Beyond the Wage Channel: Climate-Smart Public Works Programmes and Household Resilience in Malawi

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Abstract

One of the main arguments for implementing public works programmes (PWPs) instead of other social protection schemes such as cash transfers is that the assets created through these programmes themselves can generate medium- to long-term benefits. This is particularly important as the costs for supervision and the construction materials can account for up to 70 per cent of programme budgets. Despite this, there is scarce empirical evidence on PWPs' effects through the "asset channel": indeed; most studies have focused solely on the traditional "wage channel". To bridge this gap, this paper examines whether and how assets created under Malawi's Climate-Smart Enhanced Public Works Programme (CS-EPWP) – a programme recently implemented by the government of Malawi and funded by the World Bank – strengthen the resilience of households to climate shocks such as droughts and floods. The paper relies on case study analysis using primary qualitative data based on focus group discussions and key informant interviews with different stakeholders at the national, district and community levels. Interviews were conducted during fieldwork in September 2024 in two southern districts of Malawi highly affected by climate change. The analysis is complemented by site visits and quantitative survey data on asset quality. By combining these methods, we find that the CS-EPWP generates durable, community-maintained assets, which in turn enhance households' capacity to cope with and adapt to climate shocks. In particular, land-based assets provide multiple benefits for both households and communities, while forest-based interventions are expected to generate similar long-term gains, though further research is needed to confirm their (long-term) impacts. To maximise the impact of climate-smart public works programmes, policymakers and donors should align asset creation with climate objectives and adopt participatory approaches to ensure their relevance, maintenance and long-term sustainability.

Keywords: public works programmes, climate resilience, social protection, climate adaptation, Malawi

Contents

Figures

Tables

Figures in Appendix

Tables in Appendix

Boxes in Appendix

Abbreviations

CMC	Catchment Management Committee
CS-EPWP	Climate-Smart Enhanced Public Works Programme
CS-PWP	climate-smart public works programme
FGD	focus group discussion
KII	key informant interview
NLC	national-level consultation
PSNP	Productive Safety Net Programme
PWP	public works programme
SLM	sustainable land management
VLAP	Village Level Action Plan

1   Introduction

Public works programmes (PWPs) have recently received renewed interest as a prominent policy tool in many low-income countries, offering temporary, modestly paid employment while simultaneously creating or rehabilitating community assets (Bagga et al., 2026). Typically, PWPs reach unskilled and semi-skilled individuals from poor and vulnerable households through formal targeting or self-targeting mechanisms, particularly during periods of economic distress or seasonal unemployment (Beierl & Dodlova, 2022; Gehrke & Hartwig, 2018; Sakketa & von Braun, 2019). Unlike unconditional cash transfers, PWPs aim not only to alleviate poverty in the short term but also to build infrastructure that supports long-term development.

The assets created through PWPs – ranging from roads and water systems to sanitation facilities and communal forests – provide essential public goods, improve access to services and support environmental management. As such, PWPs can be designed to produce assets that advance climate adaptation and strengthen communities' capacity to withstand shocks and disasters (Burchi, Terskaya, Sakketa, & Aurino, 2025). Importantly, the benefits of climate-smart public works programmes (CS-PWPs) extend beyond programme participants to the wider community in which the assets are created. For these reasons, CS-PWPs have attracted growing attention, particularly in countries frequently affected by droughts, floods and other climate-related shocks. In recent years, climate resilience has been explicitly stated as a programme objective of PWPs in several low- and lower-middle-income countries, including Ethiopia, India and Malawi (Burchi et al., 2025; Costella et al., 2024).

Despite the theoretical appeal of PWPs for building resilience, empirical evidence on their effectiveness in the context of climate shocks remains sparse. Additionally, there is a lack of knowledge regarding the key mechanisms through which these effects materialise. A recent review by Burchi et al. (2025) shows that most studies focus primarily on short-term labour market outcomes or immediate welfare improvements generated through the traditional wage channel, often overlooking the longer-term impacts of the assets created through PWPs such as afforestation, natural regeneration, and land and soil conservation. These durable assets help households and communities withstand the adverse effects of climate change.

Moreover, the evidence is largely concentrated in a few countries, particularly India and Ethiopia, and focuses primarily on a limited set of programmes, most notably India's Mahatma Gandhi National Rural Employment Guarantee Act (Fischer, 2020; Godfrey-Wood & Flower, 2018) and Ethiopia's Productive Safety Net Programme (PSNP) (Bagga et al., 2026). This narrow focus limits the generalisability of the findings across diverse contexts.

Taken together, these gaps constrain policymakers' ability to make informed decisions about when to implement PWPs – especially in comparison with other social protection instruments such as cash transfers – and how best to design them. As governments and donors increasingly incorporate climate adaptation and broader resilience-building objectives into PWPs, there is an urgent need for more comprehensive evidence on whether and how assets created through these programmes improve adaptive livelihoods and enhance resilience to climate shocks.

In this paper, we examine whether and how the Climate-Smart Enhanced Public Works Programme (CS-EPWP) – a programme implemented by the government of Malawi and funded by the World Bank – affects, or could affect, the climate resilience of households and communities through the asset channel. By "climate resilience", we mean a two-pronged concept encompassing the capacity to cope with and adapt to climate-related shocks (Bahadur et al., 2015; Beazley, McCord, & Solórzano, 2016; Bowen et al., 2020). While coping capacity refers to the ability to withstand and recover from such shocks, adaptive capacity refers to adjusting to risks and opportunities, reducing long-term exposure and learning from past shocks to lower future vulnerability. As a complementary objective, we also identify the main factors affecting the quality and sustainability of PWP assets.

The paper employs a mixed-method approach. First, it relies on 10 focus group discussions (FGDs) with PWP beneficiaries as well as other community members. The FGDs were conducted during fieldwork in September 2024 in two southern districts of Malawi highly affected by climate change. Second, it uses information obtained during the same fieldwork from 13 key informant interviews (KIIs) with different stakeholders at the national, district and community levels. Third, we complement the paper with site observations to check the quality of the assets on the ground. Fourth, we integrate quantitative data on the quality of the CS-EPWP assets, drawing on a survey conducted in 2024. By combining these methods, we also aim to generate policy-relevant insights on designing CS-PWPs that effectively address climate shocks and deliver broader societal benefits.

The main findings of the paper are the following. First, overall, CS-EPWP assets are generally of good quality and well-maintained. However, the effectiveness and planting practices of forest-based assets differ across the two districts, largely due to variation in quality checks, durability and maintenance practices.

Second, these assets are already delivering multiple benefits – at both the household and community levels – in mitigating land degradation and strengthening local flood resilience. Land-based assets such as swales, check dams and deep trenches, along with forest-based assets such as tree and vetiver planting, are widely reported to reduce runoff speed and flood intensity, thereby limiting damage to agricultural crops. These measures also enhance soil and water conservation, with participants noting increased infiltration and improved soil moisture retention. The benefits extend beyond direct programme participants.

Third, the mid- to long-term effects of the assets go beyond flood and soil protection, improving conservation knowledge (such as skills development in sustainable land management (SLM) practices) and community cooperation, including behavioural changes that foster climate adaptation. Moreover, most CS-EPWP beneficiaries stated the long-term ecological benefits of afforestation, including improving air quality, restoring ecosystems and enhancing biodiversity. Over time, these gains are expected to improve agricultural productivity and livelihood diversification, with long-term implications for the resilience of households and communities.

Fourth, factors such as the employment of participatory, bottom-up approaches in the different programme phases, training and awareness-creation seem to contribute to the positive impacts, including local ownership of assets. In contrast, delays in wage payments, the limited availability of materials and competing multiple tasks by extension workers were among the identified factors that can undermine the long-term sustainability of the programme.

Our findings contribute to three growing bodies of literature. The first relates to the emerging empirical evidence on the effectiveness of PWPs in fostering the resilience of households and communities through asset creation. A closely related paper to ours is Levine et al. (2024), who find limited or no impact of PWP assets three to five years after completion in northern Ethiopia and Makueni County, Kenya, largely due to design and implementation weakness. Our paper extends this work in three important ways: it examines a more diverse set of assets, including both land-based and forest-based interventions; it draws primarily on qualitative data complemented by quantitative evidence and direct observations of asset quality; and it uses a broader set of outcome indicators to assess climate resilience.

Related to the above, our paper also contributes to the growing literature on the role of asset type and asset quality in shaping the impacts of PWPs. As highlighted in recent reviews (Burchi et al., 2025; Costella et al., 2023), only very few empirical studies explicitly examine resilience outcomes. In this regard, our findings underscore the contribution of CS-PWP assets in enhancing climate resilience and adaptation through the production of high-quality assets among poor and vulnerable communities. This has direct implications for the design and implementation of CS-PWPs to generate stable infrastructure, particularly in rural areas with limited infrastructure providing "double dividend" or dual benefits.

The third contribution of the paper is to our understanding of the role of CS-PWPs for ecosystem restoration and conservation in developing countries hit hard by climate change and loss of biodiversity. As Malawi has experienced devastating climate shocks such as heavy floods in recent decades, which has resulted in loss of ecosystems and biodiversity, CS-PWPs can help tackle some of these shocks, thereby enhancing the conservation of biodiversity loss (Beverdam, Hubacek, Scholtens, & Sijtsma, 2025).

The remainder of the paper is structured as follows. Section 2 provides background information on the CS-EPWP. Section 3 discusses the conceptual framework. Section 4 describes the methods of analysis. Section 5 presents the empirical findings, while Section 6 discusses the underlying factors that determine the sustainability of the programme. Section 7 concludes with key policy implications.

2 The CS-EPWP in Malawi

According to the World Bank, Malawi is the fourth-poorest country in the world (World Bank, 2025), facing complex socio-economic challenges that are further intensified by climate shocks. For example, in 2014, El Niño-induced floods and droughts severely damaged the agricultural sector, which is the backbone of Malawi's economy, pushing nearly 40 per cent of the population into acute food insecurity (World Bank, 2025).

Social protection programmes have been vital in addressing these challenges by providing income support to the most vulnerable communities in normal times as well as during catastrophic events (Otchere & Handa, 2022). Since the 1980s, with support from the World Bank, Malawi has also had a large PWP: However, a comprehensive impact assessment revealed insignificant effects on several outcomes (Beegle, Galasso, & Golberg, 2017).

For this reason and to ensure a better response to persistent climate-related and socio-economic challenges, the Government of Malawi, with substantial support from the World Bank, launched a revised PWP in 2021, referred to as the Climate-Smart Enhanced Public Works Programme (CS-EPWP).[1] The revised programme aims to address immediate short-term income needs through temporary employment, while simultaneously building climate-resilient assets. Unlike the earlier phase of the PWP, which primarily focused on constructing seasonal roads and bridges, the CS-EPWP ensures climate adaptation and environmental sustainability through the creation of two types of assets: land-based assets and forest-based assets. The former include activities such as the construction of contour ridges, gully reclamation, swales, deep trenches, check dams and eyebrow terraces aimed at reducing soil erosion, land degradation, and improved water retention, among others. In turn, this can improve microclimates and increase agricultural productivity in the medium to long term. Activities related to forest-based assets include tree planting along riverbanks to restore degraded forests, prevent siltation and improve biodiversity, afforestation and natural regeneration support, which aim at protecting and nurturing naturally regenerating vegetation to enhance ecosystem recovery.

As such, the new PWP targets poor households living in rural parts of the most climate-vulnerable areas of the country. In line with the Malawi National Social Support Programme – the main vehicle for the operationalisation of the National Social Protection Policy in Malawi – the CS-EPWP targets ultra-poor households with labour capacity. The beneficiaries are selected

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1   The programme is a key component of the broader Social Support for Resilient Livelihoods Project, a project run by the World Bank in Malawi to improve resilience among the poor and vulnerable population, especially by strengthening the nation-wide Social Cash Transfer Programme and the CS-EPWP.

from the Malawi Social Registry, which is the sole source of household information in Malawi to assist in harmonising the targeting for social protection programmes in the country. Its implementation follows a watershed-based planning approach through the development of Village Level Action Plans (VLAPs), which are community-driven, participatory planning tools used to jointly identify and assess local development priorities, map climate vulnerabilities and design appropriate interventions.[2] These VLAPs and activities such as check dams, swales and reforestation efforts are implemented at the micro-catchment level. A micro-catchment is a geographically defined climate-vulnerable hotspot within the district, typically covering areas of less than 250 hectares. On average, each district contains approximately five such micro-catchments.

A distinctive feature of the Malawi CS-EPWP is its participatory design: All residents within a catchment area, regardless of programme enrolment status, are invited to contribute to the formulation of VLAPs. This process involves the establishment of local committees tasked with coordinating, guiding and overseeing the implementation of project activities.

3 Conceptual framework: linking CS-PWP assets to climate resilience

This section examines the theoretical linkages between CS-PWPs and climate resilience. To do so, it builds on current theoretical literature as well as empirical evidence from other countries and similar programmes.

In theory, one would expect that assets created through CS-PWPs may have different effects on households' or communities' resilience, depending on the timespan, quality (durability, effectiveness and resilience of the physical infrastructure created), types of assets created and programme design (Burchi et al., 2025). Generally, we group these effects temporally into short-term (immediate outputs) and mid- to long-term (intermediate and final outcomes). Below, we describe how these different asset types (land and forest-based) could influence climate resilience and summarise them in Figure 1.

Both types of assets can potentially generate five complementary outputs: i) soil conservation, ii) water conservation, iii) ecosystem restoration, iv) biodiversity conservation and v) rehabilitation of degraded land.

Land-based assets such as swales, check dams, eyebrow terraces, gully reclamation and riverbanks implemented across micro-catchments promote sustainable resource use, reduce land and environmental degradation, and improve water conservation, while also easing household budget constraints in the short term through earned wages. This, in turn, can enhance agricultural productivity (contributing to long-term income generation) and strengthen climate resilience in the medium to long term (Costella et al., 2023; Scognamillo & Sitko, 2021; Subbarao, Del Ninno, Andrews, & Rodríguez-Alas, 2012). Among these practices, gully reclamation such as the construction of check dams and stone bunds is a key intervention commonly prioritised in areas affected by land degradation due to soil erosion. It plays a vital environmental role by stabilising gullies, controlling erosion and reducing flood risks. These measures restore degraded land and increase soil moisture, thereby making land suitable again for agricultural production or tree planting, which boosts household agricultural yields, incomes

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2 VLAPs offer an inclusive platform where community members, traditional authorities, government representatives and other stakeholders jointly assess needs and set priorities. VLAPs guide the selection and prioritisation of CS-EPWP activities, supporting community ownership, accountability and long-term sustainability.

and community resources (intermediate outcome). As a result, such interventions build the resilience of households and/or communities to climate shocks by enhancing adaptive capacity and fostering community participation in SLM practices. However, the extent to which these assets contribute to resilience depends significantly on their relevance, quality and long-term functionality.

Forest-based assets – including afforestation, reforestation, regeneration of trees, woodlots and vetiver grass – play a vital role in building long-term resilience to climate shocks by preventing soil erosion and restoring biodiversity and ecosystems in highly degraded areas. Forest cover enhances water regulation and soil moisture retention by increasing infiltration through tree roots and forest litter, thereby reducing surface runoff and downstream flooding in flood-prone areas. This absorbed water is stored in the soil, sustaining plants over time and recharging groundwater, which is also essential for crop production. Evidence from Ethiopia's PSNP supports this hypothesis, as Akuma, Köhlin and Guta (2025) document that the programme has impacted soil and water conservation practices in a positive manner, thereby contributing to the promotion of sustainable land use. Additionally, trees help buffer climate extremes by moderating local temperatures and humidity, creating more favourable conditions for crop and livestock production, thereby supporting livelihoods and food security over the long term. While these assets contribute to long-term transformative capacity by mitigating the effects of climate change (the effects of these assets on resilience are expected to materialise in the medium to long term), they also strengthen adaptive capacity in the medium and long term.[3] This is achieved by helping communities diversify their livelihoods (e.g. trees support agroforestry practices) and adopt SLM practices that enhance their ability to recover quickly from climate shocks such as droughts and floods.

Furthermore, through the combination of the training received as well as the learning-by-doing while engaging in various project-related activities, community awareness of the environment increases, as does the engagement in land and forest management. These efforts may also incentivise behaviours and practices that enable adaptation as well as strengthen local governance and coordination around natural resources. All this can improve environmental sustainability and economic opportunities and, in turn, further enhance people's adaptive capacity and resilience. Specifically, CS-PWPs can strengthen collective action and facilitate knowledge-sharing within communities. By requiring collaborative labour for group activities such as afforestation, soil and water conservation, or small-scale infrastructure, CS-PWPs encourage regular engagement among community members, including with local authorities and stakeholders, building social trust and cooperation, as has also been noticed in PWPs elsewhere (e.g. Zintl & Loewe, 2022). Participation in the programme also promotes a sense of shared responsibility and ownership, as communities contribute labour and skills towards common goals, while training and experience-sharing cultivate a culture of mutual support. Moreover, involvement in CS-PWPs can shift perceptions regarding environmental stewardship and social roles, encouraging inclusive participation and creating a virtuous cycle of cooperation (Sakketa, 2025). These actions are critical for sustaining long-term resilience and the adoption of climate-smart practices. However, there are also concerns that the activities in CS-PWPs are low-skill and short-term, making it difficult to transfer these skills in practice (Gehrke & Hartwig, 2018) and crowding out individual activities (Mersha & van Laerhoven, 2018; Zintl & Loewe, 2022). For example, a study of Ethiopia's PSNP found that the time and labour demands of PWPs limited some households from participating in strategies that could be more "transformational" from a climate change perspective, such as investing in their own farms (Mersha & van Laerhoven, 2018).

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3   Increased forest cover and land restoration practices also contribute to climate change mitigation measures by reducing greenhouse gas emissions (Bhalla, Knowles, Dahlet, & Poudel, 2024; Costella et al., 2023; Hirvonen, Machado, Simons, & Taraz, 2022).

Moreover, CS-PWPs can contribute to improved agricultural production and livelihood diversification by improving the natural resource base on which rural livelihoods depend, and by enhancing households' capacity to manage climate shocks. For instance, land-based assets such as swales, terraces and check dams rehabilitate degraded land, improve soil moisture retention and reduce erosion, thereby increasing agricultural productivity over time. However, productivity gains, especially through an intensification of agricultural production, may also exacerbate exposure to soil erosion and vulnerability to weather-related shocks. As a result, the medium- to long-term implications of these dynamics for overall climate resilience remain unclear.

Furthermore, CS-PWPs provide short-term income through wages and, in the medium to long term, enable income diversification through fruit trees, woodlots and other productive assets. Together, these pathways reduce vulnerability, stabilise food production, raise agricultural productivity, improve incomes and savings, and strengthen households' ability to meet their food needs amid increasing climate risks.

Figure 1: Conceptual framework: linking CS-PWP assets to climate resilience
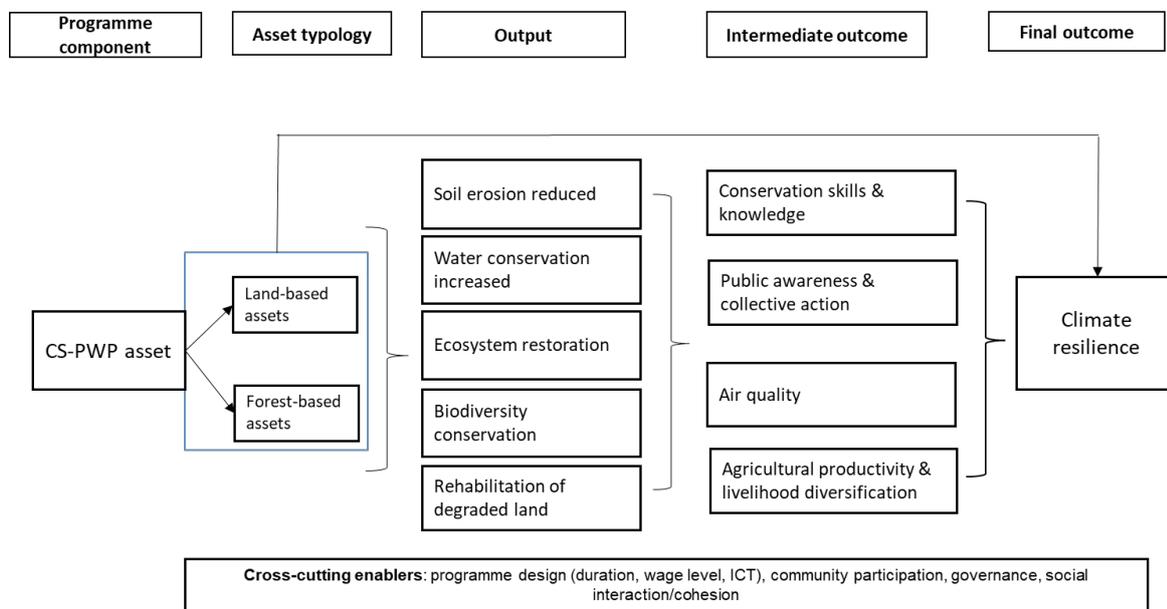
Source: Authors

4   Methodology

The study employs a mixed-methods approach that integrates qualitative and quantitative evidence. The qualitative analysis, which forms the core of the study, draws on FGDs and KIIs with stakeholders at the national, district and community levels. These are complemented by site visits and household survey–based quantitative analysis of asset quality, which serves to validate and contextualise the qualitative findings. The two methods are elaborated further in Sections 4.1 and 4.2.

4.1   Qualitative methods

4.1.1   Fieldwork design (sampling strategy)

In collaboration with Malawian partners, fieldwork was conducted in September 2024 in the capital city, Lilongwe, and in two southern districts of Malawi, selected for their high exposure to climate shocks. The first is Balaka, which is primarily prone to droughts and strong winds, and the second is Chikwawa, which is frequently affected by floods. Both districts are located on the Shire River and depend on agricultural production as the most important source of income.

Within each district – in consultation with social protection experts and extension workers – seven micro-catchments were purposively selected. They encompass 19 communities where CS-PWP interventions had been implemented between one and three years earlier. The choice of micro-catchments and specific communities was aimed at obtaining good representation of the different typologies of assets. As stated earlier, the fieldwork focused on two asset categories, namely land-based and forest-based assets, which were created between one and three years prior to data collection.

Next, FGD participants (including both direct CS-EPWP beneficiaries and non-beneficiaries) were randomly drawn from micro-catchment beneficiary lists. In each of the two districts, we also conducted one specific FGD only with people who were not participating in the CS-EPWP and were identified by district extension workers.

4.1.2   Data collection

The study employed FGDs and KIIs at multiple administrative levels, starting from national stakeholders to communities. FGDs included both direct PWP participants and non-participating community members to capture diverse perspectives on programme benefits, asset quality and long-term sustainability. National-level consultations (NLCs) were conducted with representatives from the World Bank, Poverty Reduction and Social Protection (PRSP), the National Local Government Finance Committee (NLGFC), the Resource Department, the International Labour Organization (ILO) and the African Risk Capacity Secretariat. Interviews with Social Protection Platform desk officers, Catchment Management Committee (CMC) members, extension workers and digitisers were conducted through both FGDs and KIIs. A total of 10 FGDs with 87 participants and 13 KIIs with 25 participants were conducted with stakeholders, including 6 NLCs. This resulted in a total of 23 discussions involving 112 participants. The KII with one participant, coded as CHI_D8, was excluded from the final analysis due to translation difficulties.

Data were collected using semi-structured questionnaires tailored to the participant. These questionnaires guided the FGDs and KIIs and allowed the facilitators to ensure consistency throughout the interviews while also enabling flexibility and adjustments to the participants' expertise.

At the district and community levels, FGDs and KIIs focused on programme implementation processes, perceived and expected impacts of the created assets, stakeholder coordination,

social dynamics, CS-EPWP assets and quality, stakeholder mapping, social interactions and capacity-building efforts, among other items. National-level KIIs explored the broader policy framework, programme design and institutional implementation modalities, including operational challenges. Additionally, questions regarding unforeseen outcomes and challenges were asked.

The FGDs were conducted by the research team in local languages to ensure participants' comfort, while national- and district-level KIIs were conducted in English. In all cases, skilled participatory facilitators led the FGDs and KIIs. All KIIs and FGDs were audio-recorded with prior consent and subsequently transcribed and, where necessary, translated into English.

Table 1 summarises the key stakeholders interviewed and their respective roles, while Table A1 in the Appendix presents an overview of the interviews conducted, their function and the number of participants in each interview.

Table 1: Overview of key stakeholders in CS-EPWP implementation and their roles

Level	Stakeholders	Role
National	Poverty Reduction and Social Protection (PRSP) Unit of the Ministry of Finance and Economic Affairs	Coordination of the overall social protection programmes
	National Local Government Finance Committee (NLGFC)	Implementation support
	International Labour Organization (ILO)	Government implementation oversight
	Land Resources Conservation Department (LRCD) (Ministry of Agriculture)	Technical input for land and water conservation
	World Bank	Donor
District	District Environmental Sub-Committee (DESC)	CS-EPWP coordination and implementation
	CS-EPWP project facilitation and technical oversight	CS-EPWP desk officers
	Extension workers	Training and asset design assistance
	Digitisers	Converting the project log sheet into soft-copy and reporting to district and national level
Community	Catchment Management Committee (CMC)	Oversee asset creation and maintenance at micro-catchment level
	Foremen	Technical guidance/training, supervision, coordination with CMC, attendance and output monitoring, quality control
	CS-EPWP communities	Active labour contribution, community planning and participation, asset creation and maintenance

Source: Authors

During our interviews and FGDs, we took several measures to minimise social desirability bias. In studies of this nature, participants may be inclined to overstate positive behaviours, often due to fear of judgment or repercussions, or to underreport socially undesirable actions, such as noncompliance. We ensured strict confidentiality and the anonymity of participants, safeguarding privacy during interviews by removing any identifiers, employed neutral and non-judgmental questioning and avoided culturally sensitive language throughout the data collection process. Moreover, during the FGDs, in addition to listening to the most common opinion within the group, we also gave enough time and space to listen to individual voices that may be different from the others.

We applied triangulation methods by cross-verifying information through direct field observations (site-level assessments) in all selected communities. These visits were conducted by researchers, extension workers and selected farmers to assess asset quality, functionality and compliance with approved design specifications. The team examined adherence to technical plans, verified material standards and evaluated the operational status of CS-PWP assets. These inspections strengthened the credibility of the findings by validating information gathered from FGDs and KIIs, reducing reliance on self-reported data, and identifying potential discrepancies between reported practices and on-site realities. Engagement with end-users during site visits further provided contextual insights into asset maintenance and perceived impacts. Field notes, photographs and brief analytical reports were systematically integrated into the transcription and coding process, enhancing the rigor and reliability of the analysis.

These two complementary methods reinforced the validity of the findings and deepened our understanding of the functionality, maintenance and impacts of CS-PWP assets.

4.1.3 Ethical considerations

Prior to the meetings, people were informed about the objectives and purpose of the study. They were provided with oral consent forms to indicate acceptance for voluntary participation, audio recording and the use of anonymised quotes (see Box A1 in the Appendix for the detailed contents of the consent form). In line with the IDOS data management plan and ethical clearance, audio recordings and transcriptions were stored on password-protected devices accessible only to the research team.

4.1.4 Data analysis

All interviews were prepared and organised for analysis. To ensure anonymity, each interview was assigned a unique identification code; for instance, BAL_D1 indicates that the interview was conducted in Balaka, with the number indicating the specific interview. CHI_Dx indicates interviews conducted in Chikwawa district, while NLCs are marked with the prefix NLC_. Individual participants within FGDs are identified by participant number (P1, P2, P3) within each interview when presenting direct quotations. A detailed overview of the interview codes, participant roles, group compositions and location details is provided in Table A1 in the Appendix.

Qualitative data were managed and analysed using the software MAXQDA. To address the stated objectives, we use thematic analysis, which is a common way to identify patterns and combines deductive and inductive coding approaches (Braun & Clarke, 2006). Initial codes were developed deductively from the paper's conceptual framework and research questions, establishing broad categories. This preliminary codebook was then systematically tested and refined through inductive open coding of the initial transcripts. Two researchers independently coded the same subset of transcripts to establish consistency in code application and inter-pretation. Regular meetings facilitated discussion of interpretations and decisions. Once agreement was established by the coders, the remaining transcripts were coded systematically. Throughout the coding process, researchers maintained analytic memos in MAXQDA to

document interpretation decisions, emerging patterns and theoretical connections. Codes were iteratively refined, merged or subdivided as analysis progressed.

The final coding system (Table 2) comprises four primary themes aligned with the research objectives: programme structure and governance; asset development and management; PWP operations; and programme impacts.

Table 2: Coding topics to analyse resilience impacts of CS-EPWP

Categories/domain	Sub-categories/category	Codes
Programme structure and governance	Stakeholder involvement	Committees, extension workers, government entities, community members
	Decision-making processes	Committee selection, community participation, inclusion
	Administrative functions	Supervision, training, reporting, grievances
Asset development and management	Asset description	Type, choice, utility, durability
	Implementation	Planning, quality control, maintenance, community ownership
	Challenges	Equipment, training
PWP	Participation and targeting	Beneficiary selection and verification, payment systems
	Work organisation	Work units, wages, delivery mechanisms
	Challenges	Wages, health care, data-entry errors
Programme impact	Environmental outcomes	Ecosystem resilience, ecosystem conservation, ecosystem restoration, soil management, climate adaptation

Source: Authors

4.2 Quantitative methods

The quantitative data came from the asset quality survey conducted to assess community assets created during the CS-EPWP pilot programme (2022-2024). The data were collected by the Lilongwe University of Agriculture and Natural Resources (LUANAR) on request of the Ministry of Local Government. The data collection followed a multi-stage sampling procedure. First, one micro-catchment area was randomly selected from each of the traditional authorities in the eight districts where the pilot was established. Second, three community assets were selected per micro-catchment area: two land-based assets and one forest-based asset. In total, 53 community assets – 34 land-based and 19 forest-based – were surveyed for quality assessment. Approximately 81 per cent of them were created between 2022 and 2024. Third, representatives of the asset committee for each asset type were selected. These representatives usually comprised the chairperson, secretary and a few members of the CMC. In total, three to five people per asset participated in the survey as a group.

Carefully designed quality assessment tools covering multiple dimensions were used, including the extent to which asset creation adhered to established protocols and guidelines; the acceptability of the intervention; the effectiveness of the assets in addressing critical needs of communities; the completeness, functionality and quality of the assets; the benefits generated by the assets; and external factors affecting programme delivery. To quantify responses, the evaluation team used a combination of direct measurements, physical observations, Likert

scales, binary indicators and other appropriate methods, depending on the nature of the questions. Since the questionnaire was administered to the group, the responses reflect a group consensus. In cases where group members had different opinions on a question, they were first given the opportunity to discuss and reach an agreement. Only the agreed-upon responses were recorded by the team.

For data analysis, we used descriptive statistics, which were analysed using STATA 17 software. Together, this multi-method design enabled multi-level analysis of programme implementation dynamics, asset sustainability trajectories, and the contextual and institutional determinants of outcomes in climate-vulnerable settings. Although the research team sought to mitigate social desirability biases through this method, this possibility should be kept in mind when interpreting the findings.

5   Results

This section examines the effects of CS-EPWP assets on the resilience of households and communities. It first assesses the overall quality and functionality of the assets (Section 5.1), then presents the findings, organised by asset type: land-based assets (Section 5.2.1) with immediate protective and productive effects, and forest-based assets (Section 5.2.2) with medium-term and longer-term expected benefits. We then present cross-cutting benefits that are derived from both assets (Section 5.2.3).

5.1   CS-EPWP asset quality assessment

Asset quality and functionality are critical in determining whether CS-EPWP assets strengthen resilience to climate shocks. For this reason, participants were first asked to evaluate asset quality and utility, including functionality, material quality and adherence to technical guidelines outlined in the CS-EPWP implementation manual. Participants then commented on visible wear and tear and overall asset quality, considering both manual standards and watershed management principles. Additionally, discussions covered implementation issues such as asset selection, maintenance practices and completeness of the asset.

CS-EPWP assets were constructed on both private and communal land, depending on asset type and watershed placement. Land-based assets such as swales, deep trenches and eyebrow terraces were constructed on private land. Others such as check dams and forest-based assets were typically established on communal land (CHI_D14), although in some cases households also planted trees on their own plots (P3, BAL_D2).

The functionality of CS-EPWP assets was confirmed through FGDs, KIIs and field observations, including for assets constructed in 2021-2022. Participants in the FGDs at the community level generally acknowledged the functionality of CS-EPWP assets. As one extension worker in Balaka stated: "Yes, most of them [assets] are still functioning like those constructed in 2021 and 2022" (P1, BAL_D7). KIIs conducted with national and local stakeholders confirmed that many assets remained functional as originally constructed – findings that were corroborated by field visits (BAL_D7). Nevertheless, a participant from Balaka noted that there were significant losses, with 40,000 trees dying due to dry spells and animal damage (P3, BAL_D2). Similarly, national stakeholders reported that durability was lost due to a lack of supervision (NLC_D20), and that the competing tasks of the experts make monitoring difficult (NLC_D19).

These qualitative findings align with the quantitative survey evidence conducted in 2024 across eight districts of Malawi, including Balaka and Chikwawa. The survey results indicate that about 77 per cent of the respondents rated the overall quality of these assets as either

"very high" or "somewhat high". Respondents who reported lower quality of the assets largely attributed this to maintenance challenges or deterioration over time, rather than poor initial construction. Only 2 per cent of the evaluated assets were described as "not functional at all" at the time of the survey, while about 43 per cent of the respondents reported some degree of damage or depletion.

We noticed, however, a considerable variation in the quality of the assets across different areas and specific types of assets. For instance, Balaka, a district mainly prone to droughts and strong winds, had more extensive forestry efforts than Chikwawa, given that "[...] from the pilot phase, more than 70,000 trees were planted" (P3, BAL_D2). However, the survival rate of seedlings was reported to be low, largely due to dry spells, insufficient post-planting care and external factors such as grazing livestock (BAL_D2). In contrast, Chikwawa recorded higher seedling survival rates, albeit at a smaller scale. These outcomes were attributed to effective nursery practices, proper planting techniques, and more specialised roles and quality assurance mechanisms during implementation as well as active guarding of planted areas (CHI_D15). Respondents from Chikwawa reported that they would expect eight to ten out of ten seedlings to survive (P3, P7, CHI_D14). Overall, this suggests that both the durability and the maintenance of assets vary by district.

Key informants stressed that Chikwawa's emphasis on quality control, including clearly defined roles for forestry tasks and routine monitoring, was critical to the success and sustainability of its assets (Px, CHI_D8). Beneficiaries in Chikwawa also reported greater community involvement in asset management, which helped preserve their functionality and relevance. For instance, forestry group FGD participants in Chikwawa stated, "We have people guarding the areas where we have planted trees" (P5, CHI_D15). In Balaka, limited follow-up and weak enforcement of grazing restrictions were cited as key challenges affecting asset durability, particularly in areas vulnerable to livestock encroachment (P12, BAL_D6).

These findings highlight the importance of both technical quality and institutional arrangements in determining the durability and long-term value and sustainability of CS-EPWP assets. Although initial construction quality was broadly adequate across both districts, maintenance practices, community engagement and localised adaptation proved to be decisive in sustaining benefits over time. These institutional factors are examined further in Section 6.

5.2   Effects of CS-EPWP assets

In the next sub-sections, we examine the direct effects of CS-EPWP assets on the resilience of communities and households to climate-related shocks, beginning with land-based and then forest-based assets. Land-based assets have already generated observable benefits, reflecting their short-term impacts, whereas forest-based assets typically require longer time horizons before their effects materialise. Put differently, land-based assets have substantially enhanced communities' capacity to protect infrastructure and livelihoods from climate shocks. Figure A1 illustrates the types of assets created and their respective functions.

5.2.1   Land-based assets

The creation of land-based assets appears to have significantly enhanced the resilience of households and communities. Land-based assets created through the CS-EPWP include swales, deep trenches, check dams, vetiver grass planting and contour ridges. We explore the specific benefits of the assets below.

Prevention of soil erosion and rehabilitation of degraded land

Across both districts, participants identified the reduction of flood risk as a core benefit of land-based assets, particularly swales, check dams, deep trenches and vetiver grass (BAL_D5, BAL_D7). These assets act as a layered defence mechanism against floods (threat, speed and intensity of floods). For instance, swales and ridges in the upland areas slow and capture initial runoff; check dams in mid-catchment areas reduce flow velocity and trap sediment; and stream channel changes near settlements prevent floodwaters from reaching homes and fields. One participant from Chikwawa articulated:

> As my colleagues have mentioned, we dig swales and plant trees on our farms. We also block the smaller streams that flow into the rivers to prevent our crops from getting washed away. We start by digging the swales in the upland areas, then plant trees as well as block the smaller streams. As such the flooding and washing away of our crops is reduced since when the flooding occurs the runoff is first stopped by the Swales, then by the trees, and finally by the blocked smaller streams. (P4, CHI_D16)

This protective effect was reported repeatedly during five other FGDs and KIIs in Balaka and Chikwawa (BAL_D4, BAL_D5, BAL_D6, CHI_D11, CHI_D15, CHI_D17).

Similarly, in Balaka, where seasonal flooding used to cause structural damage to homes, beneficiaries reported that swales and deep trenches now act as barriers, preventing the floodwaters from reaching residential areas. Participants from Balaka reported that the floods used to enter the houses (BAL_D4), sometimes even leading to the collapse of their own houses (BAL_D6). The new assets act as barriers and floods no longer enter the houses. Participants from Chikwawa also reported on the occurrence of floods, which led to crops being washed away. Some assets, such as the planting of vetiver grass, can prevent the crops from being flushed away (CHI_D16). Another participant from the CMC in Chikwawa explained it this way:

> Through the committee, we can lead our areas towards progress. For instance, through climate-smart practices, we have addressed runoff water, which used to be a problem. We managed to redirect the water, protecting our area from erosion. The committee ensures the safety of our community. (P9, CHI_D10)

Moreover, participants noted that the programme has enabled the rehabilitation of unproductive or degraded land and effectively protected land from further destruction and degradation (BAL_D2, CHI_D15). Thanks to CS-PWP assets such as swales and deep trenches, and improved skills, beneficiaries have been able to minimise shocks to extreme events such as heavy winds and droughts, making once-barren fields cultivable again.

These findings underscore the potential of CS-PWP assets to mitigate climate-related hazards in vulnerable rural settings – particularly during extreme events such as heavy rainfall – by reducing damage to infrastructure and crops, preventing soil erosion and improving land conservation outcomes.

Improved soil moisture and water harvesting

Another important benefit of land-based assets has been their contribution to improvement in soil moisture and water harvesting, both of which are critical for enhancing agricultural productivity. Swales and deep trenches were most frequently credited with reducing soil erosion, improving land conservation outcomes and enhancing soil moisture relative to pre-intervention conditions (BAL_D2, BAL_D4, BAL_D6, BAL_D7, CHI_D10). Participants from BAL_D2 and BAL_D4 reported that these assets improved water harvesting, enhanced soil moisture retention and soil fertility, and provided tangible benefits for food production. By slowing surface runoff, the assets allowed increased infiltration, extending soil water availability during dry spells (BAL_D6, BAL_D7). Participants consistently noted that farms with swales retained soil

moisture for up to five days longer during periods of no rainfall than farms without them (CHI_D14). As one Chikwawa respondent explained: "Construction of check dams to reduce runoff as well as digging swales in our fields to help with this" (P6, CHI_D16). Field observations and quantitative survey data corroborate these findings. As shown in Figure 2, nearly all respondents (96 per cent) identified reduced soil erosion as the primary expected benefit for the community, followed by improved groundwater and soil moisture retention (45 per cent). This moisture retention translates into tangible agricultural benefits, as discussed below.

Such observations align with previous studies that demonstrate the co-benefits of land-based climate adaptation assets for both hazard mitigation and agricultural productivity (Béné Frankenberger, & Nelson, 2015; Burchi et al., 2025; Costella & McCord, 2023; Gazeaud & Stéphane, 2020). These results are also consistent with the broader literature on ecosystem-based disaster risk reduction, which highlights the importance of water retention structures in limiting flood impacts and preserving productive land (IPCC, 2022; Thakur, 2018).

Nevertheless, there are also slightly different perspectives on the effectiveness of the assets created. For instance, one participant in a national-level KII noted that

> despite the droughts, there is still a slight difference between the farms that have swales and the ones that do not. This is because when the rains come, farms with swales retain moisture for much longer, for example, a week longer than farms without. However, the difference is only minimal. (P4, CHI_D16)

Improved agricultural productivity and livelihood diversification

The improvements in land conservation outcomes, soil moisture retention and water harvesting documented above translated into tangible gains in agricultural productivity, and consequently, economic benefits for the communities. To assess these linkages, participants were explicitly asked whether improved land-based assets had translated and/or will translate into outcomes such as higher crops yields or related benefits that could potentially enhance the food security and resilience of households. Their responses and perspectives are summarised below.

Participants reported increases in agricultural productivity resulting from reduced soil erosion and minimised losses during floods. For instance, swales and other soil conservation techniques have significantly improved crop yields, especially under low rainfall conditions (BAL_D2, BAL_D3, BAL_D6, BAL_D7). Deep trenches have also been reported to improve vegetative growth (BAL_D4). A participant from Balaka emphasised the benefits of swales by comparing different farms:

> Just to add to this, we have had rain this year. We have seen the importance of swales. We could compare farms that had swales and farms that did not; the harvest was different. Those that had swales harvested more than those that did not. (P11, BAL_D6)

Maize farmers in Nanjiri (Balaka) made similar statements (BAL_D6, BAL_D7).

National stakeholders reinforced this linkage between environmental improvements and livelihood outcomes (NLC_18, NLC_D21). For instance, during our national stakeholder consultations, a participant from the National Local Government Finance Committee explained:

> If they (farmers) improve their soil and water, they can produce more food and thereby enhance their income as well as food security. This is just because we have taken steps to also reduce poverty while also adding structures to the environment, improve food production and further alleviating poverty. (P#, NLC_D20)

A complementary practice alongside land-based assets that helps farmers achieve more favourable harvests and enhance food security is the increased adoption of improved crop

varieties. Participants reported that, in anticipation of droughts, community members deliberately select drought-tolerant crops such as sweet potatoes, finger millet and millet to minimise the adverse effects of dry spells. The use of these drought-resistant varieties was associated with more stable harvests and improved food production, even under challenging weather conditions (CHI_D16). As participants in Balaka noted, combining soil and water conservation measures implemented through the CS-EPWP with drought-tolerant crops improved agricultural productivity and strengthened the food security of households. Consistent with these findings, evidence from Malawi's Social Action Fund (MASAF) suggests that the climate-smart agriculture agenda can be further strengthened by explicitly integrating current social protection interventions (e.g. land-based assets) with the promotion of climate-smart agriculture practices (Scognamillo & Sitko, 2021).

The core direct benefits of the land-based assets – such as reduced soil erosion, improved ground water and soil fertility – are clearly in line with initial expectations highlighted in the asset quality survey (Figure 2). In contrast, our analysis indicates that improvements in terms of income and food security are probably higher that those originally expected, given that only a small share of respondents indicated expected improvements in these two outcomes (8 per cent and 4 per cent, respectively).[4] These results highlight the programme's potential to strengthen livelihoods through both direct and indirect pathways.

Figure 2: Reported benefits of CS-EPWP assets
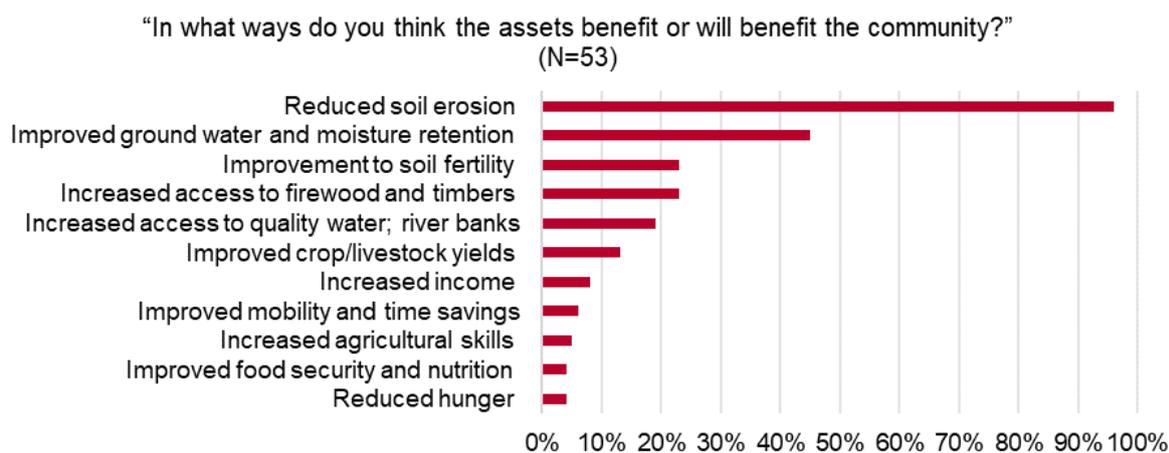
Source: Authors, based on the asset quality assessment survey

Given that land-based asset creation targets rural areas characterised by severe land degradation and high poverty, these interventions are expected to improve agricultural productivity, food security and incomes. Integrating climate-smart practices such as land-based assets into well-designed PWP interventions can thus generate multiple benefits, including enhanced environmental sustainability, reduced disaster risks and strengthened rural livelihoods.

5.2.2   Forest-based assets

As discussed earlier, forest-based assets require longer timeframes than land-based assets for benefits to materialise. Common assets in the study areas include trees such as apple-ring acacia, gliricidia, acacia, cassia, African mahogany, white acacia, albizia lebbeck and nimu (BAL_D2, CHI_D11, CHI_D14). Participants of FGDs and KIIs from forestry groups in both

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4   One reason for this could be that survey respondents tended to focus more on the possible immediate outcomes and less on second-order outcomes (e.g. food security).

districts, and to some extent non-beneficiaries, noted that trees planted in 2021 remained too small by 2024 to provide substantial benefits (BAL_D2). As one participant from a forestry group in Balaka stated: "As it stands since 2021, we have not yet started benefiting because the trees are still small, but when it comes to land resources, we have started benefiting" (P6, BAL_D2). Nevertheless, forest-based assets have produced multiple environmental benefits, with more long-term benefits expected as vegetation matures. These include strong wind protection, air quality improvement, ecosystem and biodiversity restoration, and livelihood diversification opportunities – all of which are discussed briefly below, with the focus on medium- to long-term expected benefits. Further illustration of the different types of assets and their respective functions is provided in Figure A1.

Protection from strong wind, floods and improvement in air quality

Afforestation activities introduced through the CS-PWP have produced and will produce multiple environmental benefits. The increased number of trees is reported to act as a natural barrier against strong winds (BAL_D2), protecting crops, soil and infrastructure from storm-related damage. Participants also reported that afforestation, specifically increased vegetation cover, is not only expected to block strong winds – identified as a major challenge for both agriculture and a threat to human health in the study areas – but also improve air quality and local rainfall patterns (BAL_D5, CHI_D14). These interventions have thus become an integral part of the CS-PWP solutions for climate adaptation, offering both immediate protection and long-term ecological improvements. Survey respondents in the asset quality assessment similarly reported these anticipated benefits.

Additionally, afforestation contributes to flood control through the vegetative stabilisation of slopes and riverbanks. Tree roots stabilise soils and slow water flows, thereby reducing downstream flood risks. Participants in the FGD explicitly noted the benefits of tree planting in mitigating flood intensity. As one participant stated: "In terms of floods, the intensity has decreased. It is better now since the beginning of this project" (P3). Another participant added: "Compared to the past five years, it is now better since we have planted trees along the riverbanks" (P4). These accounts demonstrate how forest-based assets complement land-based flood infrastructure by contributing to longer-term watershed management improvements.

Restoring ecosystems and biodiversity

Beyond immediate protective gains, forest-based assets contribute to restoring ecosystems and biodiversity across micro-catchments. As one participant from Chikwawa described, "the planting of trees has helped [them to] bring back nature" (P5, CHI_D9). Another added:

> Just to add to what was said earlier, we encourage each other to plant trees as we now have nurseries to restore the trees that were cut down and plant new ones to try to restore things to how they used to be before. (P8, CHI_D16)

Community members also expressed hope that wildlife would gradually return to the rehabilitated areas with expanded tree cover and that degraded land would be restored (BAL_D5, CHI_D13, CHI_D15, CHI_D16). Some participants have already observed positive impacts from the natural forest regeneration, particularly vegetation growing along rivers, such as bamboo (P2, P4, CHI_D9).

A common challenge reported by participants was the difficulty of obtaining firewood and charcoal, which had previously driven households to cut trees from surrounding forests. However, the establishment of woodlots and broader tree-planting under the CS-PWP helped reduce pressure on natural forests by providing alternative sources of fuelwood as well as increasing awareness of the consequences. As one participant explained,

> Now they are able to attest to the fact that this is contributing to at least increasing levels of food production. Even now, women are no longer travelling long distances to fetch water. We have not yet reached the same level with the fuelwood because we have not reached that level, we can say that we have so many forests that people rely on fuel. (P#, NLC_D20)

Contrary to this, some participants indicated that they still rely on charcoal burning as a livelihood strategy due to the low CS-PWP wage income (BAL_D1).

Furthermore, conserving forests can enhance communities' resilience to climate shocks. The proper management of regenerating forests preserves ecological functions, which participants particularly valued during droughts (BAL_D2). Communities in both districts also reported increased awareness of environmental conservation (BAL_D5), prompting the protection of newly planted trees and the establishment of local bylaws penalising the unauthorised cutting down of trees (BAL_D2). Afforestation and tree-regeneration efforts in degraded areas not only improve biodiversity and ecosystem health but are also expected to enhance long-term carbon sequestration (Hirvonen, Machado, Simons, & Taraz, 2022).

Improved livelihood diversification

Forest-based assets create livelihood diversification opportunities that enhance the resilience of households to climate shocks. Additional income from beekeeping (honey production) (BAL_D5), fruit trees and vegetables produced through the CS-PWP programme can significantly enhance the food security of households over the medium to long term. Households that planted fruit trees can sell the produce (BAL_D5, CHI_D10), while woodlots provide opportunities for timber sales (BAL_D2), and surplus trees from nurseries can also be sold (CHI_D17). Moreover, vetiver grass and tree plantings help reduce crop losses from flooding, supporting a more stable food supply (CHI_D13, CHI_D15). Together, these benefits strengthen households' capacity to adapt to climate-related risks.

Many participants also anticipated that the benefits of these assets extend beyond direct beneficiaries to the wider community. For example, tree nurseries enabled beneficiaries to sell seedlings to non-beneficiaries or organisations, thereby generating more income (BAL_D5). Similarly, improved environmental assets such as rehabilitated riverbanks, roads and vegetative cover strengthen long-term climate resilience for the entire community (BAL_D2, BAL_D5, CHI_D11, CHI_D15) by promoting peer learning and spillover adoption of sustainable agricultural practices within communities.

5.2.3   Cross-cutting (benefits)

Improved knowledge and practices in agriculture

Beyond the benefits discussed above, the CS-EPWP has generated substantial gains in agricultural knowledge and skills while fostering broader social and behavioural changes through training sessions, collective action, peer learning and spillovers. These gains represent long-term benefits that strengthen both individual and collective resilience.

Forest-based asset-creation activities involved training that equips communities with technical skills in nursery management, tree planting and regeneration, soil and water conservation techniques, and gully management (BAL_D3, BAL_D4, CHI_D17). Training also covers crop and tree selection (suited to soil and climatic conditions), appropriate farming practices, soil preparation, techniques for tree pruning and the use of vetiver grass (BAL_D2, BAL_D4, CHI_D11, CHI_D14). Trainings also enhanced the capacity of communities to manage land-based assets and adopt sustainable agricultural practices. Before asset creation begins, extension workers initially train CMC members and foremen, who then train, supervise and

guide beneficiaries during asset construction (CHI_D9, CHI_D11, CHI_D17). Delivered through both classroom theoretical instruction and field-based demonstrations, the training emphasises adherence to technical and quality standards from the implementation manual as well as appropriate site selection for asset construction (BAL_D3, BAL_D7, CHI_D9). For instance, participants learnt construction techniques for swales, box ridges, dams, contour ridges and how to manage gullies (BAL_D3, BAL_D4, CHI_D17). Training typically lasts three to six days, though some participants expressed a need for longer or refresher sessions (BAL_D3, BAL_D4, CHI_D9, CHI_D14). A participant from Balaka stated: "We so much appreciate the training, and we would like to be getting the training frequently so that we refresh the knowledge we have" (P1_BAL_D7).

Beyond formal training, participants in both districts highlighted knowledge exchange and the transfer of best practices – often extending to non-beneficiaries or neighbouring communities – as a key contribution of the programme, particularly in the selection of drought-tolerant crops and tree species (BAL_D1, BAL_D7, CHI_D12). As one participant from Balaka explained,

> When droughts occur or when we are anticipating droughts, we take into consideration the type of crops we are going to cultivate. If we are expecting poor rains, we cultivate drought-tolerant crops such as sweet potatoes, finger millet and Mappillai millet. This helps to reduce the impacts of the droughts. (P8, CHI_D16)

Careful selection of drought-tolerant crops led to improved harvests, helping communities maintain production under dry conditions (CHI_D16). National stakeholders and district desk officers also emphasised knowledge transfer and spillover effects as key mechanisms for sustaining the programme and enhancing resilience.

Many participants described the technical knowledge and acquired skills as long-lasting and reported increased confidence in acting independently after the programme ends, in addition to improving their understanding of SLM practices. As one FGD participant in Balaka explained,

> We do not usually wait for others to do the work; instead, we leverage our skills and knowledge to address the problems in our respective areas. Not all farms can implement smart solutions, we encourage one another to take care of our responsibilities ourselves. (P2, BAL_D6)

Another participant emphasised: "That's why they teach us about sustainability. This is because they want us to continue these projects even when they phase out" (P7, BAL_D6). Consequently, this knowledge not only enhances immediate food security but also strengthens long-term adaptive capacity, enabling communities to make more informed agricultural decisions. In fact, this accumulation of knowledge capital enhances the likelihood of continued use, maintenance and replication of created assets, thereby enhancing sustainability impacts. However, comprehensive evaluations of the investments into the CS-PWPs and their contribution to skills development remain scarce, with evidence of this being largely anecdotal (Gehrke & Hartwig, 2018).

6   Discussing the sustainability of the programme

Earlier, we showed that Malawi's CS-EPWP – particularly land-based assets – provided multiple benefits for households and communities, while forest-based interventions are expected to generate long-term gains. However, long-term effectiveness depends on the presence or constancy of certain factors and is constrained by persistent operational shortcomings. This section critically examines the key enablers and constraints affecting programme effectiveness and sustainability, drawing on respondents' assessments, field observations and relevant literature.

6.1   Key drivers of sustainability of the programme (enablers)

Below, we discuss five key factors enabling sustainable impacts.

Frequent exposure to extreme climate shocks: A central factor influencing the adoption of CS-PWP practices is frequent exposure to extreme weather events such as droughts, heavy winds and floods (CHI_D10, CHI_D17)**.** Households directly affected by such shocks perceive a tangible need for climate adaptation interventions. This heightened risk awareness makes governments, donors and community members more receptive to conservation practices such as swales/ deep trenches, check dams and afforestation. Similar findings have been reported in Ethiopia, where repeated environmental stressors increased participation in CS-PWPs (Shigute, 2022). In Malawi, the perceived benefits of these interventions were clear drivers in the adoption of CS-EPWP practices, despite initial resistance. A CMC member in Balaka reported that, due to increasing environmental destruction and global warming impacts, the community reached out to the Environmental Affairs Department in Lilongwe to discuss solutions and subsequently received assistance in SLM practices (BAL_D4).

Participatory approaches and collective ownership: Malawi's CS-EPWP adopts a participatory approach called Village Level Action Plans, which follow a watershed logic and engage communities directly: from project planning to implementation at the micro-catchment level. Importantly, all catchment residents – both beneficiaries and non-beneficiaries – are invited to participate in developing VLAPs through local committees that coordinate project implementation. This inclusive decision-making process fosters a sense of ownership (private and/or collective) of created assets and strengthens the commitment to their maintenance, even in the absence of financial incentives. Evidence from Ethiopia also suggests that participatory approaches can shift community attitudes towards the sustained use and maintenance of PWP assets (Shigute, 2022). More broadly, a recent review finds that public participation – particularly involvement in local climate planning – impacts both adaptation and mitigation outcomes in a positive manner, with stronger effects observed for adaptation (Burchi & Sakketa, 2025; Cattino & Reckien, 2021).

Public awareness about sustainability: Another key enabling factor is enhanced public awareness and the change of mindsets about sustainability, which may also extend to younger generations. Interaction among community members – coupled with the visible benefits of the assets – raised awareness, shifted mindsets, created enthusiasm and encouraged the adoption of land- and forest-based assets, including among non-beneficiaries. These dynamics also strengthened community ownership, with spillover effects being particularly pronounced for land-based assets such as swales, check dams and deep trenches (BAL_D1, BAL_D2, BAL_D6, BAL_D7, CHI_D14, CHI_D15).

The demonstrative effects of successful interventions, such as visible improvements in soil and water conservation and forest regeneration, helped convince initially sceptical farmers and non-beneficiaries alike, as they came to appreciate environmental rehabilitation as a pathway to reducing land degradation and strengthening resilience. As one participant from Balaka stated: "At times, some tend to be our neighbours and we usually explain to them the importance of deep trenches and swales that we usually make. Upon seeing the benefits, they tend to agree with us" (P6, BAL_D6). Another participant from Chikwawa (forestry group) noted that initial resistance gave way to broader acceptance after communities observed tangible outcomes: "At first, some farmers were resistant, but after witnessing our work with check dams and afforestation, they are now interested to participating in the project. We have managed to reduce soil erosion […]" (P5, CHI_D15).

These changes in perception extend beyond the community level and are also being observed at the district management and national levels. For instance, a representative from the government finance committee in Lilongwe explained:

> Yes, from what we learned from the pilot that we conducted in Machinga, people can continue this work even without receiving money. We are confident that if the financial incentives were removed across all district councils, communities still carry on with these activities. (P#, NLC_D20)

However, it is important to note that such changes in perceptions were not uniformly observed across all asset types (BAL_D4).

Local governance and enforcement through bylaws: Another key factor, which is related to public awareness, is the role of local governance and enforcement through bylaws. Community bylaws that penalise destructive behaviours were reported as an important factor in sustaining project gains. One such bylaw imposes a monetary fine for cutting down trees and requires the planting of three new trees for every tree that is cut down (P3, P6, BAL_D2). Over time, enforcement of these rules has shifted perceptions, creating social norms that discourage environmentally harmful practices. In addition, participants emphasised that local leaders, such as chiefs, play a critical role in convincing communities and promoting the usefulness of the assets, as these may have symbolic importance (BAL_D4, NLC_D21) or enhance workers' motivation (BAL_D5, CHI_D15). This demonstrates the role of local governance structures and informal institutions in mediating the long-term impacts of PWP investments.

Stakeholder coordination and division of labour: A clear division of roles among stakeholders – from local government and extension workers to catchment committees – facilitates the coordinated implementation and monitoring of assets created. The involvement of local leaders is also key, as it helps encourage community members to contribute labour and other resources voluntarily (BAL_D4).

This multi-actor engagement helps distribute responsibilities for maintenance and conflict resolution, thereby strengthening sustainability prospects.

6.2 Key implementation challenges limiting sustainability (barriers)

Despite these enabling factors, several challenges undermine the programme's ability to deliver sustainable impacts. Three key constraints are discussed below.

Payment delays and inadequacy: Repeated long delays in wage payments were reported by both community members and other stakeholders (BAL_D2, BAL_D4, CHI_D9, CHI_D17). Such delays not only reduce the motivation of participating households but also erode trust in the programme, potentially affecting future participation and the willingness to contribute unpaid labour for asset maintenance. For instance, participants in Balaka reported that the lack of timely communication about payment delays created distrust and rumours among participants (BAL_D4). In a context where PWPs are valued primarily for their safety-net function, consistent and timely payment remains crucial.

Additionally, beneficiaries reported that wages were insufficient to meet daily needs (BAL_D6, CHI_D9, NLC_D18) and did not increase during floods or with rising costs of living (BAL_D2, BAL_D4, CHI_D10). Some participants also reported not receiving full wages despite perfect attendance (CHI_D12), while others expressed confusion about payment schedules and methods. As one Chikwawa participant explained: "They were only assured that the issue would be sorted out and so we continued to work. But now, we are even in the third cycle, and we are over 100 people that still have not received our payments" (P5, CHI_D9). These delays were attributed to errors in documentation, attendance verification and incorrectly recorded numbers (BAL_D1), gaps in the system (BAL_D4) and problems with the central registry (CHI_D12).

Despite these challenges, many participants indicated that the environmental benefits of the programme outweigh the labour costs, even if payments were to stop (CHI_D15), and they continue to participate due to these positive outcomes. However, the pressing needs of households lead participants to prioritise paid over unpaid work (CHI_D16), as immediate needs often take precedence over long-term benefits. One participant from Chikwawa added the importance of clarifying in advance which tasks are paid and which are voluntary (P5, BAL_D4).

Inadequate provision of materials: Another constraint is the limited supply of essential tools and safety equipment needed for asset construction**.** In many cases, participants were forced to use their own implements to carry out technically demanding conservation tasks, often at the expense of their safety (BAL_D3, BAL_D5, CHI_D14). This shortage of essential equipment not only exposes participants to health and safety risks but also compromises the quality and durability of assets, thereby undermining their long-term environmental benefits.

Limited monitoring capacity and follow-up support due to multiple assignments and competing tasks: Extension workers and other technical staff often face multiple competing assignments, which limit their ability to conduct regular monitoring and provide ongoing technical support (NLC_D19, NLC_D20). As a result, asset maintenance may be inconsistent, and the community's capacity to manage interventions can weaken over time. This gap highlights the importance of adequate institutional capacity and resource allocation for sustaining project outcomes. Without sufficient staffing and clear prioritisation of CS-PWP monitoring responsibilities, even well-designed and initially well-constructed assets risk deterioration.

7   Conclusion and policy implications

This paper provides new evidence on the role of PWPs in strengthening the resilience of communities and households to climate shocks, addressing a key research gap related to the asset-creation channel. Our findings from Malawi's recently implemented CS-EPWP show that well-designed interventions can support the creation of high-quality assets and their sustained maintenance over time, enhancing people's capacity to cope with and adapt to climate shocks. In particular, land-based assets – such as swales, deep trenches, check dams, eyebrow terraces and vetiver grass – provided multiple benefits, including protection from floods, improved soil moisture retention and water harvesting, as well as improved agricultural productivity and livelihoods, at both the household and community levels, and the benefits extended beyond direct programme participants. Forest-based interventions such as natural tree regeneration, tree planting and woodlots are expected to generate long-term benefits that include wind protection, improved air quality, ecosystems and biodiversity restoration, and enhanced livelihood diversification.

The sustainability of these impacts hinges on programme design features that encourage community ownership and collective action. As such, participatory planning and implementation approaches are vital for increasing community engagement. Additionally, providing training for and raising awareness of key actors – including the appropriate selection of types of assets to be created, such as choosing appropriate seedlings and crops – can improve technical know-how and encourage continued asset maintenance beyond programme cycles. Furthermore, the enforcement of local bylaws and the demonstrating of visible benefits also play a pivotal role in fostering resilience by enhancing the long-term benefits of CS-EPWP assets. For this, the role of CMCs, which oversee asset-creation and maintenance at the micro-catchment level, and the local development committee, the lowest administrative (political) unit, is important. However, several operational constraints have been identified that can undermine these gains and the overall sustainability of the programme. For example,

persistent payment delays have eroded participants' motivation and social trust, while the limited availability of materials reduces implementation quality, and the multiple competing assignments of extension workers constrain their ability to provide regular monitoring and technical support.

Overall, the paper offers valuable insights into how climate-sensitive PWP interventions can enhance people's resilience to climate shocks, particularly through the asset channel. Future research should examine the long-term socio-ecological outcomes of these interventions, especially in relation to the creation of forest-based assets and potential climate mitigation co-benefits. For instance, future studies should aim to capture the full spectrum of long-term benefits generated by such programmes by rigorously considering and quantifying the value of created assets, the provision of public goods and amenities, and their broader environmental and social impacts. Moreover, the sustainability of the project deserves further study. To this end, addressing operational bottlenecks – while sustaining and strengthening participatory planning and implementation – and capacity-building elements will be critical for translating future CS-PWP investments into durable, climate-resilient development outcomes beyond temporary employment gains.

Through this paper we are able to draw four key policy recommendations. First, integrate climate-smart design by aligning PWP assets with national climate adaptation and disaster risk-reduction strategies, prioritising land- and forest-based interventions in vulnerable areas with high climate exposure and low adaptive capacity. Second, invest in quality assets and monitoring by strengthening technical expertise, providing quality materials and establishing regular asset monitoring systems to ensure durable, productive assets that maximise long-term returns. Third, strengthen participatory planning by engaging local communities, district officers and committees throughout the asset lifecycle to improve relevance, maintenance and sustainability through enhanced community ownership. Fourth, establish cross-sectoral coordination mechanisms at the community level for joint planning, supervision and maintenance of assets, ensuring investments effectively contribute to both development and climate adaptation goals.

Finally, it is important to acknowledge the limitations of our methodology, despite the measures taken to minimise potential risks. As with many qualitative methods, the use of FGDs and KIIs may have introduced social desirability bias, whereby participants might have felt pressured to express opinions or attitudes they perceived as more socially acceptable. Furthermore, the processes of transcription and translation may have unintentionally led to minor distortions or a loss of nuance in some statements made by participants.

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Appendix

Figure A1: CS-EPWP assets and their functions, 2021-2024

Vetiver grass

A natural barrier to prevent soil erosion in sloppy fields. Its deep roots help stabilise the soil, reduce runoff and improve water retention. Drought-resistant and can be used in contour planting to protect crops and enhance soil fertility over time, making it a valuable tool for sustainable land management.

Eyebrow terraces

Constructed to slow down water movement while at the same time promoting water retention. They also reduce soil erosion and sediment transport, which in turn maintains soil health and fertility, which are critical for sustainable agricultural productivity.

Deep trenches/ swales

Shallow trenches dug along the contour lines to capture rainwater. They help retain water in the soil, reduce surface runoff and support tree planting, contributing to long-term land restoration and reforestation.

Check dams

Built in gullies to slow water flow. Check dams help reduce soil erosion by capturing sediments and improving water retention, which benefits agricultural activities and prevents further land degradation.

Woodlots

Fast-growing tree species provide sustainable firewood and help reduce pressure on natural forests, contributing to reforestation efforts and providing an alternative source of income for households.

Natural tree regeneration

Regeneration is intended to help trees recover and grow back on their own; the process was mainly intended to recover ecosystems.

Source: Authors

Table A1: Overview of interviews: methods, functions (of target group) and number of participants across districts and micro-catchments

Inter-view ID	District	Micro-catchment	Method/ interview type	Function	No. of participants
D1	Balaka		KII	DESC officers	2
D2	Balaka	Mtumbwe	FGD	Forestry Group	8
D3	Balaka	Mziza-Mtsimuke	KII	Foremen	2
D4	Balaka	Nanjiri	FGD	CMC	5
D5	Balaka	Nanjiri	FGD	Forestry Committee	6
D6	Balaka	Nanjiri	FGD	Deep Trench and Swales	11
D7	Balaka	Nanjiri	KII	Extension worker	1
D8	Chikwawa		KII	Desk officer, Climate Smart and Senior Land Resource Conservation officer	2
D9	Chikwawa	Dzobwe Chinkodzo	FGD	CMC	8
D10	Chikwawa	Lamnya	FGD	CMC (Livunzu EPA)	9
D11	Chikwawa	Lamnya	FGD	Forestry group	16
D12	Chikwawa	Lamnya	KII	Digitizer	1
D13	Chikwawa	Lamnya	KII	Local leaders	2
D14	Chikwawa	Mphonde	FDG	CMC	8
D15	Chikwawa	Mphonde	FDG	Forestry group	8
D16	Chikwawa	Mphonde	FGD		8
D17	Chikwawa	Mphonde	KII	Extension workers	1
D18	Lilongwe		KII: NLC	WB: Task Team Leader and Public Work Specialist	2
D19	Lilongwe		KII: NLC	Director of PRSP (Poverty Reduction and Social Protection), Deputy Director (Poverty Reduction & Social Protection)	2
D20	Lilongwe		KII: NLC	National Local Government Finance Committee	7
D21	Lilongwe		KII: NLC	Director of the Land Resource Department	1
D22	Lilongwe		KII: NLC	ILO: National Project Coordinator for Social Protection	1
D23	Lilongwe		KII: NLC	African Risk Capacity	1

Note: KII (key informant interview); FGD (focus group discussion); NLC (national-level consultation)

Box A1: Consent form used for the interviews

Climate-related shocks can have a significant impact on community livelihoods, and public works programmes designed to address such shocks can ensure long-term resilience. This fieldwork aims to understand and explore how a recently implemented Climate-Smart Enhanced Public Works Programme (CS-EPWP) has contributed to building community resilience. Specifically, we want to understand whether land resource management-based asset and forestry-based asset infrastructure are effective in building resilience to shocks (such as floods, droughts, cyclones, dry spells). We aim to conduct expert interviews/stakeholder consultations in Lilongwe and focus group discussions in Balaka and Chikwawa with about 19 communities where the infrastructure (micro-catchment) exists.

We will make sure that all the information provided for the purpose of the research will remain confidential and any information publicized will be anonymized. After the interview the recorded transcribed documents will be stored in the office laptop that is locked using a password that is only known to us. Hence, no identifying information (e.g., respondent name) will appear in the data report. Participation in this interview is voluntary, and you may refuse to participate, discontinue the interview at any time, or skip any question you do not want to answer with no penalty or loss of benefits to which you are otherwise entitled. You are allowed to ask questions concerning the research before agreeing to participate in the interview, during, and after the interview.

Before we start, do you have any questions, or is there anything we have said that you would like further clarification?