
WFP – IRP Cost-Effectiveness Analysis



Methodology for calculating the Return of investment (ROI), the Benefit-Cost Ratio (BCR), and Cost Effectiveness Ratio (CER) of the integrated resilience programmes in the Sahel.

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Executive Abstract

The Sahel faces persistent climate, food security, and livelihood challenges that require integrated approaches to resilience building. In response, the World Food Programme (WFP) and partners have implemented Integrated Resilience Programmes (IRPs) combining food assistance, asset creation, livelihood support, nutrition, education, and capacity strengthening. This report presents a standardized methodological framework to assess the Value for Money (VfM) of IRPs through the estimation of Return on Investment (ROI), Benefit–Cost Ratio (BCR), and Cost-Effectiveness Ratio (CER). The framework draws on international best practices from CGIAR, WFP, and development economics, integrating Cost-Benefit Analysis (CBA) and Cost-Effectiveness Analysis (CEA). It applies a multi-level approach, combining detailed farm-level enterprise budgets with site-level analysis of programme costs and benefits. Both monetized and non-monetized outcomes are captured, including productivity gains, nutrition and health improvements, education outcomes, environmental services, and resilience to climate shocks. The methodology provides a robust, transparent tool to support accountability, learning, and evidence-based investment decisions for resilience programming in the Sahel.

Key words: Cost-Benefit analysis, Cost-Effectiveness analysis, Resilience programmes, Sahel, Africa.

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Contents

Acronym.....	3
1. Introduction.....	1
2. Background on Value for Money (VfM) analysis approach	1
2.1. CGIAR methodology	1
2.2. WFP methodology	2
2.3. Global methodology	2
2.4. Choice of VfM analysis methodology	7
3. Methodological framework	7
3.1. Farm level.....	7
3.2. Cost Benefit Analysis for IRP at site	12
3.2.1. Cost of IRP	12
3.2.2. Benefit of IRP	14
3.2.3. Indicators of CBA	16
3.3. Cost Effectiveness Analysis	19
4. Data collection approach	19
5. References	23
Annex : Data collection tools	27

List of tables

Table 1. Farm budget structure for crop production including agroforestry	9
Table 2. Structure of farm fishing budget (data will be collected yearly per cycle)	10
Table 3: Structure of livestock budget	11
Table 4: Summary of IRP costs and Benefits	18
Table 5: Different outcomes for each intervention used for CEA.....	21

Acronym

ABC	: Activity-Based Costing
ABC-I	: Activity-Based Costing–Ingredients
BCR	: Benefit Cost Ratio
BERA	: Basic Efficiency Resource Analysis
CBA	: Cost-Benefit Analysis
CEA	: Cost–Effectiveness Analysis
CGIAR	: Consultative Group on International Agricultural Research
CIAT	: Centre International d'Agriculture Tropicale
CUA	: Cost Utility Analysis
CUR	: Cost Utility Ratio
DALY	: Disability Adjusted Life Year
DFID	: Department for International Development
FFA	: Food Assistance for Assets
FFT	: Food for Training
FFW	: Food for Work
GASPA	: Groupes d'Apprentissage et de Suivi des Pratiques d'ANJE
GLV	: Green Leafy Vegetables
IDP	: Integrated Development Program
IRP	: Integrated Resilience Program
IRR	: Internal Rate of Return
LCS-EN	: Livelihood Coping Strategies for Essential Needs
LCS-FS	: Livelihood Coping Strategies for Food Security
LWM	: Land and Water Management
MAD	: Minimum Acceptable Diet
MAM	: Moderate Acute Malnutrition
MCA	: Multi-Criteria Analysis
MDD-W	: Minimum Diet Diversity for Women
NPV	: Net Present Value
PHL	: Post-Harvest Losses
PMTCT	: Prevention of Mother-To-Child Transmission
PROGRESA	: Programa de Educación, Salud y Alimentación
PV	: Present Value
QALY	: Quality Adjusted Life Years
rCSI	: reduced Consumption-based coping Strategy Index,
ROI	: Return on Investment
RUSF	: Ready-to-Use Supplementary Food
RUTF	: Ready-to-Use Therapeutic Food
SABER	: Systems Approach for Better Education Results
SAMs	: Smallholder farmers Access to Market support
SBCC	: Social and Behavior Change Communication
SDGs	: Sustainable Development Goals
SROI	: Social return on investment
TB-DOTS	: Tuberculosis directly observed treatment
TCTR	: Total Cost per Transfer Ratio
UNESCO	: United Nations Educational, Scientific and Cultural Organization
UNHCR	: United Nations High Commissioner for Refugees
UNICEF	: United Nations Children's Fund
VfM	: Value for Money
WFP	: World Food Programme

1. Introduction

The Sahel region faces persistent challenges including climate shocks, food insecurity, conflict, and poverty, all of which threaten the well-being of its populations and hinder long-term development. In response, integrated resilience programmes have been implemented by various actors to enhance the adaptive capacity of communities, reduce vulnerabilities, and improve livelihoods. Given the complexity and scale of these interventions, there is a growing need for robust, transparent, and standardized methods to evaluate their performance and justify investments.

This document aims at developing a comprehensive methodology for assessing the economic and operational effectiveness of integrated resilience programmes in the Sahel, using three key financial and economic indicators:

- **Return on Investment (ROI):** Measures the financial return generated for every unit of currency invested, providing an overall indication of programme efficiency.
- **Benefit-Cost Ratio (BCR):** Compares the present value of benefits to the present value of costs, helping determine whether an intervention delivers net positive value.
- **Cost-Effectiveness Ratio (CER):** Assesses the cost incurred per unit of desired outcome (e.g., improved food security, reduced livelihood losses), making it especially useful when benefits are not easily monetized.

The methodology draws from international best practices, including guidance from development economics, impact evaluation, and resilience measurement frameworks, while adapting to the unique socio-economic and environmental context of the Sahel. It integrates both quantitative and qualitative data sources and accounts for multi-sectoral impacts across agriculture, health, education, and social protection.

This framework is intended not only to support accountability and learning for programme implementers and donors, but also to inform future investment decisions by demonstrating the value and effectiveness of resilience programming. By applying this methodology consistently across projects, stakeholders can compare outcomes, scale successful models, and ultimately contribute to more sustainable and impactful resilience-building efforts in the region.

2. Background on Value for Money (VfM) analysis approach

2.1. CGIAR methodology

In CGIAR institutes, several approaches have been mobilized to assess Value for Money. The main approaches applied by CGIAR encompass cost-benefit analysis (CBA) and cost-effectiveness analysis (CEA), particularly to evaluate agricultural technologies.

Particularly, cost-benefit analysis (CBA) has emerged as a critical method for evaluating the economic viability of agroecological business models and innovations. Recent studies have applied CBA to assess upgraded agroecological business models (Narjes et al., 2024) and to analyze inclusive models within agroecology initiatives in Zimbabwe (Dawes and Mushongachware, 2023). Additionally, CBA has been instrumental in quantifying the multifaceted benefits of resource recovery and reuse—capturing social, environmental, and economic dimensions to support broader value creation and human well-being (Lazurko, 2018).

The framework has also been extended to evaluate social welfare impacts in large-scale poverty alleviation strategies. For example, the PROGRESA program utilized a social CBA to balance the costs and impacts of its interventions, highlighting how such analyses can inform the

effectiveness of policy instruments (Coady, 2000). Further applications of CBA have included studies assessing the integration of agroecological innovations in green leafy vegetable (GLV) value chains in Kiambu County, Kenya (Onyango et al., 2024) and the implementation of agroecological packages in the dairy value chain in Bobo-Dioulasso (Vall et al., 2024).

Moreover, recent research has quantified the economic repercussions of agricultural challenges, such as the impact of *Fusarium oxysporum* f. sp. cubense Tropical Race 4 on value chain actors and their environments, providing essential insights into the disease's far-reaching consequences (Ritter et al., 2024; Mockshell et al., 2024). Complementary studies have employed CBA to assess investment cases for agroecological business enterprises in Kenya (Chege et al., 2024) and to analyze the economic impacts of seed system interventions in Uganda implemented by the International Potato Center (Feukeng et al., 2024).

CGIAR researchers have applied CEA in evaluating interventions ranging from improved crop technologies to gender-transformative programs. For example, studies on interventions such as intimate partner violence prevention have measured cost per case averted, providing evidence on which strategies deliver the best outcomes for the lowest cost (Leight et al., 2021). Although less frequently applied in agricultural research compared to public health, Cost Utility Analysis (CUA) has been used by CGIAR researchers to account for non-monetary benefits—such as improvements in nutritional status and overall well-being—which are crucial in evaluating interventions aimed at enhancing food security and reducing malnutrition. In adaptation area, de Brauw (2025) supported Norwegian Government to conduct Cost-effectiveness of anticipatory action including cash transfers, agricultural inputs, early warning information in Lesotho, Madagascar, and Mozambique.

Collectively, these studies illustrate the robust and diverse applications of VfM and CBA methodologies in agricultural and rural development. They not only provide critical insights into the financial and social returns of various interventions but also guide policy decisions and strategic investments in sustainable agriculture and community development.

2.2. WFP methodology

During its interventions, the World Food Programme (WFP) has utilized various approaches to assess Value for Money (VfM) across single projects, broader programs, and multi-sectoral interventions. These include economy analyses (Venton et al., 2015), efficiency studies (WFP and UNHCR, 2014), and Cost-Effectiveness Analysis (CEA). For instance, Jenkins (2012) applied CEA to evaluate the Integrated Management of Acute Malnutrition program in southwestern Uganda. Similarly, the CEA approach was used in the Unlock Literacy program, where the equivalent years of schooling gained were found to be cost-effective, especially in Eswatini compared to Ethiopia (World Vision, 2022). In Afghanistan, Hall (2013) conducted a comparative CEA of four WFP hunger reduction activities—Food for Assets (FFA), Food for Training (FFT), and Food for Work (FFW)—focused solely on transfer modalities.

Many WFP assessments have also applied Cost-Benefit Analysis (CBA), particularly in evaluating school feeding programs (WFP, 2018; 2019; Dunaev and Corona, 2019) and integrated resilience programs (Sissoko and Traore, 2019; WFP, 2024).

2.3. Global methodology

VfM assessments seek to measure the extent to which a particular investment or project represented the best possible use of the funds in the pursuit of a particular goal. Several

definitions have been elaborated since DFID (2011) defines VfM as “the optimal use of resources to achieve outcomes”. *“New Zealand’s aid programme defines it as the best possible way to meet objectives during the lifetime of an activity regarding the total cost of managing and financing the activity, while ensuring the resources are used effectively, with no waste”* (Adou, 2016). A range of VfM approaches can be applied depending on the theoretical and practical context-specific questions (Fleming, 2013). Theoretically, the way to measure value (consideration of economy, efficiency, effectiveness or equity) and which stakeholder value considered are the key issues. In practical terms, method choices depend on: (i) if the evaluation concerns a single project or comparing multiple projects; (ii) possibility to monetize or use of proxy measure of value; (iii) the way to participatory and transparently evaluate costs and benefits; and (iv) deciding whether the method promotes/enables participation and accountability to community or partners. There is also concern about the availability of data relating to the costs and benefits of the project, as well as the availability of comparators. In each case, the costs of a project are weighed up against the benefits that these costs generate. Various approaches include cost-minimization analysis (including Activity-based costing, Activity-based costing-ingredients, cost driver, follow the money, and efficiency analysis), cost effectiveness analysis, cost utility analysis, cost-benefit analysis, social return on investment, rank correlation of cost vs impact, basic efficiency resource analysis, multi-criteria analysis.

Activity-based costing (ABC) has been trialed as an alternative approach in some contexts. While there is no standard approach to activity-based costing in humanitarian appeals, Stoddard et al., (2017) define ABC generically as average cost per beneficiary per sectoral activity. These are estimates based on the average previous costs of implementing these sectoral activities per number of people served, which indicate to donors the overall probable costs of a response (Puett et al., 2013).

Activity-based costing-ingredients (ABC-I): This method merges activity-based accounting methods with the ‘ingredients’ method, which calculates programme costs from inputs, input quantities and input unit costs (Margolis and Hoddinett, 2015). The precise ‘ingredients’ for the study should be established based on discussions with staff, to determine the costs that were specific to the different transfer modalities (Margolis and Hoddinett, 2015). This approach, cost apportionment, spreads the total programme costs across multiple activities that produce specific outcomes, and then determines the unit costs of each outcome, which can be compared to unit costs for producing these outcomes through alternative means (as per CEA, below) (Abou-Ali et al., 2010). Another approach is to assess whether the total cost of providing a range of benefits $\{b_1, b_2, \dots, b_n\}$ under a single Integrated Development Program (IDP) (c_{joint}) is lower than the summed costs of multiple separate projects delivering the same results at the unit costs of $\{c_1, c_2, \dots, c_n\}$:

$$c_{joint} \{b_1, b_2, \dots, b_n\} < \sum c_i \times b_i \quad (1)$$

The inequality shows costs savings or efficiency due to synergistic interventions within IDPs, as individual activities within an IDP share programme overheads and reinforce each other’s results (Acharya and Hilton, 2018).

Cost driver analysis: Cost driver refers to the cost categories that most influences the overall cost of a project / programme / portfolio (e.g. international staff, aid commodities or overheads) (Pongracz et al., 2016). It is a common practice for ex ante reviews of proposals and ex post audits to identify the types of costs that are the largest percentage of a budget and then establish if they are reasonable by referring to cost data from similar projects from other organizations, from previous responses and even global averages (Wheatley and Pongracz, 2014). Economy and cost driver analysis are highly relevant to humanitarian aid as both are about ensuring good stewardship of resources. However, aid agencies have expressed concerns that the focus on costs could lead to a 'race to the bottom' that privileges cheaper suppliers and a lack of consideration for quality (Stoddard et al., 2017). Also, projects or programs often seek to influence multiple aspects of wellbeing which cannot easily be summarized with a single benefit measure (food security, income, poverty, health). In such cases, it is advised to list the various single outcomes alongside the costs known as cost-consequence analysis (Ahmed et al. 2009; Hidrobo et al. 2014; Masset et al. 2018).

Follow the money: This approach involves the detailed recording of all expenditures at each step in the implementation of an intervention (Pongracz et al., 2016). At each step the question is asked whether the results could have been obtained with less money, whether it was necessary to reach the next level (e.g. output) and what would have been the better alternative (Renard and Lister, 2013). It is applicable primarily at the project level.

Efficiency approach: Conversion of inputs to outputs or 'cost per beneficiary', it refers to proportion of assistance directly reaching beneficiaries and ratio of programme costs to administrative costs (Wheatley and Pongracz, 2014). Cost per beneficiary is calculated by dividing the budget of a programme by the number of beneficiaries. The total cost per transfer ratio (TCTR) indicates the value of assistance that reaches beneficiaries compared to all other costs (often referred to as administrative costs) (White et al., 2013). A ratio of programme costs to overhead / administrative costs commonly appears in the public records of aid agencies to encourage private donations (e.g. 90 cents out of every dollar donated goes to programmes).

Cost-effectiveness analysis (CEA) is applied when benefits cannot be readily monetized. CEA provides an approximate unit cost for producing a particular desired output. Unlike CBA, its applicability requires comparator programmes that are aiming to produce the same outputs, allowing for comparisons of, for example, 'cost per year of schooling' under a range of different delivery models. CEA lacks the ability to provide an absolute analysis or a standardized metric for comparison. It also falls short in addressing uncertainty and equity considerations. Additionally, determining appropriate thresholds or target risk levels can be complex and subjective.

Another study introduced the Omega Value (ratio of in-kind nutrient value per dollar and voucher, purchased food nutrient value per dollar) to assess vouchers and in-kind food assistance (Ryckembusch et al., 2013). While developed by WFP, this approach has limitations, including a lack of consideration for intra-household food distribution and an assumption that cash is always spent on food within households.

To differentiate between vouchers and cash assistance, Hoddinott et al. (2018) conducted a randomised trial control. Their study found that in-kind transfers significantly improved consumption and dietary quality, while cash transfers were more effective in promoting

agricultural investment. This highlights a key trade-off between short-term and long-term economic resilience. Bailey (2014) identified several factors that influence the efficiency of intervention, including scale, size, frequency and duration of transfers, the delivery mechanism and whether cash replaces in-kind aid or supplements it. He also noted a major gap in VfM assessments due to the lack of practical tools for analyzing the efficiency and effectiveness of cash transfer programs.

Most existing literature on the cost-effectiveness of cash, voucher, and in-kind food assistance points challenges in making direct comparisons. For instance, Gentilini (2007) emphasized the influence of context, management, and project objectives on comparison process. Additionally, hidden costs, inconsistent accounting methods, and varying budgeting practices can distort cost effectiveness calculations (Meyer, 2007). Given these challenges, robust comparison frameworks are essential for effective CEA (CRS, 2015).

A cost-effectiveness analysis (CEA) cannot be conducted without reliable effectiveness data. It is essential to ensure that high-quality effectiveness data are available, either through monitoring and evaluation systems or from formal program evaluations (ACF-IN, 2013). In practice, it is often difficult to obtain data on program effectiveness at the impact level. However, impact data are not strictly required to perform a CEA. While decision-makers generally prefer final outcomes, intermediate outcomes may be used under certain conditions: (1) The intermediate outcome is more directly linked to the intervention than the final outcome (e.g. Example: Using the number of fully vaccinated children when the link between vaccination and disease reduction is not yet established); (2) The intermediate outcome is directly measurable within the study's time frame, whereas the final outcome would occur much later (e.g. Measuring the number of individuals who quit smoking in a cessation campaign, since the reduction in lung cancer cases would manifest too far in the future); (3) There is no well-established relationship between the intermediate and final outcome (e.g. In an HIV risk-reduction program, the number of people counseled may be used as the outcome if there is limited evidence linking counseling to actual prevention of HIV infections); (4) Cost data for the final outcome are not available or incomplete (e.g. In a community-based pneumonia treatment program, using the number of households reached may be more feasible if the total treatment cost is unknown). In such cases, using intermediate outcomes allows the CEA to proceed, provided the limitations are clearly stated and the outcomes are meaningfully linked to the intervention.

Cost Utility Analysis: QALY or DALY

The cost-utility approach explicitly addresses multiple outcomes by aggregating utilities produced by the outcomes. This method can be used where monetizing outcomes is not possible or appropriate and appropriate with health projects applying Quality Adjusted Life Years (QALY) and Disability Adjusted Life Years (DALY). These indicators allow the comparison of medical interventions by the number of years that they extend life. The estimation of an overall utility of the intervention assumes knowledge of the utilities associated to each outcome and of the functional form used for their aggregation. QALYs and DALYs used by health economists are applications of this approach. QALYs and DALYs aggregate all outcomes in terms of life years gained weighted by the quality of living under different levels of morbidity and disability. Miller et al. (2017) considered non-health benefits to perform CUA.

The approach is based on the estimation of utility (U) through a utility function specified for b outcomes ($b_1, b_2 \dots b_n$): $U = f(u_i(b_i))$.

The utility so obtained is then used to calculate a Cost Utility Ratio: $CUR = C/U$ (2).

Cost–Benefit Analysis (CBA) monetizes all costs and benefits to give an overall benefit-to-cost ratio – a headline figure that clearly expresses whether benefits have outweighed costs on a particular project, and which allows for comparison with other potential investments and their respective benefit-to-cost ratio. CBA requires all benefits to be monetized, and as such, is often limited to projects where targeted returns are largely financial in nature. CBA compares the streams of all project benefits $B = b_1 + b_2 + \dots + b_n$ and all project costs ($C = c_1 + c_2 + \dots + c_n$), all expressed in monetary terms and discounted over time t at the rate r . (Baird et al. 2011; Bernal and Fernández 2013). While CBA offers significant advantages, it primarily focuses on efficiency, sometimes overlooking other important criteria such as uncertainty and equity. Additionally, it faces challenges in accounting for non-monetized costs and benefits and often requires subjective judgment when selecting and appropriate discount rate.

Social return on investment (SROI) is an innovative framework for measuring and accounting for the value generated by interventions or policies. It quantifies the social impact (benefits) of an activity in monetary terms and compares this value to the costs required to achieve it. While like traditional cost-benefit analysis, SROI is uniquely designed to evaluate socially driven initiatives. As James and Faivel (2012) explain, “SROI is specifically tailored to the analysis of social purpose activities.” Rooted in principles of social accounting and cost-benefit analysis (Weston and Hong, 2013), SROI translates significant project outcomes into monetary equivalents, enabling direct comparison with input costs (both financial and in-kind). By calculating a benefit-to-cost ratio, SROI helps organizations communicate the value added by their projects to external stakeholders.

Rank correlation of cost vs impact: This approach enables the relative measurement of value-for-money across a portfolio of initiatives. It facilitates comparisons between alternatives with differing objectives and is particularly useful for multi-unit programs. Additionally, it supports participatory decision-making by engaging stakeholders in identifying and valuing program outcomes (Fleming, 2013).

Basic efficiency resource analysis: It evaluates complex programs by comparing impact against resource allocation, offering a relative perspective on performance. Units are benchmarked against peer units, simplifying complex data into actionable insights. However, BER Analysis should not be used in isolation. It must be combined with complementary data sources and analytical methods to ensure robust decision-making (Cugelman and Otero, 2010; Fleming, 2013).

Multi-criteria analysis (MCA): This is a structured approach for evaluating different intervention options based on multiple criteria. Each criterion is assigned a weight, and these weights are used to calculate an overall score for each option. The intervention with high score, the best it is. MCA is particularly useful when only partial data is available, when cultural and ecological factors are difficult to quantify, or when monetary benefits and effectiveness are just two among several important criteria. It provides a framework to integrate diverse decision factors into a quantitative

analysis without requiring monetary values to all factors. The reliability of MCA result depends on the certainty of the information used for the selected criteria, the relative importance assigned to each criterion (the weights or scores) and the level of stakeholder agreement on these weights. Sensitivity analysis can be applied to assess how changes in scores or weights affect the robustness of the results (UNFCCC, 2011). MCA is limited by the subjective nature of scoring and ranking interventions, making comparisons challenging.

Several donor agencies have preference for applying specific VfM approach. The World Bank uses CBA in developing and managing programmes and is mandated to use this type of analysis to determine the economic rate of return (World Bank, 2010). The Network International uses SROI for discussing VfM (Fleming, 2013). ADB uses financial analysis and an assessment of the financial policies and the capacity of the financial management systems of the borrower or executing agency in developing and managing programmes (ADB, 2003). USAID uses results-based management in addressing Congressional questions on value for money.

From previous works and particularly based on White et al. (2013) and Tappis and Doocy (2017), the Value for Money could be conceptualized as follows:

Cost Analysis: VfM Involves a descriptive assessment of program costs, including, where applicable, additional transaction, opportunity, social, political, or economic costs.

Cost Efficiency Analysis: VfM Examines the relationship between administrative/program costs and outputs, assessing how efficiently resources are converted into deliverables.

Cost Effectiveness Analysis: VfM evaluates the relationship between program costs and outcomes or impacts, comparing alternative approaches to achieving the same results without necessarily monetizing outcomes.

Cost-Benefit Analysis: VfM assesses the relationship between program costs and outcomes/impacts expressed in monetary terms, requiring credible valuation of those outcomes to determine net economic gain.

2.4. Choice of VfM analysis methodology

Economic evaluation provides valuable tools for assessing the costs and consequences of resource allocation decisions. These methods systematically identify, measure, value, and compare the costs and outcomes of different options (Drummond et al., 2005). While economic evaluation methods aim to analyze efficiency, they vary in scope and measurement units. Three key approaches include cost-effectiveness analysis (CEA), cost-utility analysis (CUA), and CBA. Each has its strengths and limitations. However, based on the TOR objectives and the WFP's previous approach to evaluate projects and programs, this study selects CBA and CEA to assess return on investment, the benefit-cost ratio, and Cost-Effectiveness Ratio.

3. Methodological framework

Considering the scope of the terms of reference, a multi-levels methodological framework will be applied.

3.1. Farm level

At the farm level, we will first evaluate the implementation of Food Assistance For Asset (FFA) activities and then assess the overall contribution of the IRP at site level. In this study, a site refers to villages where one or more interventions have been implemented. Depending on the nature

and type of interventions, data will primarily be collected at the household (including farms) and village levels.

For each site, the process will begin by collecting data on:

- the number of beneficiary households within each site
- demographic details including the average of people per household by sex,
- the extent of rehabilitated degraded land (in hectares),
- the area of lowland developed for rice and vegetable production,
- the number of water reservoir built,
- the number of ponds realized,
- the number of micro dams built and number of fertilizer application,
- the area of horticulture,
- the area of moringa reforestation
- the area of reforestation in degraded land,
- the area of irrigated gardens,
- the area of school gardens established,
- the number of fuel-efficient stoves installed, among others.
- Number of innovations or improved agro-practices.

The rehabilitated land will be disaggregated by crop type according to the standard use, such as maize, sorghum, millet, cowpea, groundnut, Bambara groundnut, cotton, sesame, forage etc., and the yield or production per hectare will be collected. Different land management practices (e.g. zai, half-moon, stone bunds), will also be considered for a more nuanced analysis.

Additionally, yield data from rice and various vegetables (onions, tomatoes, okra, hibiscus, chili peppers, amaranth and vegetable leaf, etc.) produced in both irrigated and school gardens will be collected.

Each crop will be analyzed through farm budget building where all charges (labor, seeds, fertilizer, small farming tools, and other farming cost) and related incomes (crop sale, estimation own consumption, donation and crop residues) for one hectare exploited will be established. Beyond agricultural outputs, we will estimate or record quantities of agroforestry products such as firewood and tree pole per hectare. Tables 1, 2 and 3 represent the farm budget structure that will be employed during the field data collection, respectively for cropping, fishing, and livestock (poultry, small ruminants). See Annex 1, 2 and 3 for details about data collection tools.

Table 1. Farm budget structure for crop production including agroforestry.

Intervention	1=Rehabilitation, 2=Lowland developed, 3=Irrigated land, 4=School Garden		
Crop			
Practices	1=Zai, 2=Half-moon, 3=Stone bunds		
Revenue/income	Quantity/unit	Unit price	Total revenue
– Crop sales			
– Fruit trees (Mangoes, Papayas, Baobab fruit)			
– Nuts and seeds (Moringa, Shea, Nere)			
– Firewood from agroforestry			
– Tree poles from agroforestry			
– Other crop related income (residues, medicinal plants) non-timber forest product, herbaceous and forest seed, forestry production.			
Costs	Description/units	Unit cost	Total cost
Variables costs			
– Vegetable seeds			
– Tree seedlings (Moringa, Baobab, Fruit trees)			
– Inorganic Fertilizers			
– Organic fertilizers (Composts and manure)			
– Pesticides			
– Nursery establishment			
– Labor (land preparation, planting, weeding, harvesting, application of fertilizer or herbicide)			
– Transport and logistics			
– Other variable costs (food)			
Fixed costs			
– Land rent or lease			
– Drip irrigation system			
– Equipment and tool depreciation (tractors, hoes, watering can, pruning shears)			
– Repairs and maintenance			
– Other fixed expenses			

Farm fishing budget/per cycle / year

Table 2. Structure of farm fishing budget (data will be collected yearly per cycle)

Costs	Description/unit	Unit cost	Total cost
Fixed cost			
– Pond construction			
– Borehole			
– Pompe			
– Irrigation canals			
– Nets			
– Aerators			
– Feeders			
– Testing kits			
– Fish storage			
– Smoking/drying equipment			
Variable costs			
– Fingerlings (juvenile fish: Tilapia, Catfish)			
– Fish feed			
– Labor (workers' salaries)			
– Pond maintenance (repairs, water quality management)			
– Medicine and disease control			
– Transportation and marketing			
Revenue	Description or unit	Unit price	Total revenue
– Fish sales			
– By-products (fish waste like organic fertilizer, animal feed)			

Contribution of forage availability for livestock in each site will be estimated through triangulation among pastoralists and small-scale breeders comparing the additional net profit that they could be attributed to IRP interventions.

Table 3: Structure of livestock budget

Cows, Goats, sheep	Description/unit	Unit cost	Total cost
Total initial investment	Depreciation		
Purchase price per animal			
Housing/Shelter			
Equipment (feeders, waterers)			
Operating costs	Description/unit	Unit cost	Total cost
Feed & supplements (seasonal feeding, dry season support)			
Veterinary/ health care (vaccines, deworming, basic treatment)			
Labor (daily care, herding, feeding, watering)			
Family labor			
Water access			
Breeding/AI services			
Transport			
Miscellaneous (admin fees)			
Revenue	Description or unit	Unit price	Total revenue
Offspring sold (calves, kids, lambs)			
Conservative estimates			
Milk sales (if applicable)			
Manure/Soil fertility/compost			

Finally, the evaluation will consider the intangible benefits of FFA, including positive environmental impacts (carbon sequestration, soil fertility improvement, etc.) and improvement in beneficiary wellbeing (cost of malnutrition and health averted).

The financial analysis will be converted to economic one by using the standard conversion factor. The analysis of FFA will be used as inputs for CBA, particularly the gross revenue will represent a component of benefits in IRP analysis.

To accurately assess the livelihood improvements associated with Asset creation and land rehabilitation (land and water management, LWM), it is essential to consider the flow of costs and benefits over the evaluation period (T) assuming to be 15¹ years. This will be done by calculating the net present value (NPV) for both non-LWM and the LWM systems, as outlined in Equations 1 and 2. The overall net benefits of using the LWM farming system will then be determined by the difference between the two (Equation 3).

$$Benefit_t =$$

$$NPV_{non-LWM} = \sum_t net\ crop\ revenue_t / (1 + r)^t + \sum_t net\ other\ revenue_t / (1 + r)^t \quad (3)$$

¹ As applied for several interventions due practical and theoretical way (FAO et al., 2021)

$$NPV_{LWM} = \sum_t \frac{\text{net crop revenue}_{it}}{(1+r)^t} + \sum_t \frac{\text{net other revenue}_{it}}{(1+r)^t} - \sum_t \frac{\text{LWM implementation \& management cost}_t}{(1+r)^t} \quad (4)$$

$$\Delta NPV = NPV_{LWM} - NPV_{non-LWM} \quad (5)$$

The return on investment will be calculated using the following formulas

$$ROI_{FFA} = \frac{\text{Benefit or Revenue}_{FFA} - \text{Cost}_{FFA}}{\text{Cost}_{FFA}} \quad (6)$$

3.2. Cost Benefit Analysis for IRP at site

For IRP analysis at the site level, all costs and benefits will be first identified for each intervention. These interventions include asset creation for land restoration and natural resources conservation, Reducing Post-Harvest loss and development of value chains, Capacity strengthening, Nutrition, and School feeding. Most of the required data will be sourced from country offices through specific surveys, M&E reports and dataset. Additional information will also be collected through focus group discussion to ensure data completeness, triangulation, and validation.

The “with and without” scenario will be used in identifying the costs and benefits. Only costs and benefits resulting from the interventions will be identified and those that would have still taken place even without the interventions will be ignored. Thus, only incremental costs and benefits arising from the interventions will be considered.

3.2.1. Cost of IRP

Beyond administrative and management cost, which will be integrated at the overall intervention level, site-specific investments will be assessed across the five IRP components. These costs will generally fall into three categories: fixed costs, operational costs and social² and environmental costs. Fixed costs will include expenses related to beneficiary training, equipment and installation, initial inputs (such as fertilizers, seedlings, cash capital, etc.), project planning, implementation and monitoring. Operation costs will cover ongoing expenses such as maintenance, raw materials and supplies, monitoring, security, and replacement of short-life equipment. Even if they are not considered for this study, social costs generally account for potential losses in social benefits resulting from intervention, while environmental costs will consider potential negative impacts, including water quality deterioration, soil and land degradation, and pollution. These costs will be allocated to each component or intervention at site level. In cases where is not feasible, a weighted approach will be applied based on stakeholder feedback triangulation.

² A social cost is a net loss of social benefit incurred due to the introduction of a particular project or intervention, such as failure by a community to access a natural resource (e.g. firewood) previously enjoyed by the community without the project.

2.2.1.1. Asset creation for land restoration and natural resources conservation

The cost associated with this component will include expenses for sustainable land and water management, community gardens, boreholes installation with solar pumps, and rehabilitation of feeder roads, trails, and dikes. A key cost consideration will be households' transfers, factoring in the number of beneficiary households, the duration of transfers per year, and the total number of years the transfers are made. Cost Adjustments will be accounted for increased inputs such as seeds, labor, and machinery costs while factoring in the overall productivity boost.

2.2.1.2. Smallholder Farmers Access to Market support

Costs under this component will include expenses for farmer training, warehouse rehabilitation, investment in solar equipment, and maintenance. Relevant data will cover the number of farmers trained, the number of warehouses rehabilitated, and the percentage and value of post-harvest losses prevented. Agricultural and livestock inputs (improved seeds, fertilizers, etc.) distributed or subsidized, shared tools and machine support for groups will be accounted for cost of Smallholder Farmers Access to Market support (SAMs) interventions.

2.2.1.3. Capacity strengthening

This component will focus on vocational capacity building, sustainable management practices, leadership development, income-generating activities, and land restoration capacity building. Associated costs will include trainer fees, venue rentals, material purchases, participants transportation, allowance, and other relevant expenditures. Data collection will consider the number of participants and community size, training duration, and the year of implementation for each sub-component.

2.2.1.4. Nutrition

Nutrition-related costs will include expenses for malnutrition prevention, treatment of moderate malnutrition, provision of locally fortified/improved food for vulnerable groups, SBCC initiatives, and support for nutrition education sessions in GASPA. Apart from logistics and food transport cost, key cost elements will include RUTF, medical supplies, health facilities, therapeutic feeding centres: Personnel devoted to food assistance-related activities (or % staff time); Staple rations + storage & Transport; Value of beneficiary time spent traveling to, waiting for and attending distributions; Value of beneficiary time traveling to and waiting at health centres for malnutrition treatment; Value of distribution sites; Value of time spent by community leaders in beneficiary selection; Equipment & Supplies, including materials for distributing rations and building distribution sites; Personnel devoted to additional activities related to RUSF (or % staff time), and its management and logistics; RUSF sachets used in program + storage & transport; medical & anthropometric equipment; Program support costs (Puett et al., 2013). Data will be collected from country offices on the number of beneficiary households, per capita food supply, and other relevant metrics.

2.2.1.5. School feeding

Costs in this component will cover school meals provision, installation of school gardens (including various inputs and materials), rehabilitation of school kitchen, and canteen equipment such as fuel-efficient stoves. Data will focus on the numbers of students affected, quantity and cost of food supplied per student, training and capacity building expenses for school gardens,

infrastructure investments, etc. They also include value of commodities (food given or purchased), transport (international and landside transportation, storage and handling), operational costs (staff, vehicles and facilities), and overhead costs.

3.2.2. Benefit of IRP

Both tangible and intangibles benefits that enhance the resilience of communities will be assessed. Tangible benefits include measurable financial gains such as increased revenues from improved agricultural production, while intangible benefits encompass social and environmental gains, such as knowledge acquisition, and gains from environmental and natural resources conservation, that are more challenging to quantify.

2.2.2.1. Asset creation for land restoration and natural resources conservation

This component focuses on the establishment of soil and water management practices and conservation initiatives. The first Benefits consideration will be about the net profit of agricultural, fishing, agroforestry and livestock practices. They will be calculated per household based on the number of beneficiaries and average gains per household.

Productivity Gains: This benefit will be drawn from farm budgets established for FFA (see farm budgets for different sectors).

Time Savings: Quantifying and valuing reductions in transport time for goods, access to fields, and services such as health, education, and communication due FFA implementation.

Environmental Benefits: quantifying and estimating value of increases in soil fertility, reductions in topsoil loss and nutrient depletion, enhanced water storage, reduced runoff, carbon sequestration (Gordon et al., 2020), and biodiversity improvements.

$$\frac{Benefit_t^{Country}}{SCC^{country} * E} = H_{crop} [CO2^{Urea} (U_{Crop,gap}^{with} - U_{crop}) + CO2^{DAP} (D_{Crop,gap}^{with} - D_{crop})] * \quad (7)$$

H_{crop}	Land area
$CO2^{Urea}$	CO2 per kg of Urea fertilizer
$CO2^{DAP}$	CO2 per kg of DAP fertilizer
U_{crop}	Kg of Urea used at Baseline
D_{crop}	Kg of DAP used at Baseline
$U_{Crop,gap}^{with}$	Kg of Urea used under FFA
$D_{Crop,gap}^{with}$	Kg of DAP used under FFA
$SCC^{country}$	Country level Social cost of Carbon
E	Real Exchange Rate

Due to land rehabilitation, the conflict about land and reducing outflow of able-bodied workers will be reduced and it will be valued as benefit for IRP.

2.2.2.2. Reducing Post-Harvest loss and development of value chains: SAMs

This segment evaluates the efficiency improvements achieved through:

Productivity Enhancements: quantifying and valuing yield improvements and the reduction in post-harvest losses (PHL) due to advanced conservation/storage practices and technologies.

Market Integration: Assess additional profits from shifts toward higher-value cropping systems, increased access to agricultural market, and the stimulation of private investments driven by the implementation (see annex 4 and 5).

2.2.2.3. Capacity strengthening

The IRP arm aims to empower local communities by reinforcing other components, achieving their potential. Benefits from this component will be captured as follows:

- Training and Skill Development: Measuring and valuing its contribution to the improvement in agricultural practices, natural resource management, and technical skills, as well as income opportunity generating. Knowledge acquired will be valued using Abelson (2007) approach where he attributed percentages to the training cost to obtain the training benefit for different beneficiary levels. Thus, benefit represents 10%, 20% and 30% respectively for individual, individual and households, individual, households and communities (FAO et al., 2021).
- Institutional Strengthening: Evaluating and valuing its support to the increased capacity of local institutions to manage and sustain agricultural innovations and resilience strategies.

2.2.2.4. Nutrition

The nutrition intervention within the IRP could generate a wide range of measurable benefits, contributing to both immediate and long-term improvements in health, productivity, and economic outcomes. These benefits will be quantified based on the number of beneficiaries and the estimated value per beneficiary across several key dimensions:

- Improved Hygiene and Time Savings: Enhanced hygiene practices and reduced time spent collecting water lower the incidence of waterborne diseases and free up time, resulting in increased productive labor days.
- Prevention of Malnutrition in Vulnerable Groups: Targeting children under five and pregnant or lactating women, the intervention aims to prevent malnutrition. Benefits will be calculated based on healthcare cost savings and enhanced well-being. (Total admission, recovery, defaulters, non-response, death with treatment, defaulters' death, non-response death; number of deaths without treatment; deaths averted yearly);
- Reduction in Disease Incidence and Healthcare Costs: fewer and less severe illnesses among beneficiaries will lead to direct savings in healthcare expenditures.
- Treatment of Acute Malnutrition: The number of individuals treated for acute malnutrition and the economic value of lives saved and health will be quantified.
- Lowering Mortality Rates: A decrease in mortality among vulnerable groups will be assessed by the economic value of lives saved.
- Strengthening Local Health Systems: Improvements in system capacity and service delivery will enhance community health outcomes and contribute to long-term resilience, with benefits valued accordingly.

2.2.2.5. School feeding

This component of IRP could yield several benefits including: Value Transfer to the Household (the value of the food received, and the healthcare expenditures avoided due to the children's better health); Return on Investment on Saved Assets; Increased Productivity of the Beneficiary

(increased school attendance); Healthier and Longer Life; and Externalities (lower costs for government or community benefits), gender equity. In monetary terms, the study will adopt the benefit framework developed by WFP and MasterCard (2016), which allocates the total benefits as follows: 12% for value transfers or access to food and healthcare services, 8% for improved health and increased life expectancy, 4% for return on investment, and 67% (6-25% of variation) for gains in productivity.

2.2.2.6. Global benefit

Transversally, the benefit of IRP will consider reduction of debt burden, increased solidarity, jobs creation, floods protection, recharge of water table, and other tangible and intangible benefits will be considered.

3.2.3. Indicators of CBA

Three indicators for a time span of 15 years (2018-2032) including NPV, BCR and IRR using # social discount rate (see Excel file : IRP_CBA).

$$NPV_{IRP} = \sum_{t=0}^N \frac{Benefit_{IRP_t} - Cost_{IRP_t}}{(1+r)^t} \quad (8)$$

$$BCR = Benefit_{IRP} PV / Cost_{IRP} PV \quad (9)$$

$$NPV_{IRP} = \sum_{t=0}^N \frac{Benefit_{IRP_t} - Cost_{IRP_t}}{(1+IRR)^t} = 0 \quad (10)$$

Where:

- NPV (Net Present Value): The difference between the present value of benefits and the present value of costs over the analysis period.
- PV (Present Value): The current worth of a future stream of benefits or costs, discounted at a specified rate.
- BCR (Benefit-Cost Ratio): The ratio of the present value of benefits to the present value of costs, used to assess economic efficiency.
- IRR (Internal Rate of Return): The discount rate at which the net present value of an investment becomes zero, reflecting the project's rate of return.
- t (Time): The time period or horizon over which the analysis is conducted.
- IRP (Integrated Resilience Program): The program under assessment, comprising multiple interventions aimed at strengthening resilience.
- r (Discount Rate): The rate used to discount future costs and benefits to their present values.

There is currently no consensus on the appropriate social discount rate for evaluating social and environmental projects in the central Sahel. Reported rates vary widely—for example, 12% for the Sahel (IDG, 2018), 3.9–5% (WFP, 2024), 10% for Benin (WFP, 2019), 7% for Ghana (Dunaev and Corona, 2019), and 5–10% (Westerberg et al., 2019). Since a social discount rate reflects either society's time preference for money or the social opportunity cost of capital, it is generally expected to be lower than market (private or commercial) rates (FAO et al., 2021). A rate of 6%

has been suggested as appropriate for social investments (Maradan, 2017). At USAID, the convention is to apply a 12% rate for economic analyses, while the financial analysis uses a rate aligned with the cost of capital, typically reflecting the prevailing interest rate in the intervention area (Schubert, 2020). For the purposes of this study, a 10% discount rate will be used for Food Assistance for Assets (FFA) analysis, and a 5% social discount rate will be applied to Integrated Resilience Programming (IRP) interventions at the site level. Sensitivity analysis will also be realized considering different levels of social discount rate (3%, 7% and 10%).

Table 4: Summary of IRP costs and Benefits

Components	Cost	Benefit
Food Assistance For Asset	Transfer to households	Revenue from agriculture
	Equipment	Revenue from livestock
	Machinery	Revenue from fishing
	Farming tools	Revenue from agroforestry
	Specialist for field work (agronomists, technicians)	Valorization of time saving (transport goods, access to fields and services)
	Boreholes installation	
	Solar pumps	
	Additional cost for feed road rehabilitation	Environment benefit
	Additional cost for trait rehabilitation	Value of hardship reduction
	Additional cost for dike rehabilitation	Reduction of land conflict
	Seed distributed	Environmental service
	Seedling distributed	Carbon sequestration
	Additional labor	
SAMs	Training costs	Value of PHL prevented
	Warehouse building	
	Solar equipment	Benefit of market integration
	Maintenance of equipment	Value of compost production
	Improved seed distributed	
	Fertilizer distributed	
	Subsidized farm inputs	
Capacity strengthening	Trainer fees	Training and skill development valuation
	Venue rentals	
	Training materials	Value of local institution
	Participant transports	
	Allowance	
	Other expenditures	
Nutrition	Logistics	Hygiene and time saving value
	Management	
	Food transports	Healthcare cost averted
	Storage	Welfare value
	RUTF (ready to use therapeutic food)	Lived saved
	Medical	Value of health restored
	Heath facilities	
	Therapeutic feeding center	
	Personal related cost	
	Anthropometric equipment	
School feeding	Meals/food supplies	Value transfer/food/healthcare
	Installation of school garden	
	Rehabilitation/construction of kitchen	Productivity increased
	Canteen equipment	Healthier and long life
	Stoves fees	Externalities
	Training capacity building cost	Saved assets
	Transport	
	Storage	
	Overhead	

3.3. Cost Effectiveness Analysis

Regarding the availability of project or intervention documents (e.g. endline survey reports, baseline survey reports, external evaluation reports, final project/program reports, annual results reports, indicator tracking reports, and narrative reports), the Cost Effectiveness Analysis will examine indicators related to food assistance, health, and resilience. For food assistance, the indicators include Food consumption score, Livelihood based Coping Strategy Index LCSI, Household dietary Diversity Score, Reduced coping Strategy Index, Household hunger scale, household economy approach, and poverty gap (USAID, 2020). Health indicators will focus on the number of individuals whose health improved, cases of death or sickness averted. Resilience will be assessed based on the improvement or reinforcement at the individual or household level.

Following Cochran et al. (2024), the cost effectiveness ratio is expressed as follow:

$$CER_i = \frac{Total\ IRP\ component\ costs_i}{Outcome\ measure_i} \quad (11)$$

with i represents the single intervention to yield *outcome measure*

For each outcome indicator, the difference or gain attributable to the IRP will be calculated using baseline or midline values as a reference. Endline values will be scaled up to reflect changes over time in both the intervention and control areas.

$$Outcome_{t,i,j} = baseline_Outcome_{t,i,j} - midline\ or\ extrapolate_Outcome_{t,i,j} \quad (12)$$

$$Outcome_{c,i,j} = baseline_Outcome_{c,i,j} - midline\ or\ extrapolate_Outcome_{c,i,j} \quad (13)$$

$$Outcome_{IRP_{i,j}} = Outcome_{t,i,j} - Outcome_{c,i,j} \quad (14)$$

Where t and c represent the situations with and without the IRP, respectively, and j denotes the outcome indicators (food security, health, school, malnutrition, capacity building, climate change indicators).

Based on available monitoring and evaluation systems and existing evaluation reports, we will review and identify relevant outcomes indicators that can serve as the principal indicators for each intervention (Table 5; Annex 4 and 5).

4. Data collection approach

Given the nature of the study, most data will be sourced from existing project-level datasets and documentation. Secondary data will be obtained from available materials related to the project's monitoring and evaluation (M&E) system. These include periodic progress reports, budget execution files, and impact evaluation documents such as baseline, midline, and endline studies. This existing documentation will provide foundational quantitative and qualitative information for conducting both cost-benefit analysis (CBA) and cost-effectiveness analysis (CEA).

To complement this secondary data, national consultants will carry out targeted visits to relevant reference institutions, such as health centers, schools, and research institutes, to gather additional contextual or technical data required for accurate modeling.

Primary data collection will focus specifically on the development of representative farm budgets across various productive sectors, including crop farming, livestock, and fishing. Within crop production, attention will be given to major crops such as sorghum, millet, maize, cowpea, vegetables, and rice. The analysis will also consider different land management and restoration techniques (e.g., half-moons, zai pits, stone bunds) and types of land development (e.g., degraded land restoration, lowland rehabilitation, irrigated gardens, and school gardens).

Rather than conducting household surveys or structured individual interviews, primary data will be collected through focus group discussions (FGDs) with key informants and beneficiary representatives. These discussions will be organized to co-develop detailed farm budgets for each sector, crop type, and land management practice. Depending on logistical feasibility and local conditions, two-day workshops may be organized at central locations to facilitate in-depth discussions and consensus-building among stakeholders.

The data collection process will apply standardized units to ensure consistency and comparability across sites. This includes estimating costs and revenues per hectare of cultivated land, per head of livestock, or per standard fishing unit. These standardized farm budgets will serve as critical inputs for the CBA and CEA models.

Table 5: Different outcomes for each intervention used for CEA

IRP Components	Indicators	Without IRP		With IRP		Outcomes
		Start	Reference year	Start	Reference year	
Food Assistance For Asset	Percentage of the population in targeted communities reporting benefits from an enhanced livelihood asset base					
	Percentage of FFA supported assets that demonstrate improved vegetation and soil conditions					
	Proportion of the population in targeted communities reporting environmental benefits					
Smallholder farmers Access To Market support (SAMs)	Value and volume of smallholder sales through WFP-supported aggregation systems					
	Average percentage of smallholder post-harvest losses at the storage stage					
	Percentage of targeted smallholder farmers reporting increased production of nutritious crops					
	Percentage of targeted smallholder farmers selling through WFP-supported farmer aggregation systems					
Capacity Strengthening	Transition strategy for school health and nutrition and school feeding developed with WFP support					
	Number of national policies, strategies, programmes and other system components contributing to zero hunger and other SDGs enhanced with WFP capacity strengthening support					
	Number of national policies, strategies, programmes and other system components relating to school health and nutrition/including school feeding enhanced/developed with WFP capacity strengthening support					
	Number of new or adapted policies and legislative instruments contributing to zero hunger and other SDGs endorsed with WFP capacity strengthening support					
Nutrition	Proportion of eligible population reached by nutrition preventive programme (coverage)					
	Proportion of target population who participate in an adequate number of distributions (adherence)					
	Proportion of children 6–23 months of age who receive a minimum acceptable diet (MAD)					
	Minimum diet diversity for women and girls of reproductive age (MDD-W)					

	Percentage of moderate acute malnutrition (MAM) cases reached by treatment services (coverage)					
	Moderate acute malnutrition (MAM) treatment performance rate (recovery, mortality, default and non-response)					
	Default rate of clients from anti-retroviral therapy, tuberculosis directly observed treatment (TB-DOTS) and prevention of mother-to-child transmission of HIV (PMTCT) programmes					
School Feeding	Retention rate/drop-out rate (by grade)					
	Attendance rate (complementary with UNICEF, UNESCO, World Bank)					
	Enrolment rate					
	Graduation/completion rate (complementary with UNICEF, UNESCO and the World Bank)					
	Systems Approach for Better Education Results (SABER) school feeding index					
Transversal outcomes						
Food Security and essential needs	Food consumption score					
	Consumption-based coping strategy index, reduced CSI (rCSI)					
	Livelihood coping strategies for food security (LCS-FS)					
	Economic capacity to meet essential needs					
	Livelihood coping strategies for essential needs (LCS-EN)					
	Food consumption score – nutrition					
Actions to protect against climate shocks	Climate adaptation benefit score					
	Climate resilience capacity score					
	Climate services score					
	Investment capacity index					

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Annex : Data collection tools

Annex 1. BAU, Zai, Stone bunds, Half-moon, Lowland developed, Irrigated gardens and school gardens

Annex 1.1. Land used for crop, vegetable, agroforestry and tree

For each crop and land development technique, data will be collected during interview with CO representative farmers within each site

Area developed and farmed (ha)	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Sorghum										
Millet										
Maize										
Cowpea										
Groundnut										
Bambara ground nut										
Sesame										
Cotton										
Rice										
Onions										
Tomatoes										
Okra										
Hibiscus										
Chili peppers										
Amaranth										
Vegetable leaf										
Mango										
Papaya										
Baobab										
Moringa										
Nere										
Shea										
Agroforestry firewood										
Agroforestry tree poles										
Timber tree										
Crop1										
Crop2										
Crop3										
Crop4										
Crop5										
Vegetable1										
Vegetable2										
Vegetable3										
Tree planting1										
Tree planting2										
Tree planting3										

Annex1.2. Crop, Vegetable, Agroforestry and Tree production per ha

For each crop and land development technique, data will be collected during interview with representative farmers within each site

Crop/vegetable/tree	Product			Subproduct		
	Unit	Quantity	Farmgate price	Unit	Quantity	Farmgate price
Sorghum						
Millet						
Maize						
Cowpea						
Groundnut						
Bambara ground nut						
Sesame						
Cotton						
Rice						
Onions						
Tomatoes						
Okra						
Hibiscus						
Chili peppers						
Amaranth						
Vegetable leaf						
Mango						
Papaya						
Baobab						
Moringa						
Nere						
Shea						
Agroforestry firewood						
Agroforestry tree poles						
Timber tree						
Crop1						
Crop2						
Crop3						
Crop4						
Crop5						
Vegetable1						
Vegetable2						
Vegetable3						
Tree planting1						
Tree planting2						
Tree planting3						

Annex 1.3. Input for Crop, Vegetable, Agroforestry and Tree production per ha

For each crop and land development technique, data will be collected during interview with representative farmers within each site

Crop/vegetable/tree	Inorganic fertilizer			Organic fertilizer		
	Unit	Quantity	Price	Unit	Quantity	Price
Sorghum						
Millet						
Maize						
Cowpea						
Groundnut						
Bambara ground nut						
Sesame						
Cotton						
Rice						
Onions						
Tomatoes						
Okra						
Hibiscus						
Chili peppers						
Amaranth						
Vegetable leaf						
Mango						
Papaya						
Baobab						
Moringa						
Nere						
Shea						
Agroforestry firewood						
Agroforestry tree poles						
Timber tree						
Crop1						
Crop2						
Crop3						
Crop4						
Crop5						
Vegetable1						
Vegetable2						
Vegetable3						
Tree planting1						
Tree planting2						
Tree planting3						

Annex 1.4. Input for Crop, Vegetable, Agroforestry and Tree production per ha

For each crop and land development technique, data will be collected during interview with representative farmers within each site

Crop/vegetable/tree	Herbicide			Pesticide		
	Unit	Quantity	Price	Unit	Quantity	Price
Sorghum						
Millet						
Maize						
Cowpea						
Groundnut						
Bambara ground nut						
Sesame						
Cotton						
Rice						
Onions						
Tomatoes						
Okra						
Hibiscus						
Chili peppers						
Amaranth						
Vegetable leaf						
Mango						
Papaya						
Baobab						
Moringa						
Nere						
Shea						
Agroforestry firewood						
Agroforestry tree poles						
Timber tree						
Crop1						
Crop2						
Crop3						
Crop4						
Crop5						
Vegetable1						
Vegetable2						
Vegetable3						
Tree planting1						
Tree planting2						
Tree planting3						

Annex 1.5. Input for Crop, Vegetable, Agroforestry and Tree production per ha

For each crop and land development technique, data will be collected during interview with representative farmers within each site

Crop/vegetable/tree	Improved seed			Local seed		
	Unit	Quantity	Price	Unit	Quantity	Price
Sorghum						
Millet						
Maize						
Cowpea						
Groundnut						
Bambara ground nut						
Sesame						
Cotton						
Rice						
Onions						
Tomatoes						
Okra						
Hibiscus						
Chili peppers						
Amaranth						
Vegetable leaf						
Mango						
Papaya						
Baobab						
Moringa						
Nere						
Shea						
Agroforestry firewood						
Agroforestry tree poles						
Timber tree						
Crop1						
Crop2						
Crop3						
Crop4						
Crop5						
Vegetable1						
Vegetable2						
Vegetable3						
Tree planting1						
Tree planting2						
Tree planting3						

Annex1.6. Labor for Crop, Vegetable, Agroforestry and Tree production per ha: Fertilizer application

For each crop and land development technique, data will be collected during interview with representative farmers within each site

	Inorganic fertilizer application			Organic fertilizer application		
Crop/vegetable/tree	Unit	Quantity	Price	Unit	Quantity	Price
Sorghum						
Millet						
Maize						
Cowpea						
Groundnut						
Bambara ground nut						
Sesame						
Cotton						
Rice						
Onions						
Tomatoes						
Okra						
Hibiscus						
Chili peppers						
Amaranth						
Vegetable leaf						
Mango						
Papaya						
Baobab						
Moringa						
Nere						
Shea						
Agroforestry firewood						
Agroforestry tree poles						
Timber tree						
Crop1						
Crop2						
Crop3						
Crop4						
Crop5						
Vegetable1						
Vegetable2						
Vegetable3						
Tree planting1						
Tree planting2						
Tree planting3						

Annex 1.7. Labor for Crop, Vegetable, Agroforestry and Tree production per ha: Herbicide and pesticide applications

For each crop and land development technique, data will be collected during interview with representative farmers within each site

	Herbicide application			Pesticide application		
Crop/vegetable/tree	Unit	Quantity	Price	Unit	Quantity	Price
Sorghum						
Millet						
Maize						
Cowpea						
Groundnut						
Bambara ground nut						
Sesame						
Cotton						
Rice						
Onions						
Tomatoes						
Okra						
Hibiscus						
Chili peppers						
Amaranth						
Vegetable leaf						
Mango						
Papaya						
Baobab						
Moringa						
Nere						
Shea						
Agroforestry firewood						
Agroforestry tree poles						
Timber tree						
Crop1						
Crop2						
Crop3						
Crop4						
Crop5						
Vegetable1						
Vegetable2						
Vegetable3						
Tree planting1						
Tree planting2						
Tree planting3						

Annex 1.8. Labor for Crop, Vegetable, Agroforestry and Tree production per ha: Sowing and land preparation

For each crop and land development technique, data will be collected during interview with representative farmers within each site

	Sowing			Land preparation		
Crop/vegetable/tree	Unit	Quantity	Price	Unit	Quantity	Price
Sorghum						
Millet						
Maize						
Cowpea						
Groundnut						
Bambara ground nut						
Sesame						
Cotton						
Rice						
Onions						
Tomatoes						
Okra						
Hibiscus						
Chili peppers						
Amaranth						
Vegetable leaf						
Mango						
Papaya						
Baobab						
Moringa						
Nere						
Shea						
Agroforestry firewood						
Agroforestry tree poles						
Timber tree						
Crop1						
Crop2						
Crop3						
Crop4						
Crop5						
Vegetable1						
Vegetable2						
Vegetable3						
Tree planting1						
Tree planting2						
Tree planting3						

Annex 1.9. Labor for Crop, Vegetable, Agroforestry and Tree production per ha: Weeding and harvesting

For each crop and land development technique, data will be collected during interview with representative farmers within each site

	Weeding			Harvesting		
Crop/vegetable/tree	Unit	Quantity	Price	Unit	Quantity	Price
Sorghum						
Millet						
Maize						
Cowpea						
Groundnut						
Bambara ground nut						
Sesame						
Cotton						
Rice						
Onions						
Tomatoes						
Okra						
Hibiscus						
Chili peppers						
Amaranth						
Vegetable leaf						
Mango						
Papaya						
Baobab						
Moringa						
Nere						
Shea						
Agroforestry firewood						
Agroforestry tree poles						
Timber tree						
Crop1						
Crop2						
Crop3						
Crop4						
Crop5						
Vegetable1						
Vegetable2						
Vegetable3						
Tree planting1						
Tree planting2						
Tree planting3						

Annex 1.10. Transport and logistics, Vegetable, Agroforestry and Tree production per ha

For each crop and land development technique, data will be collected during interview with representative farmers within each site

	Transport			Logistic and other costs		
Crop/vegetable/tree	Description	Unit	Unit cost	Description	Unit	Unit cost
Sorghum						
Millet						
Maize						
Cowpea						
Groundnut						
Bambara ground nut						
Sesame						
Cotton						
Rice						
Onions						
Tomatoes						
Okra						
Hibiscus						
Chili peppers						
Amaranth						
Vegetable leaf						
Mango						
Papaya						
Baobab						
Moringa						
Nere						
Shea						
Agroforestry firewood						
Agroforestry tree poles						
Timber tree						
Crop1						
Crop2						
Crop3						
Crop4						
Crop5						
Vegetable1						
Vegetable2						
Vegetable3						
Tree planting1						
Tree planting2						
Tree planting3						

Annex 1.11. Fixed cost: Vegetable, Agroforestry and Tree production per ha

For each crop and land development technique, data will be collected during interview with representative farmers within each site.

	Depreciation of irrigation system equipment		Depreciation of other equipment and tools	
Crop/vegetable/tree	Description	Unit cost	Description	Unit cost
Sorghum				
Millet				
Maize				
Cowpea				
Groundnut				
Bambara ground nut				
Sesame				
Cotton				
Rice				
Onions				
Tomatoes				
Okra				
Hibiscus				
Chili peppers				
Amaranth				
Vegetable leaf				
Mango				
Papaya				
Baobab				
Moringa				
Nere				
Shea				
Agroforestry firewood				
Agroforestry tree poles				
Timber tree				
Crop1				
Crop2				
Crop3				
Crop4				
Crop5				
Vegetable1				
Vegetable2				
Vegetable3				
Tree planting1				
Tree planting2				
Tree planting3				

Annex 1.12. Fixed cost: Vegetable, Agroforestry and Tree production per ha

For each crop and land development technique, data will be collected during interview with representative farmers within each site

	Reparation and maintenance		Other fixed cost	
Crop/vegetable/tree	Description	Unit cost	Description	Unit cost
Sorghum				
Millet				
Maize				
Cowpea				
Groundnut				
Bambara ground nut				
Sesame				
Cotton				
Rice				
Onions				
Tomatoes				
Okra				
Hibiscus				
Chili peppers				
Amaranth				
Vegetable leaf				
Mango				
Papaya				
Baobab				
Moringa				
Nere				
Shea				
Agroforestry firewood				
Agroforestry tree poles				
Timber tree				
Crop1				
Crop2				
Crop3				
Crop4				
Crop5				
Vegetable1				
Vegetable2				
Vegetable3				
Tree planting1				
Tree planting2				
Tree planting3				

Annex 1.13. Fixed cost: Vegetable, Agroforestry and Tree production per ha

For each crop and land development technique, data will be collected during interview with representative farmers within each site

	Land rent or lease			
Crop/vegetable/tree	Description	Unit cost		
Sorghum				
Millet				
Maize				
Cowpea				
Groundnut				
Bambara ground nut				
Sesame				
Cotton				
Rice				
Onions				
Tomatoes				
Okra				
Hibiscus				
Chili peppers				
Amaranth				
Vegetable leaf				
Mango				
Papaya				
Baobab				
Moringa				
Nere				
Shea				
Agroforestry firewood				
Agroforestry tree poles				
Timber tree				
Crop1				
Crop2				
Crop3				
Crop4				
Crop5				
Vegetable1				
Vegetable2				
Vegetable3				
Tree planting1				
Tree planting2				
Tree planting3				

Annex 1.14. Yield change over year: Vegetable, Agroforestry and Tree production per ha

For each crop and land development technique, data will be collected during interview with representative farmers within each site

	Yield	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Crop/vegetable/tree	Initial level per ha									
Sorghum										
Millet										
Maize										
Cowpea										
Groundnut										
Bambara ground nut										
Sesame										
Cotton										
Rice										
Onions										
Tomatoes										
Okra										
Hibiscus										
Chili peppers										
Amaranth										
Vegetable leaf										
Mango										
Papaya										
Baobab										
Moringa										
Nere										
Shea										
Agroforestry firewood										
Agroforestry tree poles										
Timber tree										
Crop1										
Crop2										
Crop3										
Crop4										
Crop5										
Vegetable1										
Vegetable2										
Vegetable3										
Tree planting1										
Tree planting2										
Tree planting3										

Annex 2. Livestock**Annex 2.1. Evolution of livestock**

	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Bovine										
Goat										
Sheep										
Swine										
Poultry										
Livestock1										
Livestock2										
Livestock3										
Livestock4										
Livestock5										

Annex 2.2. Evolution of livestock and subproduct sale

	Livestock numbers										Unit	Price
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10		
Bovine												
Goat												
Sheep												
Swine												
Poultry												
Bovine milk												
Goat milk												
Sheep milk												
Livestock1												
Livestock2												
Livestock3												
Livestock4												
Livestock5												
Bovine byproduct												
Goat byproduct												
Sheep byproduct												
Swine byproduct												
Poultry byproduct												
Livestock1 byproduct												
Livestock2 byproduct												
Livestock3 byproduct												
Livestock4 byproduct												
Livestock5 byproduct												

Annex 2.3. Evolution of livestock purchase

	Livestock numbers										Unit	Price
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10		
Bovine												
Goat												
Sheep												
Swine												
Poultry												
Livestock1												
Livestock2												
Livestock3												
Livestock4												
Livestock5												

Annex 2.4. Per capita feeding, supplements, and veterinary for livestock

	Average feeding		Average Supplements		Veterinary	
	Quantity	Unit cost	Quantity	Unit cost	Quantity	Unit cost
Bovine						
Goat						
Sheep						
Swine						
Poultry						
Livestock1						
Livestock2						
Livestock3						
Livestock4						
Livestock5						

Annex 2.5. Per capita health care, labor, and water access for livestock

	Average Health care		Average labor		Family labor		Water access	
	Quantity	Unit cost	Number	Unit cost	Number	Unit cost	Number	Unit cost
Bovine								
Goat								
Sheep								
Swine								
Poultry								
Livestock1								
Livestock2								
Livestock3								
Livestock4								
Livestock5								

Annex 2.6. Per capita transport, marketing and other variable costs for livestock

	Transport		Marketing		Other variable cost	
	Number	Unit cost	Number	Unit cost	Number	Unit cost
Bovine						
Goat						
Sheep						
Swine						
Poultry						
Livestock1						
Livestock2						
Livestock3						
Livestock4						
Livestock5						

Annex 2.7. Per capita housing/shelter, feeder, waterer depreciation for livestock

	Housing/shelter		Feeder		Waterer		Other equipment	
	Number	Unit cost	Number	Unit cost	Number	Unit cost	Number	Cost
Bovine								
Goat								
Sheep								
Swine								
Poultry								
Livestock1								
Livestock2								
Livestock3								
Livestock4								
Livestock5								

Annex 3. Fishing**Annex 3.1. Evolution of fishing area or infrastructure (fishing hole, floating boat, pond, etc.)**

	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Tilapia										
Catfish										
Fish1										
Fish2										
Fish3										
Fish4										
Fish5										
Fish6										
Fish7										
Fish8										

Annex 3.2. Evolution of fish and subproduct sale

	Livestock numbers										Unit	Price
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10		
Tilapia sale												
Catfish sale												
Fish1 sale												
Fish2 sale												
Fish3 sale												
Fish4 sale												
Fish5 sale												
Fish6 sale												
Fish7 sale												
Fish8 sale												
Tilapia byproduct												
Catfish byproduct												
Fish1 byproduct												
Fish2 byproduct												
Fish3 byproduct												
Fish4 byproduct												
Fish5 byproduct												
Fish6 byproduct												
Fish7 byproduct												
Fish8 byproduct												

Annex 3.3. Evolution of fingerlings purchase

	Livestock numbers										Unit	Price
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10		
Tilapia fingerlings												
Catfish fingerlings												
Fish1 fingerlings												
Fish2 fingerlings												
Fish3 fingerlings												
Fish4 fingerlings												
Fish5 fingerlings												
Fish6 fingerlings												
Fish7 fingerlings												
Fish8 fingerlings												

Annex 3.4. Per capita feeding, labor, and veterinary for livestock

	Average feeding		Average labor		Medicine & Disease control	
	Quantity	Unit cost	Number	Unit cost	Quantity	Unit cost
Tilapia						
Catfish						
Fish1						
Fish2						
Fish3						
Fish4						
Fish5						
Fish6						
Fish7						
Fish8						

Annex 3.5. Per capita transport, marketing and other variable costs for fishing

	Transport		Marketing		Repair & maintenance		Other variables Cost
	Number	Unit cost	Number	Unit cost	Number	Unit cost	
Tilapia							
Catfish							
Fish1							
Fish2							
Fish3							
Fish4							
Fish5							
Fish6							
Fish7							
Fish8							

Annex 3.6. Per capita pond, borehole, pump, irrigation canal depreciation for fishing

	Pond		Borehole		Pump		Irrigation canal	
	Number	Unit cost	Number	Unit cost	Number	Unit cost	Number	Cost
Tilapia								
Catfish								
Fish1								
Fish2								
Fish3								
Fish4								
Fish5								
Fish6								
Fish7								
Fish8								

Annex 3.7. Per capita net, aerator, feeder, testing kit canal depreciation for fishing

	Net		Aerator		Feeder		Testing kit	
	Number	Unit cost	Number	Unit cost	Number	Unit cost	Number	Cost
Tilapia								
Catfish								
Fish1								
Fish2								
Fish3								
Fish4								
Fish5								
Fish6								
Fish7								
Fish8								

Annex 3.8. Per capita stockage kit, smoking/drying kit, other equipment depreciation for fishing

	Stockage kit		Smoking/drying kit		Other equipment	
	Number	Unit cost	Number	Unit cost	Number	Unit cost
Tilapia						
Catfish						
Fish1						
Fish2						
Fish3						
Fish4						
Fish5						
Fish6						
Fish7						
Fish8						

Annex 4. Outcome indicators with IRP

IRP Components	Indicators	With IRP	
		Start	Reference year
Food Assistance For Asset	Percentage of the population in targeted communities reporting benefits from an enhanced livelihood asset base		
	Percentage of FFA supported assets that demonstrate improved vegetation and soil conditions		
	Proportion of the population in targeted communities reporting environmental benefits		
Smallholder farmers Access To Market support (SAMs)	Value and volume of smallholder sales through WFP-supported aggregation systems		
	Average percentage of smallholder post-harvest losses at the storage stage		
	Percentage of targeted smallholder farmers reporting increased production of nutritious crops		
	Percentage of targeted smallholder farmers selling through WFP-supported farmer aggregation systems		
Capacity Strengthening	Transition strategy for school health and nutrition and school feeding developed with WFP support		
	Number of national policies, strategies, programmes and other system components contributing to zero hunger and other SDGs enhanced with WFP capacity strengthening support		
	Number of national policies, strategies, programmes and other system components relating to school health and nutrition/including school feeding enhanced/developed with WFP capacity strengthening support		
	Number of new or adapted policies and legislative instruments contributing to zero hunger and other SDGs endorsed with WFP capacity strengthening support		
Nutrition	Proportion of eligible population reached by nutrition preventive programme (coverage)		
	Proportion of target population who participate in an adequate number of distributions (adherence)		
	Proportion of children 6–23 months of age who receive a minimum acceptable diet (MAD)		
	Minimum diet diversity for women and girls of reproductive age (MDD-W)		
	Percentage of moderate acute malnutrition (MAM) cases reached by treatment services (coverage)		
	Moderate acute malnutrition (MAM) treatment performance rate (recovery, mortality, default and non-response)		
	Default rate of clients from anti-retroviral therapy, tuberculosis directly observed treatment (TB-DOTS) and prevention of mother-to-child transmission of HIV (PMTCT) programmes		
School Feeding	Retention rate/drop-out rate (by grade)		
	Attendance rate (complementary with UNICEF, UNESCO, World Bank)		
	Enrolment rate		

	Graduation/completion rate (complementary with UNICEF, UNESCO and the World Bank)		
	Systems Approach for Better Education Results (SABER) school feeding index		
Food Security and essential needs	Food consumption score		
	Consumption-based coping strategy index, reduced CSI (rCSI)		
	Livelihood coping strategies for food security (LCS-FS)		
	Economic capacity to meet essential needs		
	Livelihood coping strategies for essential needs (LCS-EN)		
	Food consumption score – nutrition		
Actions to protect against climate shocks	Climate adaptation benefit score		
	Climate resilience capacity score		
	Climate services score		
	Investment capacity index		

Annex 5. Outcome indicators without IRP

		Without IRP	
IRP Components	Indicators	Start	Reference year
Food Assistance For Asset	Percentage of the population in targeted communities reporting benefits from an enhanced livelihood asset base		
	Percentage of FFA supported assets that demonstrate improved vegetation and soil conditions		
	Proportion of the population in targeted communities reporting environmental benefits		
Smallholder farmers Access To Market support (SAMs)	Value and volume of smallholder sales through WFP-supported aggregation systems		
	Average percentage of smallholder post-harvest losses at the storage stage		
	Percentage of targeted smallholder farmers reporting increased production of nutritious crops		
	Percentage of targeted smallholder farmers selling through WFP-supported farmer aggregation systems		
Capacity Strengthening	Transition strategy for school health and nutrition and school feeding developed with WFP support		
	Number of national policies, strategies, programmes and other system components contributing to zero hunger and other SDGs enhanced with WFP capacity strengthening support		
	Number of national policies, strategies, programmes and other system components relating to school health and nutrition/including school feeding enhanced/developed with WFP capacity strengthening support		
	Number of new or adapted policies and legislative instruments contributing to zero hunger and other SDGs endorsed with WFP capacity strengthening support		
Nutrition	Proportion of eligible population reached by nutrition preventive programme (coverage)		
	Proportion of target population who participate in an adequate number of distributions (adherence)		
	Proportion of children 6–23 months of age who receive a minimum acceptable diet (MAD)		
	Minimum diet diversity for women and girls of reproductive age (MDD-W)		
	Percentage of moderate acute malnutrition (MAM) cases reached by treatment services (coverage)		
	Moderate acute malnutrition (MAM) treatment performance rate (recovery, mortality, default and non-response)		
	Default rate of clients from anti-retroviral therapy, tuberculosis directly observed treatment (TB-DOTS) and prevention of mother-to-child transmission of HIV (PMTCT) programmes		
School Feeding	Retention rate/drop-out rate (by grade)		
	Attendance rate (complementary with UNICEF, UNESCO, World Bank)		
	Enrolment rate		

	Graduation/completion rate (complementary with UNICEF, UNESCO and the World Bank)		
	Systems Approach for Better Education Results (SABER) school feeding index		
Food Security and essential needs	Food consumption score		
	Consumption-based coping strategy index, reduced CSI (rCSI)		
	Livelihood coping strategies for food security (LCS-FS)		
	Economic capacity to meet essential needs		
	Livelihood coping strategies for essential needs (LCS-EN)		
	Food consumption score – nutrition		
Actions to protect against climate shocks	Climate adaptation benefit score		
	Climate resilience capacity score		
	Climate services score		
	Investment capacity index		