive for private actors. Prices in the compliance market are higher, partly because of the higher quality guarantees required for offset projects to be sold in this market. However, many restrictions exist for projects that want to sell credits in these markets. The compliance markets restrict many credits on which LMICs rely to attract climate finance.

3.4. ADHERENCE TO MORE STRINGENT STANDARDS

Higher carbon prices for inclusive carbon projects could incentivise better quality projects. Studies show that improved social and economic impacts for local communities were often registered by standards bodies such as Plan Vivo and Verra's Climate, Community & Biodiversity (CCB) programme that stipulate higher standards and requirements for participation with local communities. However, a study by Huber et al. (2024) shows that there are contradictions around the term 'sustainability' where opinions differ on whether there is a need for social and environmental co-benefits. Interpretations of terms such as 'transparency' and 'stakeholder' saw smaller differences, but were not interpreted uniformly.

Taking that into account, projects that qualify for higher standards ensure more meaningful participation and inclusive governance structures. This gives local communities more power and decision-making opportunities and ensures that safeguards are in place to minimise negative outcomes at the local level. For example, equitable participation of indigenous people and local communities in decision-making regarding land management and ensuring direct access to carbon markets is imperative for the successful functioning of high-integrity

carbon markets (Blanton et al. 2024). Therefore, robust safeguards must be adopted to protect human rights and ensure access to independent legal counsel and grievance mechanisms. For example, Poudyal et al. (2018) cite a forest conservation project in Madagascar, where the median net present value of the opportunity cost across households was US$2,375. Annualising these costs implies 27–84% of total annual income for median-income households but with significantly higher proportions for poorer households. Whereas safeguards should be in place to compensate households for such losses, Poudyal et al. (2018) estimated that more than 50% of eligible households (3,020 households) did not receive compensation. Even then, the households that received compensation were not fully compensated for their lost income.

The CCB Standard has an optional criterion for exceptional community benefits, which states that projects must identify marginalised and/or vulnerable community groups and demonstrate that the project generates net positive impacts on their well-being (Pan et al. 2022). It further states that projects must demonstrate net positive impacts on the well-being of women and that women participate in or influence decision-making. Project monitoring plans must include impact indicators relating to women. Projects that apply standards such as gender analysis into project design not only give higher importance to social impacts related to gender equity but are also more likely to achieve social outcomes (Mantey et al. 2024).

The low carbon price combined with high transaction and implementation costs remains a significant barrier for these projects (Pan et al. 2022). Carbon prices can be increased by building the credibility of the voluntary carbon market. For this reason, the market has established several independent governance bodies to ensure integrity. For example, the Integrity Council for the Voluntary Carbon Market (ICVCM) is an independent governance body formed by the Taskforce on Scaling Voluntary Carbon Markets (TSVCM) with the purpose of establishing a set of global standards to ensure the integrity of the voluntary carbon credit market. The ICVCM published the Core Carbon Principles (CCPs), which comprise ten principles for determining the integrity of a carbon credit. Six of the principles relate to the carbon-crediting programme, three relate to the particular carbon credit, and one principle relates to both the carbon-crediting programme and the carbon credit. The CCPs were drafted along with an Assessment Framework and Assessment Procedure to determine whether project-specific methodologies, carbon-crediting programmes and carbon credits issued comply with the CCPs.

The principles for carbon-crediting programmes state that they shall have clear guidance, tools and compliance procedures to ensure that mitigation activities conform with or go beyond widely established industry best practices on social and environmental safeguards while delivering on net positive sustainable development impacts. The Assessment Framework requires the programme to have guidance and procedures relating to environmental and social safeguards, including human rights, biodiversity, and indigenous community impacts, as well as sustainable development impacts, including provisions to ensure net positive SDG impacts.

No evidence could be found to demonstrate how these initiatives influence the carbon price. This could be due to the fact it is too early, as CCPs have only recently been introduced.

3.5. ENABLING POLICIES AND INSTITUTIONS

There is increased advocacy to regulate the voluntary carbon market. This is mainly to ensure the credibility of proclaimed ex-ante carbon sequestration, which forms the basis for issuing carbon credits. The literature shows that self-regulation has its limitations, however, there is no evidence of how regulation could impact social and economic outcomes for local communities.

Domestic legislation, regulations and policies could in other forms affect carbon markets. For example, the literature mentions that the lack of strong institutions and regulations in lower-income countries, including compliance with existing legislation, increases the transaction and implementation costs of these projects. Furthermore,

although most projects have some provisions for protecting local indigenous tenure rights, the protection is often insufficient without broader land tenure reforms (Atela et al. 2015). Compliance with environmental policies could reduce opportunity costs and limit certain economic activities in protected areas. Although it goes beyond the scope of this research to understand how external policies impact carbon markets, some studies provided some insights. For example, even if full opportunity costs of reforestation and conservation projects are not met, smaller financial incentives to reforest and conserve forests may be an attractive option if there is existing social or political pressure to conserve, or where non-market values are recognised (Warren-Thomas et al. 2018).

To effectively address tensions and potential conflicts, carbon projects within historically constituted landscapes must be critically analysed. Rather than providing neat rational planning tools, it is important to consider community priorities and landscape features to avoid contestation over change (Leach & Scoones 2015).

Table 2 shows how different high-level categories of impact are influenced by different features of a carbon project.

Table 2. Enabling factors and their consequences on project outcomes

Feature of carbon project	Economic	Social	Environment	Conflict
Project level				
Defining clear approaches for revenue sharing	🟢	🟡	🔴	🟡
Community participation in governance system	🟢	🟢	🔴	🟢
Access to additional funding	🟢	🟢	🟡	🟡
Ability to reduce costs	🟢	🟡	🔴	🔴
Ability to avoid revenue mismatch	🟢	🟡	🔴	🟡
Cooperation community-based and local organisations	🟡	🟢	🟡	🟢
Quality due diligence assessments on risks for communities	🔴	🟢	🟢	🟢
Carbon programme level				
Higher carbon price	🟢	🟢	🟡	🟡
Standards and requirements	🟡	🟢	🟢	🟢
External policy level				
Regulation of voluntary markets	⚫	⚫	⚫	⚫
Strong institutions	🟢	🟢	🟢	🟡
Land reforms (e.g. land titles)	🟢	🟢	🔴	🟢
Environmental policies	🟡	🔴	🟢	🟡

🟢 Potential for positive benefits 🟡 Mixed but mostly positive benefits 🔴 No positive or potentially negative impacts
⚫ No evidence could be found

This summary shows that inclusive governance systems, access to additional funding, higher carbon prices for projects that deliver social impacts, stringent standards and regulatory processes, strong institutions, and land reforms have potentially high positive impacts on participating local communities.

The evidence also shows that economic impacts are highly possible if projects are designed for revenue sharing, facilitate meaningful participation, secure additional funds, reduce transaction and implementation costs, and prevent revenue mismatch. Higher prices are also required to ensure more revenue can be shared with local communities.

4. DISCUSSION

The findings of this review indicate that social and economic impacts can be enhanced by implementing capacity-building and revenue sharing measures. It is equally important to consider local power dynamics, oversee business practices, promote development-oriented projects, and ensure meaningful involvement of local communities and civil society. Hence, higher standards on inclusiveness, transparency, and agency are as important as improved standards on emission reductions and sequestration.

> *Notwithstanding low carbon prices, projects can positively impact local communities if designed and governed properly. . ...the contributions of forest concessions to the SDGs depend on governance context and the clear use of the instrument to deliver such objectives as better planned and implemented concessions and binding concession contracts.* (Tengenge et al, 2019; 1)

Due to the high implementation and transaction costs, project developers must be incentivised with the prospect of increased carbon prices for higher quality carbon credits, while buyers can be assured that paying more helps them to reduce risks, such as reputational damages. Only with good dialogue among all the stakeholders in the carbon credit value chain will it be possible to achieve the integrity or quality of a carbon credit, which could reduce risks like the impermanence of the environmental asset. The integrity of carbon credits can be achieved by ensuring transparency in measuring avoided and captured emissions and underscoring the importance of social additionality, which is verified with indicators of equitable distribution of benefits for local communities and entrepreneurs, among other best practices. Otherwise, value chains might not contribute to carbon mitigation in the medium and long term while increasing the risks of harming local communities and reducing the multiplier effect for broader economic development. Therefore, value chains must incentivise high-quality carbon credits, with a sustainable system of shared values while removing low-quality carbon credits from the market (UNDP, 2023).

Although many knowledge gaps related to understanding the impact of carbon markets in LMICs still exist, the evidence gives some optimism that improved and innovative approaches can benefit both the demand and supply sides.

The findings of this review can contribute to policy dialogues on the integrity of carbon markets and the need for more equal and inclusive participation of local communities in LMICs, and also help to address knowledge gaps to understand impact pathways, particularly in Africa.

Importantly, the findings of this research show potential for LMICs governments to identify and plan more strategically for carbon trading opportunities. While the voluntary carbon market is only one vehicle, other ways, such as increasing participation in higher paying compliance carbon markets must be a priority.

If well implemented, article 6 of the Paris Agreement can unlock the potential of carbon markets to drive deeper emission cuts and deliver real benefits for people and nature.[8] The transparency provisions of this agreement align with the findings of this review, highlighting the importance of quality standards and governance systems to protect local communities (do no harm) while promoting co-benefits. However, there is still a need to refine these standards and prioritise robust engagement with indigenous people and local communities. In other words, climate justice and social safeguards need to become an integrated part of the solution as they are fundamental to the success and fairness of these mechanisms. As such, integrity initiatives like the Carbon Credit Quality Initiative (CCQI) and the Integrity Council for the Voluntary Carbon Market (ICVCM) will be central to this role.

[8] See for more information on https://unfccc.int/process/the-paris-agreement/cooperative-implementation#:~:text=Article%206%20of%20the%20Paris,sustainable%20development%20and%20environmental%20integrity

5. CONCLUSION

The evidence suggests that local communities participating in carbon offsetting projects often benefit little from them and find it difficult to protect their interests. However, achieving cost-effective mitigation and sustainable livelihoods relies significantly on the specific local context within which carbon projects are implemented. The findings highlight the importance of balancing carbon sequestration and reduction with local economic preferences. It is essential to mitigate environmental risks and adopt long-term, inclusive, and pro-poor approaches to ensure the effectiveness of carbon projects, especially for nature-based projects such as reforestation and forest conservation.

1

Overall, there appear to be three inter-related dynamics going on that determine social and economic outcomes for local communities:

The intended project outcome

Incomes from carbon payments, jobs, incomes from products of carbon projects etc.

The type of project

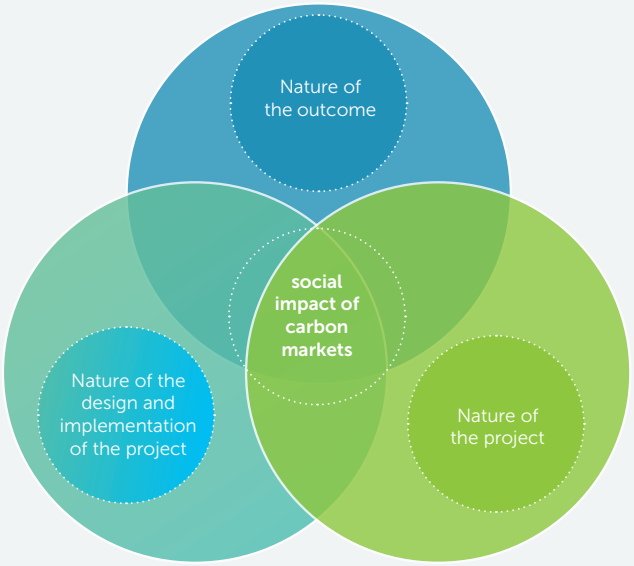
Afforestation, reforestation, agroforestry, clean energy, waste management.

The project design and implementation

Who gets paid, when, how much, what is expected in return, related to transaction and implementation costs.

The figure below illustrates the inter-related dynamics that determine the socio-economic impacts of carbon markets on host communities.

Figure 3. Three inter-related dynamics for socio-economic impacts of carbon markets on host communities



2

Inclusive carbon offsetting strategies could minimise the failure of carbon projects by creating social and economic benefits for local communities while enhancing their participation. This requires agency and active participation in governance by local communities.

3

Implementing carbon projects presents governance challenges due to their complexity and the involvement of power dynamics of various actors with differing interests. Projects need to engage local and community-based organisations to understand power dynamics within communities and between communities. Additionally, strict safeguards and grievance mechanisms must be established to mitigate the risk of negative social and economic outcomes. This includes addressing potential increased gender inequalities and tensions and conflicts.

4

Due to the challenges posed by delayed payments, a combination of upfront and non-results-based financing could provide positive signals regarding financial certainty and predictability. In this approach, ex-post payments upon delivery would likely constitute a more substantial portion of the overall financing. Implementing this payment mix will require clear performance criteria and credible reference levels. It is important to clarify definitions, assessments, performance measurements, and specific triggers for releasing the results-based payments.

5

Finally, external factors such as strong institutions and land reforms can increase economic outcomes for local communities and empower them while reducing conflicts and tensions. Projects deliver social and economic impact more effectively where strong institutions enforce norms and standards across other areas. This evidence suggests that regulatory and policy reforms within carbon markets and by governments are needed to enhance the positioning of local communities.

This review highlights the potential for climate finance and the benefits that local communities in LMICs can gain from participating in carbon offsetting projects. However, this necessitates developing solutions to improve project design. Additionally, benefit distribution requires innovative approaches to ensure carbon market projects deliver meaningful and equitable benefits to local communities.

6. KNOWLEDGE GAPS

1

More research is needed to understand the timing of various projects aimed at achieving social and economic outcomes and how to maintain those outcomes over time. The review indicates that projects with more positive social impacts rely on extra funding or subsidies to guarantee short term revenue sharing with local communities. However, it also suggests that subsidised projects are less likely to be sustainable in the longer term.

2

Comparative studies are needed to gain a clearer understanding of the differences in social and economic outcomes between projects that adhere to varying standards. This review shows that higher quality standards and requirements tend to increase the likelihood of enhanced social and economic outcomes. However, it is unclear how much the outcomes differ depending on the specific standards implemented in different projects. This review found limited evidence on how nature-based carbon projects connect environmental impacts with social and economic impacts at the community level. While there are some suggestions regarding entrepreneurial opportunities, there is no clear evidence indicating who benefits from these opportunities and who might be left out.

3

Future research should investigate the connection between carbon markets and adaptation benefits and the impacts on biodiversity. These factors are becoming increasingly significant for project funding and design because Article 6 of the Paris Agreement mandates that a portion of the proceeds from carbon trading be allocated to adaptation funding. This creates opportunities to better understand how mitigation and adaptation initiatives can be linked to create greater benefits to tackle the climate crisis.

4

There is an increased call to regulate the voluntary market to guarantee they do what they claim to do. Research is needed to understand how such regulation can contribute to developmental outcomes without increasing the already high transaction and implementation costs of carbon projects.

5

Evidence for improved empowerment and agency of local communities is generally missing or weak. Research that uses well-known methodologies and frameworks to analyse the empowerment of marginalised groups, is missing. A better understanding is needed to recognise how meaningful participation in carbon markets can increase empowerment and agency through governance systems, design and decision-making processes, knowledge and technology transfers, and increased incomes.

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ANNEX 1
METHODOLOGY

We call this review a "realist" systematic literature review, based on the ideas of realist reviews or realist syntheses, which represent one approach to systematic reviews that is particularly useful for making sense of complex interventions. A realist review is a theory-driven approach to reviewing the literature. Realist reviews are explanatory and less judgemental. In other words, as such they are more useful for explaining why outcome patterns occur rather than producing findings that describe how one intervention is "better" than another. Realist reviews are usually used to explain, in full or in part, how and why complex systems and interventions work, for whom, in what contexts and to what extent.

Our approach included the participation of a multistakeholder advisory group. This group comprised of leading figures with different and contrasting perspectives on the subject matter, including proponents and opponents, industry insiders and those working outside the industry, and it encompasses a wide range of sectoral, thematic and geographical expertise. First, this ensures the project captures the most relevant questions in a structured way. Second, this is to validate the findings and knowledge gaps and discuss and identify with the advisory group the critical areas that determine the impact pathways. The advisory panel was convened early in the project to debate the conceptual framework, recommend adaptations, and recommend data sources for inclusion. It was convened again to discuss the draft findings, suggest revisions, and support packaging and dissemination to different groups in order to maximise the utility of the research.

The literature search focused on empirical academic research and robust evaluations of carbon projects in the context of LMICs. Search terms focused on the context (C), mechanism (M) and outcomes (O) by using the CMO framework, which states that for any observed outcome, there are one or more causal processes (or "mechanisms") that only become active in certain contexts. We used a combination of the following search engines: Science Direct, Scopus, CORE, Google Scholar, and Google.

Context	Mechanisms	Outcomes
e.g. "voluntary carbon markets" "compliance carbon markets" "mandatory carbon markets" "carbon credit registry bodies" "carbon offset programmes" "carbon credits" "standards" "regulations" "requirements"	e.g. "carbon projects" "offset projects" "carbon removal" "carbon avoidance" "carbon reduction" "nature-based solutions" "carbon price" "integrity" "trust" "transparency"	e.g. "income" "employment" "food security" "agricultural productivity" "pollution" "biodiversity" "water" "gender" "marginalised groups" "empowerment" "land rights" "education"

The review used the following selection criteria:

Geographical scope

Latin America, Africa, Asia; preference was to collect as much evidence as possible from Sub-Saharan Africa, but we did not exclude evidence from non-African LMICs.

Scope of outcomes

Focus in the literature on localized, community-based outcomes. We did not select literature for review if their focus is on carbon emission outcomes and contribute little to social impacts. As long as the social and economic impacts are at the core of research approach, it was included.

Robustness

We only selected literature with the highest robustness to guarantee the evidence is of high quality. This relates to quantitative and qualitative methodologies, looking at case selection, number of participants, and methodologies. We prefer mixed approaches, combining in-depth interviews with other forms of data collection.

Period of evidence

Because carbon markets have evolved over time, we focus on literature that has been published after 2013 but still consider important evidence from older studies.

The analysis of the selected literature was structured in the following way:

First, we coded for the localized outcome categories (e.g. income, land rights, pollution), direct employment created by the projects, percentages of revenues that go as income and as other investment to local communities, if data was disaggregated or not.

Then we coded on project categories related to the kind of credits they received (carbon avoidance, carbon removal, carbon reduction) and sub-categories (e.g. forest management, reforestation, cookstoves, renewable energy), add-on certification schemes included in project or not, carbon credit price, use of external rating agencies, verification and audit processes.

Finally, we coded for context: country/region, name of registry body/standard agency, voluntary vs compliance markets, mechanism of linking demand with supply (e.g. auctions).

The literature research strategy resulted in 52 studies that were coded and analysed. More than three quarters of the studies were published in academic journals. The methods used by the studies is mixed, with 45% researching empirical evidence from carbon projects, 40% were literature reviews on carbon markets and carbon projects in LMICs, and the remaining studies used quantitative methods for measuring outcomes and costs (e.g. opportunity costs). The studies covered Latin America, Asia and Africa, researching slightly more projects in the African continent. Projects in Kenya (10) and India (7) were mostly mentioned. Most studies were looking into the voluntary carbon market, with very little focussing on compliance markets. Half of the studies refer to removal credits with all related to reforestation and afforestation projects, which is in line with the proportion of forest carbon credit transactions as they constitute more than half of trade volume (Lee et al. 2017). The other half are reduction

and avoidance credits which are a mix of transport, clean cookstoves, renewable energy projects, and waste management projects. Finally, the studies cover mainly economic (45%) and social impacts (45%) with very little studies also covering environmental impacts. This can be explained because the search was mainly focusing on understanding social and economic outcomes of carbon projects. Most studies looked into revenue and revenue sharing with local communities (30) followed at some distance by empowerment and agency (15).

Methodological Limitations

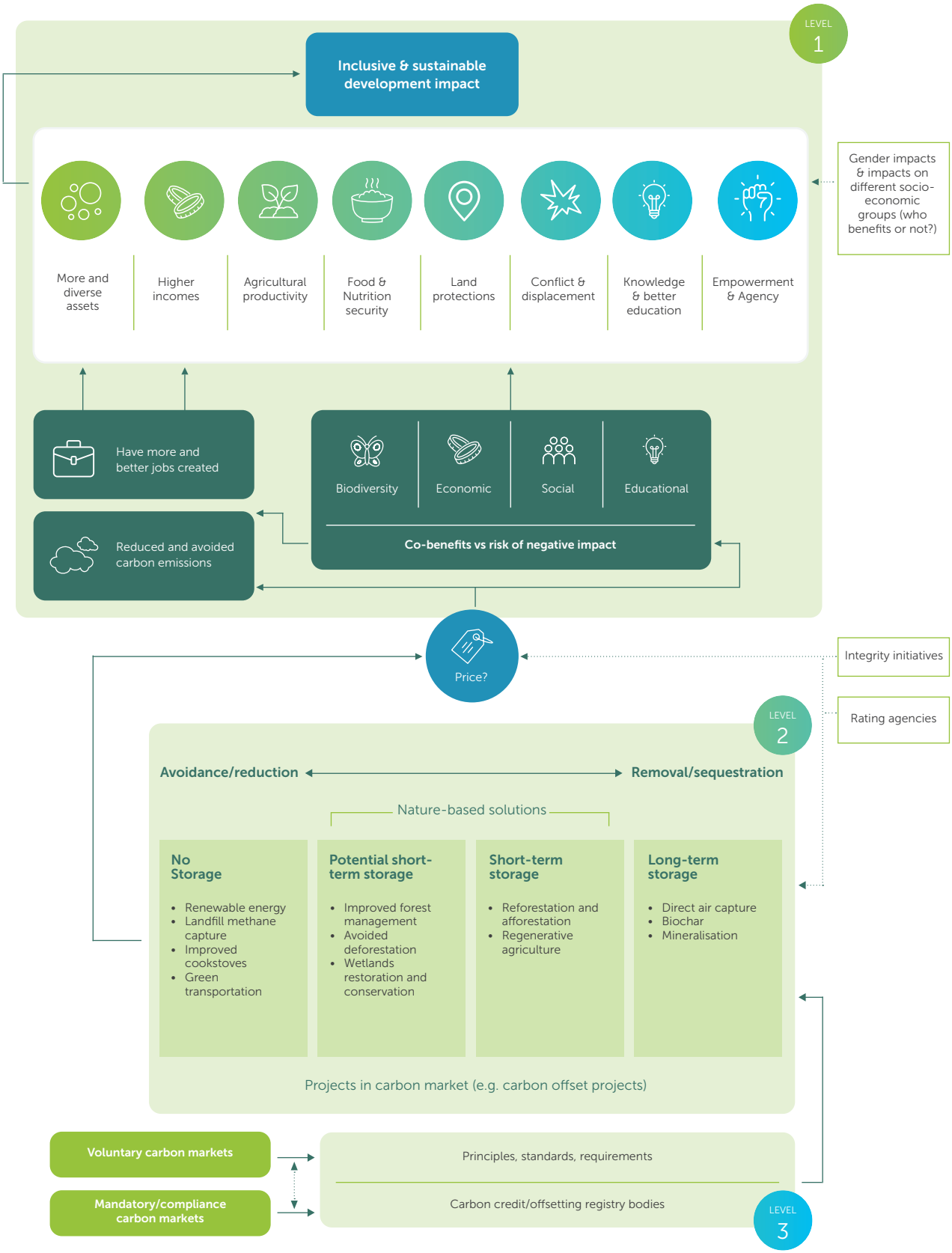
- One limitation of the research is around the geographies and timeframes within which the impacts of carbon projects are realised. Some impacts of carbon markets, both positive and negative, are global and intergenerational. A tonne of carbon removed from the atmosphere will fractionally contribute to limiting global warming, which will, at some point in time lead to fractional benefits to everyone, including the communities in which the carbon project was implemented. Similarly, carbon projects result in additional money flowing into LMICs, which likely has multiplier effects. Carbon projects are part of global value chains with impacts felt throughout as a result of a project. This research limits its assessment to impacts seen at and surrounding the site of the project during and immediately after the project's lifespan.
- Those projects of greatest relevance to the research question – specifically focusing on Africa and attempting to capture diverse outcome types, geographies, and project types – are relatively new and few. Although the findings are based on available evidence from existing projects in LMICs (other project types were not discussed in this literature in the context of LMICs e.g. geological storage, large scale renewable energy, methane capture etc), there is always the question about how far they can be extrapolated to the entire carbon market.
- Expected social and economic impacts as expressed in the selected literature might not be valued at the same level as local communities. The expectations of what is good for local communities could be very different in different contexts, but is not included in this research.
- The scope of this study was on the carbon project level and impacts on local communities, while not doing extra searches for studies that look from a wider perspective (macro level) on the link between participation in carbon markets, carbon prices, distributional outcomes, food security among many other social and economic impacts.

ANNEX 2

CONCEPTUAL FRAMEWORK

1	2	3
At the base, there are the arrangements, standards, requirements, regulations, and policies related to the functioning of voluntary and compliance carbon markets in general, including registry and standard bodies. Carbon markets need capable institutions, financial resources, and networks to function, which set the basis for quality carbon programmes that issue trusted carbon credits for further trading.	Carbon credits are always linked to specific projects. This is the middle level of the conceptual framework. These projects can be categorized for their contributions to avoid, reduce and remove carbon emissions, which depends on their ability to store carbon. These include nature-based solutions, for example related to forest management, reforestation, and afforestation.	The top shows how projects that receive carbon credits generate outcomes. Primarily the outcomes relate to carbon emissions, but increasingly other localized outcomes (e.g. social, environmental and economic) are valued. To truly impact on inclusive development, all outcomes need to be analysed - and data collected for different socio-economic groups and disaggregated by gender.

Figure 1. Inclusive Development Impact Pathway framework (source: author's own, 2024)



Central to the framework is the carbon price. The price reflects how well carbon markets work to value better quality projects that can be linked to trusted programmes, standards, and verification systems. To increase trust in carbon markets, scrutiny initiatives and rating agencies have been established. Also, for social and economic impacts of carbon credits, the price received by projects is relevant as it not only generates finance to run the projects, but also generates incomes and other impacts to local communities.

The conceptual framework shows that at each level, there are different impact pathways for carbon markets' contribution to inclusive development. By separating these impact pathways, it is possible to compare the outcomes. This research focuses on the following critical areas for specific pathways. By separating these impact pathways, it is possible to compare the outcomes.

1.

There is a distinction in the design, regulations, governance and standards between the voluntary versus compliance carbon markets, which determines the type of projects, price received, and ultimately the outcomes.

2.

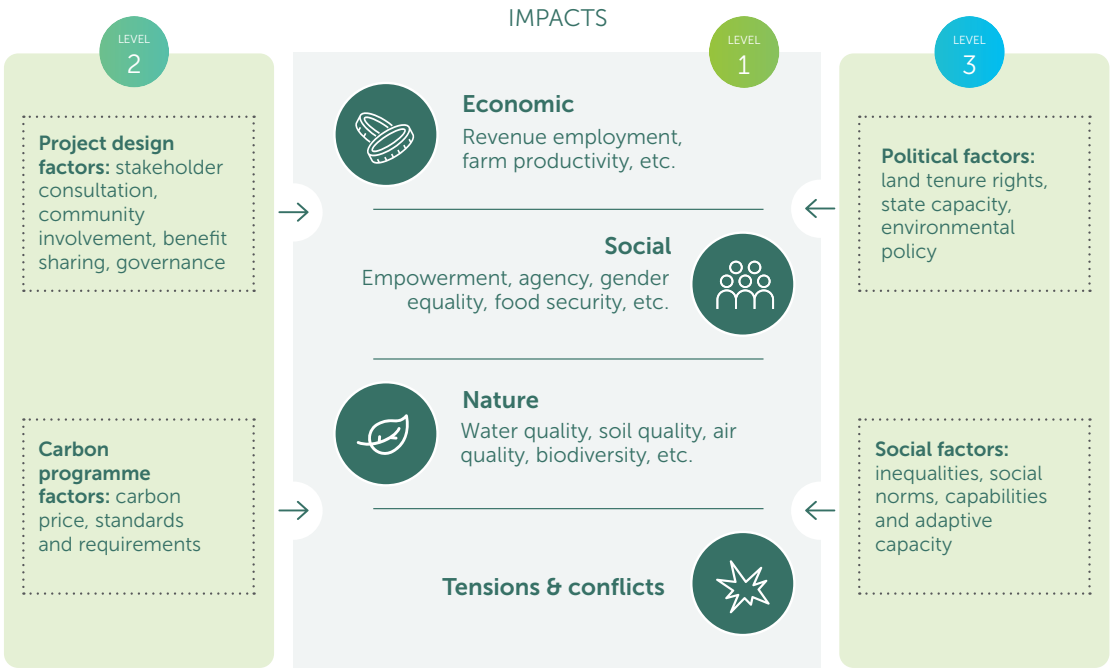
There is distinction between carbon programmes and projects that only focus on carbon emission outcomes versus programmes and projects that have specific add-on certification schemes to achieve co-benefits.

3.

Impact pathways are distinctive based on different categories of projects separated by avoidance, reduction and removal credits.

Figure 2 shows a simplified version of the conceptual framework which is used to structure the finding section between the available evidence on outcomes and enabling/contributing factors. The economic, social and environmental impacts in this figure, including the impact on conflicts and tensions regarding local communities, corresponds with the upper end of the conceptual framework (and O in our approach). The four factor levels in Figure 2 correspond with the variations of project design (middle section in Figure 1, and M in our approach), the working of the carbon programmes (mainly the lower section in Figure 1), and external social and political factors (both carbon market and social and political factors, are C in our approach - out of the direct influence sphere of projects in which local communities participate).

Figure 2: Enabling factors for economic, social, and environmental impacts



ANNEX 3

CONCEPTS AND THEIR USE IN LOWER-INCOME CONTEXT

Definitions and concepts

Carbon markets are created spaces that allow for carbon emission trading with the purpose of limiting climate change by creating a market with limited allowances for emissions. There are two types of carbon markets:

- **Mandatory/Compliance:** Trading and demand in the mandatory or compliance carbon market are created by a regulatory mandate. Mandatory systems are regulated by government organisations (through national, regional, or international carbon reduction regimes) to cap emissions for specific industries – cap and trade mechanisms. Examples are the Regional Greenhouse Gas Initiative (RGGI), the UN Clean Development Mechanism (CDM), the UN Joint Implementation, the European Union Emissions Trading Scheme (EU ETS), the UK Emissions Trading System (UK ETS), or the California Carbon Market.
- **Voluntary:** Trading and demand in the voluntary carbon market are created by non-governmental organisations. Voluntary carbon markets enable buyers (corporations, institutions, and individuals) of carbon credits to offset their emissions outside a regulatory regime. An example of a voluntary carbon market is the Climate Action Reserve (CAR). These markets can be created in different ways, such as special auctions, industry schemes (e.g. Carbon Offsetting and Reduction Scheme for International Aviation), or directly between offset registry bodies and carbon credit buyers (or via their intermediaries). As such, important actors in these markets are the carbon offset standard and registry Bodies, such as Verra, Plan Vivo, the American Carbon Registry, and the Gold Standard.

Carbon sequestration is the process of capturing and storing carbon dioxide from the atmosphere to reduce the amount of carbon in the atmosphere and slow global climate change. It can occur biologically or geologically.

- **Biological sequestration** refers to when carbon dioxide is stored in natural environments, such as forests and grasslands. Forests store twice as much carbon as they emit. An estimated 25% of global carbon dioxide emissions are sequestered by other vegetative forms.
- **Geological sequestration** refers to when carbon dioxide is captured at emission sources, transported, and then stored or buried underground. This process is also known as carbon capture and storage.

Carbon credits can be bought or sold in the carbon market after certification by a government or independent certification or standard body. One credit represents the reduction, avoidance, or removal of one metric ton of carbon dioxide or its carbon dioxide equivalent (CO_2e). The carbon market generates a price for a carbon credit based on supply and demand. A carbon credit can be sold multiple

times until it is retired by the end user that wants to claim that credit's impact. Unlike the compliance carbon market, which uses a cap-and-trade system, the voluntary carbon market uses a project-based system in which there is no finite supply of allowances. More carbon credits can be created through the development of additional projects that can help to avoid, reduce, or remove carbon emissions. As such, the price for a carbon credit in the voluntary carbon market is much more volatile and lower than in the compliance market.

Carbon credits in the voluntary carbon markets are typically purchased in coordination with public relations efforts. These efforts aim to present a company or organisation as a climate actor, for example, as part of their responsible business activities. For this reason, many factors can influence a buyer's interest in a project, often linked to their most effective reputational gains. As such, voluntary market credits differ in price based on project charisma and potential for marketing, project type, location, and co-benefits beyond climate impact that match with buyers' preferences.

Carbon offsets work by offsetting emissions through investments in emission reduction projects. When an entity invests in a carbon offset programme, it receives carbon credits. These can be used to account for net climate benefits from one entity to another. Both offsets and credits can move among the various markets they are traded in. All offset projects are registered in offset certification and registry programmes, which is a system for reporting and tracking offset project information including project status, project documents, generated credits, ownership, sale, and retirement. These programmes vary in terms of governance and accounting and standard practices.

Standards and certification processes of carbon offset programmes stipulate the criteria for a project to be registered before carbon credits can be issued and traded. The voluntary carbon market is regulated by different registry bodies that run their own carbon offset programmes. Registry bodies can decide what principles, standards, and requirements that apply to each offset programme. In general, the highest quality of carbon credits and offsets should meet the following criteria: additionality, independent verification, permanence, recognised methodology for measurability, and the avoidance of leakages. To increase the trust that the claims on carbon credits are met by the carbon offset programmes, rating agencies and integrity initiatives have joined the carbon market. Examples are Integrity Council for the Voluntary Carbon Market (ICVCM) and the Voluntary Carbon Markets Integrity Initiative.

Concerns around the inequitable participation of indigenous people and local communities and the lack of access of these groups to carbon markets have highlighted the risks involved in carbon markets in achieving the desired environmental, social, and economic goals (McAfee 2016, Blanton et al. 2024). At the same time, there has already been a surge in variations of standards, measurement, reporting, and verification mechanisms that aim to address these concerns about the quality of carbon credits. To increase the social impacts, some standards and registry bodies in the voluntary carbon market have developed various programmes that feature inclusion, revenue sharing and biodiversity criteria. Quality verification initiatives also have been set up. Although higher-integrity is not an obligation in the voluntary carbon market, demand for carbon projects that actively promote these 'co-benefits' is on the rise. Therefore, this is a good moment to understand how carbon markets can become more inclusive and achieve developmental goals through participation of local communities. That will not only make these markets more inclusive but also could increase trust levels on which basis the market price could recover.

Co-benefits of carbon offset programmes are the benefits beyond carbon reduction and avoidance, such as educational and biodiversity benefits, and social and benefits to achieve broader developmental goals, which could relate to inclusive development. The aim is to avoid negative trade-offs of these projects at the local and national level. However, these co-benefits are not an obligation to include in carbon offset programmes and are considered as an "add-on" certification scheme that introduces non-carbon-related standards for specific offset programmes. Examples are the Climate, Community & Biodiversity (CCB) Standards and the Social Carbon Standard. The CCB Standards are managed by Verra (which also manages the Verified Carbon Standard) but were developed through a multi-stakeholder process by the Climate, Community & Biodiversity Alliance, a partnership of CARE, Conservation International, The Nature Conservancy, the Rainforest Alliance and the Wildlife Conservation Society.

Box 2. Limited interaction between compliance and voluntary carbon markets

Compliance offset market credits may in some instances be purchased by voluntary, non-regulated entities, but voluntary offset market credits, unless explicitly accepted into the compliance regime by the highest standards, are not allowed to fulfil compliance market demand. An example where the compliance and voluntary offset market credits come together is in California, where the Climate Action Reserve (CAR) developed a series of voluntary offset project protocols that were subsequently adopted (with some modification) in the California Compliance Carbon Offset Program. Offset credits issued under these protocols by CAR prior to the start of California's cap-and-trade programme were able to transition over and become eligible for compliance. Countries like Mexico and South Africa have also recognised certain offset credits issued by voluntary programmes as a means of complying with carbon tax obligations. Because voluntary offset credits cannot be used in compliance markets (only when they get explicit exemption), they tend to be cheaper.

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