Irrigation is a key driver of economic growth as it improves agricultural production, strengthens rural development, and increases resilience to climate change by bridging the gap between crop water requirements and precipitation.

Moreover, irrigation could increase the country·s GDP by 0.8 percent per year through agricultural productivity gains (World Bank, 2022).

Limited use of efficient on-farm irrigation technologies is also contributing to low water productivity, as they are not yet widely available or used throughout the country.

In addition, many lack information and training necessary to grow their businesses and gain improved access to markets.

On average, only 60 percent of irrigation investments were fully executed, with efficient irrigation systems installed in only about 1 percent.

Irrigation investments are often made without considering the broader hydrological and hydrogeological context.

As a result, the Government of Peru (GoP) prioritized the rollout of efficient irrigation interventions as part of its development agenda, given the direct impact of irrigation on reducing poverty and enhancing food security for Peru's poorest in rural areas. Public sector financing is required as the targeted beneficiaries have limited capacity to access efficient irrigation infrastructure and technology given their high capital cost and relatively low revenue from farmers· existing production. Accompanying sustainable agronomic practices are also expected increase the efficiency of water use by maintaining soil health and conserving its moisture, thereby leading to improved productivity and resilience to shocks.

Technical Assistance (TA) and training are necessary for ensuring the positive impact of technological adoption and technical sustainability of irrigation systems through their improved management, given the general lack of TA and training services for farmers in Peru[2], reaching 11 percent of the total agricultural producers nationwide and 5 percent of small- and medium-sized farmers.[3] The Sierra Irrigation Subsector Project (P104760), which extended access to TA, training, and efficient irrigation systems to farmers in the Sierra regions, demonstrated the effectiveness of such investments on poverty reduction for rural populations in areas implemented.

The PSI·s objective is to improve agricultural water productivity by: (i) expanding the use of efficient irrigation technologies and on-farm practices to promote the efficient and sustainable use of water for irrigation; (ii) supporting the development and strengthening of the management capacity of WUOs and of Farmer Groups (FGs) in irrigation hydraulic blocks.

Regional and Local Governments (·Gobiernos Regionales· and ·Gobiernos Locales·) are responsible for planning and promoting irrigation development [32][33] within their jurisdictions and managing both self and externally financed program resources. These subnational (regional and local) governments apply relevant standards and policies to the design and implement sector investments.

The National Water Authority (Autoridad Nacional del Agua [ANA]) oversees improvement of water resource management across the country and operates through its decentralized agencies.[34][35] This includes a deficiency in accounting for both upstream and downstream users of water, particularly those impacted by irrigation investments and

[2] 5 De Nys, E., Hidrogo, C., Lajaunie, M., Chinarro, L. 2013.

28585, seeks to promote ·irrigation systems that allow the rational and efficient use of water to increase agricultural productivity·.

Farmer Groups (FGs) (Grupos de Gestión de Riego Tecnificado [GGRT]) manage sub-projects and comprise producers at the lower-level sections of a hydraulic block.

FGs were established for the purpose of managing ·technified· irrigation at each sub-project level to ensure that the water needs of each farmer are met and that their section of the block remains in good condition.

After several years of discussion and planning, and a careful analysis of the above-mentioned challenges, the GoP decided to reinforce its engagement in modern irrigation water management and seek World Bank support in the form of the proposed Project, to assist them with investments in, and uptake of technified irrigation approaches.

Farmers who participated in the Sierra Project reported 25 to 500 percent increases in net household income per hectare from improved water availability through advances in off-farm irrigation schemes and on-farm technology and agronomic practices used.

The Project is also aligned with the Ministry of Agriculture·s (MIDAGRI) comprehensive national climate adaptation strategy for the agriculture sector, with measures related to building resilience and maintaining productivity, including investing in irrigation infrastructure and site-specific land-use planning to mitigate water scarcity.

The Project is also aligned with the public investment recommendation of Peru·s Climate Country Diagnostic Report·s (CCDR) to improve access to efficient irrigation systems to build resilience in the agriculture sector and boost economic growth while protecting vulnerable populations.

By promoting water use efficiency and developing improved irrigation infrastructure, the operation is expected to enhance agricultural productivity and increase farmer revenues in targeted areas with positive impacts on water and food security.

The Project is also closely aligned with the World Bank's strategic framework for moving "From Crisis Response towards Green, Resilient, and Inclusive Development" (GRID) · directly supporting its Pillar 4: ·Strengthening Policies, Institutions, and Investments for Rebuilding Better,· and the goal of the World Bank Group·s 2021-2025 Climate Change Action Plan of aligning climate and development goals while boosting growth. Moreover, the Project complements the Bank's ongoing and pipeline programs to support sustainable and inclusive growth in Peru and builds on the Bank's longstanding policy dialogues in these areas.

2) Regional Governments (GOREs) that have at least 500 hectares of ·technified· irrigation projects in their respective multiannual investment portfolios.

PDO 2: Improve the productivity of water on family farms in selected areas that are vulnerable to climate change.

5) Increase in agricultural water productivity on family farms in areas vulnerable to climate change[42] (Percent)

The proposed Project is a US$126.0 million Investment Project Financing (IPF) operation, financed by a US$100.0 million IBRD loan and US$26.0 million in counterpart funds.

Proposed interventions are grouped around the following three components: (i) Component A: Irrigation Investments for Climate Resilient Agriculture; (ii) Component B: Institutional Strengthening for Effective and Sustainable Irrigation Services; and (iii) Component C: Project Management and Interagency Coordination.[43]

32. Component A: Technified Irrigation Projects (US$ 106.7 million, of which US$89.5 million is financed by the IBRD). Component A aims to improve water delivery services for irrigation and agricultural water productivity in 130 selected and prioritized subprojects covering a total of 8,014.38 hectares · involving 130 FGs (GGRTs) [44] · and serving 7,767 producer households (thereby reaching an estimated total of 24,128 beneficiaries).

The investments comprise improvements to existing irrigation schemes.

Modernization of Communal (Off-Farm) Irrigation Systems. This subcomponent aims to modernize existing off-farm irrigation schemes within designated hydraulic blocks by converting open canals to pressurized gravity-based pipe[46] networks in areas with natural slope[47] (refer to points 1-5 in Figure 1).

Such modernization of off-farm irrigation infrastructure, coupled with their enhanced management is expected to improve the reliability of water supply to farmers, facilitate diversification toward higher-value crops, and increase resilience to water supply variability exacerbated climate change.

Water productivity can be assessed at the level of (i) total yields (biomass · kg/m 3), (ii) marketable yields (kg/m 3), and (iii) their market value (PEN).

This subcomponent aims to support farmers in increasing their agricultural water productivity by improving the efficiency of water applied to crops at the farm level through the installation of advanced on-farm irrigation systems.

drip irrigation, sprinklers, micro sprinklers), land leveling, lateral pipes, equipment for improved control and regulation of water flow, and flow rate measuring devices for improved monitoring; (ii) development of feasibility studies, detailed designs, and environmental and social instruments; (iii) monitoring and supervision of civil works; and (iv) implementation of the ESMP, including reforestation activities to improve soil moisture and environmental base flow, increase efficiency of sprinkler and micro-sprinkler systems, and increase the sustainability of the hydraulic blocks. This subcomponent will be financed through a cost-sharing arrangement with farmers following the National ·Technified· Irrigation Program (NTIP) guidelines.

This subcomponent aims to strengthen the capacity of FGs participating in subprojects under Subcomponents A.1 and A.2 to ensure the sustainability of the investments in their subprojects and increase water productivity in their hydraulic blocks through TA, capacity building, and knowledge sharing activities. The assistance will be centered on the following three main areas: (i) MOM of the irrigation systems in the respective hydraulic blocks; (ii) strengthening the capacities of the farmers; (iii) improving the productive and efficient use of natural resources at their disposal by adopting sustainable agronomic practices;[51] and (vi) helping establish WUOs with a balanced representation and participation of female and male farmers to leverage economies of scale, strengthen commercial management, and connect with national and international markets.[52]

37. The combined investments in ·technified· irrigation systems, TA and capacity building as part of Component A are expected to increase farmers· resilience to water variability caused by climate change and avoid significant decreases in crop yields.[53] Adequate irrigation water delivery is critical for enabling farmers to cope with the climate-exacerbated occurrences of floods, droughts, and frost, to increase crop yields, and to grow higher value crops.

[51] Improved irrigation can increase the yields of most crops by up to 100 percent as well as improve grazing land and pastures.

To complement Component A·s interventions at the hydraulic block level, this Component focuses on providing scaled-up support to improve water services for irrigation at the local (scheme level), and subnational (regional government), and national levels. Instead, it aims to strengthen the capacity of WUOs (water user boards, commissions, and committees) as well as of subnational governments to strategically support the newly created FGs and extend access to ·technified· irrigation solutions throughout Peru.

This subcomponent is designed to improve water management and administration by WUOs to mitigate climate-exacerbated floods, droughts, and frost in the WUOs· areas of influence, promote adequate O&M of their hydraulic assets, and support efficient use of water for irrigation through

[4 These practices will focus on sustainably increasing productivity and income while helping mitigate and adapt to climate change impacts through carbon sequestration and increasing the efficiency of water use on-farm.

Specific activities include: (i) updating and implementing key technical instruments, including water distribution plans, O&M plans, asset management plans; (ii) the installation of water control and measuring devices coupled with TA on water efficiency and accounting assessments; (iii) the implementation of demonstration parcels to promote the conversion to ·technified· irrigation systems among other FGs; and (iv) development of potential water tariff restructuring strategies following improvements in services.

Subcomponent B.2: TA to Subnational Governments for the Scaling Up of Improved Irrigation Investments. It aims to build the capacity of subnational governments to expand the use of ·technified· irrigation systems in the 19 regions where the 130 subprojects under Component A are located (see Map in Annex 3). Activities include: (i) capacity building in the management and administration of water resources for agricultural purposes; (ii) strengthening the ability of Regional Agrarian Departments (Dirección Regional de Agricultura [DRA]) and Planning Directorates (Dirección de Planificación) of subnational governments to carry out the O&M of ·technified· irrigation systems; (iii) strengthen capacities for the planning and management of regional ·technified· irrigation.[56]

43. To contribute to the achievement of a sustainable nexus between water resources management and sustained or increased agricultural productivity in new investments (scale-up), this subcomponent will consider specific measures to assist in: (i) the consideration of integrated water storage solutions and comprehensive water resources planning at the watershed level; (ii) the presentation of an irrigation smart subsidy program that focuses on small farmers in an effort to provide incentives for the adoption of ·technified· on-farm irrigation systems and water management practices that conserve soil moisture and reduce polluting effects of crop cultivation; and (iii) improving resilience-based planning with the use of hydro-agro informatics, generated by MIDAGRI's information systems that will allow performance or impact assessments of irrigation and agricultural systems in targeted sub-watersheds, also informing O&M irrigation assets.

This includes a close collaboration between the Project and respective sector entities to incorporate lessons learned from the Project·s implementation into the following activities.[57] (i) updating of irrigation policies to strengthen, among others, the integration of Water Resources Management at basin level as part of the scaling up of ·technified· irrigation; redesigning of Budget Program PP0042 to update its operational model and indicators of with a focus on integrality and complementarity at the basin level; (iii) the improvement of a geographic information system, which MIDAGRI is currently developing.

The component will support capacity building on financial, environmental, social, and

[56] These activities assist with strengthening the capacity for the regional and local governments to prepare and manage investments. A 2020 report from PSI shows the lag in project implementation at the Regional and Local governments, where it was reported that only 20 percent of the programmed investment was executed (Inversiones en Riego Tecnificado Parcelario 2012/2019.

The Project will directly benefit 130 FGs serving 7,767 farmer families cultivating 8,014.38 hectares (with the total number of beneficiaries is estimated at 24,128 persons) with improved irrigation systems and relevant capacity building.

The Project·s efforts to strengthen irrigation strategies at the regional and national levels, which will foster the extension of efficient irrigation solutions, are also expected to generate future benefits for residents living outside of the Project·s target areas.

The success of the improved irrigated water services (PDO1) directly contributes to the success of the improved agricultural water use productivity (PDO2), since without adequate provision of irrigated water, the on-farm investments would be rendered ineffective.

The improvement of irrigation schemes is expected to enable optimal usage of water (according to crop water requirements [21]) and of other agricultural inputs and practices, thereby potentially facilitating increases in cropping intensity and changing of cropping patterns toward higher-value crops (in nutritional content and monetary value).

These investments are accompanied by technical assistance and capacity building to FGs (subcomponent A.3) and WUOs (subcomponent B.1), which are expected to allow for better management of water resources and investments in technified irrigation. As a result, farmers will increase their capacity to improve their production during the dry season, build their resilience to various climatic phenomena such as droughts, rising temperatures, and frost, and improve their incomes and livelihoods.

The Project·s critical assumptions include: (i) adequate availability of water for the irrigation schemes; (ii) that the TA activities will result in significant uptake by farmers in terms of utilizing irrigation schemes correctly and increasing their focus on productivity; (iii) that local contractors (construction and TA) will have sufficient technical capacity; and (iv) that counterpart funds from farmers will materialize.

The Bank is a key and long-standing partner for Peru's water and agriculture sectors and brings global knowledge, technical expertise, and innovative approaches to this proposed investment Project.

The project extended access of farmers to efficient irrigation

The WSD identified the need to prioritize the upgrade and expansion of efficient irrigation and drainage systems, especially for small and medium-sized family farms in areas with high seasonal water variability.

To maximize on the impact and sustainability of the Project, technification of collective irrigation schemes as well as on farm are integrated within the same territory of a hydraulic unit (subproject) associating the irrigation modernization with WUOs.

The Sierra projects showed that projects aiming to improve small-scale farmers· production and commercial orientation should encourage beneficiary engagement and build capacity among organizations such as FGs.

Both Sierra projects demonstrated that training and TA interventions are necessary for the technical sustainability of investments into irrigation infrastructure and to improve irrigation management.

Based on the lessons learned, the proposed Project aims to work with FGs to increase the technical sustainability of the investments in the medium and long term, including ensuring the funds for the maintenance and replacement of irrigation equipment and materials.

This is based on the successes under the two previous Sierra projects (P104760 and P079165) of providing group-centered TA to beneficiaries for increasing the productive capacity of individual households and promoting the application of adequate agronomic practices for the overall performance and sustainability of agricultural production under irrigation.

While previously, the ·lost· water might have functioned as an inflow to the water source downstream, this process could be undermined when ·freed-up· water in the upstream system is potentially repurposed for additional irrigation water, either by expanding irrigated areas or by growing crops with a higher water consumption.

Since its inception in 1997, PSI has carried out 680 technical irrigation projects that have benefited 10,497 farmers nationwide (PSI, 2017). The PSI to implement an irrigation program along the Costa that had the objective of improving the existing irrigation infrastructure, promoting efficient irrigation, and providing training to WUOs.

The PSI currently works nationwide through its seven regional offices [8] on the implementation of irrigation projects. The PSI is headquartered in Lima and has departments focused on: (i) administration and financing; (ii) infrastructure; (iii) irrigation management; and (iv) planning, budgeting and M&E.

The PSI has successfully implemented investment projects with development institutions for many years.

The Project·s combination of hard and soft investments also builds sustainability from a financial perspective; the FGs· access to irrigated agriculture will permit more reliable production of higher value crops, and the development and implementation of business plans will encourage strategic planning to successfully connect with national and international markets. The FGs· increased income will increase their capacity to pay for the WUO·s irrigated water services (this will be amplified by greater willingness to pay given the Project·s investments to improve service), building the financial sustainability of the WUOs· operations as well.

The efficient irrigation systems developed under the Project will build the capacity of FGs to produce crops utilizing less water, increasing the FGs· resilience to droughts and other climate change-induced events, and are projected to improve the system·s resilience against water stress and climate-induced disasters such as droughts by reducing average water deficits from -34 percent to zero.

Finally, the Project·s investments at the subnational and national level promote the scaling up of investments and the strengthening of sector strategies that will build their institutional capacity to provide support to FGs and WUOs after the closing of the Project.

Component A aims to improve water services for irrigation and agricultural water productivity in 130 selected subprojects with a total of 8,014.38 hectares, benefitting 130 FGs. This component is divided into three subcomponents: (i) construction and improvement of off-farm irrigation systems; (ii) construction of on-farm, efficient irrigation systems; and (iii) TA and capacity building for the user organization.

From an infrastructure quality perspective, the subprojects with detailed designs are considered as suitable to be procured under a lump sum contract, considering that the designs, technical and graphic information, technical specifications, desegregated quantities, and itemization of the offer are well detailed.

The study utilized information related to all relevant technical, economic, and financial characteristics and provides a sound rationale for the expected benefits, in line with the Project·s objective.

In summary, the Project's immediate benefits are also expected to extend beyond the Project's targeted area in the long-term given the Project's support for the preparation and implementation of a portfolio of efficient irrigation projects with regional and local governments and the strengthening of national policies for efficient irrigation and water resource management. Project costs include capital investment costs, O&M costs of the irrigation systems, and crop production costs (inputs and labor costs).

The Project's immediate benefits are tied to the increase in productivity associated with the provision of efficient irrigation systems on over 8,014.38 hectares of agricultural land. With access to efficient irrigation systems and sustainable agronomic practices (known as climate smart, regenerative, and conservation agriculture) farmers are expected to utilize water more efficiently and better withstand climatic stresses (e.g., droughts, erratic rainfall patterns, frost). Additionally, it is expected that farmers will be able to grow higher-value crops, reduce labor costs, and thereby increase their incomes while ensuring food security. The quantifiable Project benefits are linked mainly to the additional income of producers that are impacted by the sub-projects (Component A).

A standard cost-benefit analysis (CBA)[10] was performed with a 20-year horizon to assess the financial and economic merit of the Project by quantifying all incremental costs and benefits directly attributed to the Project. Financial and economic benefits were assessed for important agricultural crops with the potential for the development of value chains. Moreover, as part of the elaboration of each subproject design, the PSI will carry out a CBA for each of the 130 subprojects during implementation.

As part of the economic and financial analysis, each of the sample subprojects considered 8 crops under their production schemes.[11] These eight crops comprise the cropping systems that will be improved through the Project·s implementation and will determine the financial profitability of each subproject.

[10] A cost-benefit analysis will be carried out for each subproject as part of the feasibility studies as per national investment guidelines.

The model calculates incremental net benefits over a period of 20 years, holding constant the input and output prices t capture the effect of the change in production

In the ·with project· scenario, it is assumed that the

The model calculates incremental net benefits o
The model calculates incremental net benefits o
inputs.

For a 20-year horizon, the incremental economic benefit for the entire Project is estimated to be US$60.6 million, with an EIRR of 17.2 percen The flow of annual incremental net benefits calculated over a 20-year period, considered an economic discount rate [74] of 8 percent that is compatible with the maturation time of principal investments.

The CBA assessed the economic viability of the production models proposed by the Project, considering economic prices (shadow prices,[75] and economic value of carbon

[76] The total cost of the Project is estimated at US$126.0 million.[77] For a 20-year horizon, the incremental economic benefit for the entire Project is estimated to be US$60.6 million (representing the net present value [NPV],[78] of agricultural production, with an EIRR of 17.2 percent.

To ensure the long-term robustness of the economic behavior of the Project, a sensitivity analysis was performed to evaluate how the economic indicators of the overall Project change with: (i) reductions in yields; (ii) delays in benefit generation; (iii) cost overruns; and (iv) changes in the shadow price of carbon The results of the sensitivity analysis showed the Project·s overall NPV still presenting a positive economic return even when considering a delay in the generation of benefits of 3 years, a significant cost overrun, or a 5 percent reduction of expected benefits.

In addition to the Bank·s economic assessment, the PSI prepared an economic evaluation to comply with Peru·s public investment system, InviertePE. The evaluation models profitability indicators based on the expected effects of the Project on the yields, the incremental investment costs, and O&M costs.

[73] The economic internal rate of return (EIRR) produced by a CBA compares the economic costs and benefits of a project and provides information about the real yield of a long capital investment.

[74] Discounting expresses future costs and benefits at today·s equivalent value to account for inflation and risk.

[75] Shadow prices assume that all resources in the economy were optimally allocated and reflect the true social and economic value to society of the goods and services that the project utilizes to generate its benefits.

[76] Net incremental benefits were summed across each of the production models, and then multiplied by a scaling factor, defined as the share of the total project area that these subprojects represent.

[77] The results of the sensitivity analysis showed
- reductions in yields; (ii) delays in benefit

[78] NPV is used to evaluate the value of an investment based on the difference between the present value of cash inflows and outflows expected to be generated over the lifespan of a proposed project. NPV represents the difference between the present value of cash inflows - expected (quantified) benefits - and of cash outflows - costs for planning, preparation, and implementation) over a specified period.

The analysis results in a NPV at social prices of US$13.8 million and a social IRR of 11.35 percent for the ent Project.

Financial viability was determined as positive for the eight subprojects, with financial internal rate of return (FIRR.) 0 between 12.7 percent and 25.2 percent. A CBA was applied to eight representative sub-projects of Component A, for which the flow of annual incremental net benefits over a period of 20 years was calculated (considering a financial discount rate of 12 percent), 1 holding constant the input and output prices to capture the effect of the change in production.

0 The financial internal rate of return (FIRR) is the most common metric used in financial analysis to estimate the annual rate of return on investment. It estimates the flow of net incremental benefits of the project based on two scenarios · with and without the project.

2 If O M costs of the irrigation systems are not covered by the FGs and WUO·s revenues, alternate financing sources or changes in current sources will be discussed with stakeholders to make sure all the costs are covered.

In sum, the Project is not expected to have a negative impact on Peru·s low G G-emissions development pathways and as such it is considered aligned for mitigation.

The project aims to address these climate change vulnerabilities through investments to improve the existing off-farm and on-farm irrigation systems as an adaptation measure (such as technified irrigation including sprinkler irrigation systems and provision of adequate water storage to attenuate climate change impacts). These infrastructure investments will ensure the integration of climate-resilient design to enhance resilience against climate change-exacerbated floods and droughts which reduces the risk to an acceptable level.

The PPSD establishes the bes
procurement arrangements to ensure value for money while efficiently achieving the PDOs.

From the social perspective, the proposed Project is expected to generate important positive impacts and opportunities for small and medium-sized farmers and their families, considering the outcomes of similar past projects in Peru.

Under Component A, activities will be designed to increase productivity and economic outcomes for female farmers by: (i) raising awareness on the importance of incorporating women·s preferences in irrigation infrastructure design; (ii) targeting outreach to women in local/indigenous languages to inform them of available irrigation technologies; and (iii) training female farmers on MOM of irrigation technology/equipment.

The Project aims to ensure the participation of stakeholders and vulnerable individuals with the goal of improving the sustainability and effectiveness of irrigation water services and water productivity in family agriculture in selected areas vulnerable to climate change.

To that end, the PSI has identified FGs, and investment subprojects based on the PSI guidelines for efficient irrigation investments.

To reflect the growing threat of water scarcity considering climate change, the Project will focus on watersheds with low water availability and will ensure that efficient irrigation investments are integrated with Peru·s national instruments and policies on water resources management.

At the start of Project implementation, Project beneficiaries in targeted areas will be informed on the expected level of irrigation services provided.

The results framework will track as a PDO-level indicator the increase in beneficiary satisfaction on the improvements in irrigation service delivery, from a baseline established in year 1, target at completion 85 percent.

RESULTS FRAMEWORK AND MONITORIN

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PDO Indicators by PDO Outcomes

Baselin | Closing Perio

Sustainability and efficacy of water services for irrigation

Water User Organizations that increase operational efficiency in their hydraulic blocks by 10%.

(Number)

Jan/202 | Dec/202 9

8.0 | 16.0

Average increase of the tariff collection rate of Farmer Groups participating in the Project to generate resources for an adequate operation and maintenance of their respective irrigation systems. (Percentage)

Jan/202 | Dec/202 9

0.0 | 20.0

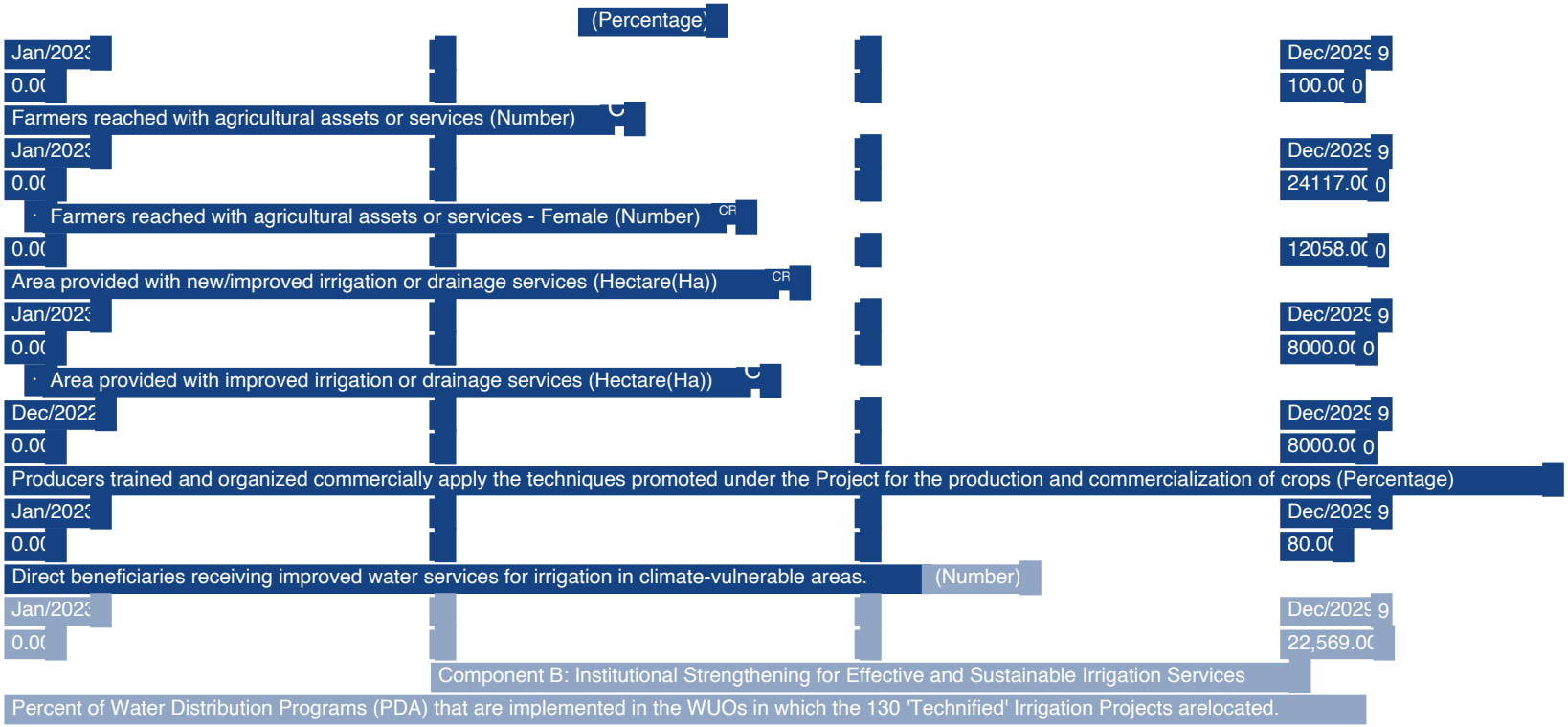
Beneficiaries report an increase in satisfaction with the improvements of irrigation services provided.

Increase in agricultural water productivity on family farms in areas vulnerable to climate change. (Percentage)

Jan/202 | Dec/202 9

0.0 | 50.0

Increase in efficiency of application of irrigation water on-farm in areas with improved/·technified· irrigation.


(Percentage)
Jan/2023
Dec/2029
0.00
100.00
Farmers reached with agricultural assets or services (Number)
CR
Jan/2023
Dec/2029
0.00
24117.00
Farmers reached with agricultural assets or services - Female (Number)
CR
0.00
12058.00
Area provided with new/improved irrigation or drainage services (Hectare(Ha))
CR
Jan/2023
Dec/2029
0.00
8000.00
Area provided with improved irrigation or drainage services (Hectare(Ha))
CR
Dec/2022
Dec/2029
0.00
8000.00
Producers trained and organized commercially apply the techniques promoted under the Project for the production and commercialization of crops (Percentage)
Jan/2023
Dec/2029
0.00
80.00
Direct beneficiaries receiving improved water services for irrigation in climate-vulnerable areas.
(Number)
Jan/2023
Dec/2029
0.00
22,569.00
Component B: Institutional Strengthening for Effective and Sustainable Irrigation Services
Percent of Water Distribution Programs (PDA) that are implemented in the WUOs in which the 130 'Technified' Irrigation Projects arelocated.
(Percentage)
Jan/2023
Dec/2029
0.00
60.00
Percent of the Demonstration Plots that show favorable indicators for production, profitability and efficiency in the use and application of water.
(Percentage)
Jan/2023
Dec/2029
0.00
90.00
Percent of the Water User Boards, with which FG interact, implement their Strategic Management Plan, incorporating new investment proposals.

Increase in agricultural water productivity (Percentage)

Description	Measured in kg crop yield per cubic meter water used.

Frequency	
Data source	
Methodology for Data Collection	
Responsibility for Data Collection	

Monitoring & Evaluation Plan: Intermediate Results Indicators by Components

Component A: Irrigation Investments for Climate Resilient Agriculture	
'Technified' irrigation projects implemented. (Number)	
Description	Measures implementation of 'technified irrigation' subprojects executed under the Project.
	The target is an increase of at least double (100%) compared to the baseline.

Frequency	Annually
Data source	
Methodology for Data Collection	
Responsibility for Data Collection	
Producers trained and organized commercially apply the techniques promoted under the Project for the production and commercialization of crops (Percentage)	
Description	Measures the uptake of TA activities promoted under Project among beneficiaries.

Targets are representing a 100% increase.

The PSI has a long experience of successfully implementing investment projects with development institutions.[8] The PSI also has extensive experience implementing projects supported by Peru's national investment program (InviertePE), the Inter-American Development Bank (IADB), the Agency for Japan International Cooperation (JICA), and the Global Environmental Facility (GEF).

These partnerships are especially important to ensure that increases in productivity due to irrigation improvements are accompanied by integration into agricultural supply chains and connection to national and international markets.

The PSI also has experience implementing projects supported by Peru's national investment program (InviertePE), the Inter-American Development Bank (IADB), the Agency for Japan International Cooperation (JICA), and the Global Environmental Facility (GEF).

The lack of a tool that can support the preparation of reliable project financial reports and monitoring of implementation at subproject level, for which the mitigating measure is the implementation of a new system to be included as a dated covenant.

An administrative specialist will perform financial monitoring of the investment programed for activity 2 (Technical assistance to the RGs for the institutionalization and promotion of investments in irrigation) as well as prepare monthly reports and financial reports on the implementation of this intervention.

The PPSD describes how procurement in this operation will support the PDO and deliver value for the money invested under a risk-based approach.

Goods and non-consulting services: Under Component A, the Project will finance the equipment for improved control and regulation of water flow (such as motors, pumps, valves), and flow rate measuring devices for improved monitoring. Besides that, the Project will finance goods and non-consulting services required for the Project Management such as: computers, equipment, office furniture, publicity services etc.

Irrigation is a key driver for economic growth as it improves agricultural production, thereby supporting rural employment and development, strengthening food security, and increasing resilience to climate change.

Adequate irrigation is critical for enabling farmers to cope with the climate-exacerbated occurrences of floods and droughts, to increase crop yields, and to grow higher value crops, both in terms of nutritional value and financial returns from their sale.

Overall, the availability of irrigation technology and cultivation high-value crops have had a major impact on Costa·s rural development, as the region has registered the strongest growth in agricultural productivity.

Crops tend to achieve substantially higher yields in the Costa (than in the Sierra or Selva) due to improved access to irrigation, more widespread mechanization, greater crop diversification (including towards more high-value crops), larger farm sizes, and proximity to consumers and export markets.

Low-income, smallholder farmers have been unable to convert to more efficient, modern irrigation systems due to high capital costs that prevent these types of investments.

These are expected to transform the current off-farm surface irrigation schemes used by small-scale family farmers into ·technified·1 ·1 0 irrigation conveyance and distribution systems and installation of improved on-farm irrigation water application systems (Component A). The Project will also provide the necessary support to selected 130 FGs with the installation of the improved ·technified· irrigation systems (both off- and on-farm).

Along the Costa, the Project will install on-farm drip irrigation (given its high-level of water efficiency performance of more than 90 percent), while in the Sierra and Selva, in addition to drip systems, the Project will also promote sprinkler and micro sprinkler systems.[101] Sprinkler systems are easier to operate and more economic than drip irrigation yet still increases water efficiency performance by 80 percent.

A standard cost-benefit analysis (CBA) was performed to assess the financial and economic merit of the proposed Project and to quantify all incremental costs and benefits directly attributed to the Project.

The following table highlights the Project·s costs and benefits.

Financial and economic benefits were quantified for important agricultural crops with the potential for the development of value chains: potato, purple maize, peas (vetch), rye grass, oats, clover, oregano. Quantifiable Project benefits are mainly linked to the additional income of producers who are impacted by the sub-projects (Component A).

The flow of annual incremental net benefits for the sample projects was calculated for a period of 20 years (considering a financial discount rate of 12 percent).

These eight crops comprise the cropping systems that will be improved through the Project·s implementation, determining the financial profitability of each subproject.

It is expected that the Project will improve both yields and, for some crops, the number of harvest cycles per year through investments in efficient irrigation systems, sustainable agronomic practices, and institutional strengthening for effective and sustainable irrigation services that will govern them.

The table below presents yields and output-price assumptions for the financial analysis.

The net present value (NPV) under the ·without project· scenario considered the current yields of each crop, the number of cultivated hectares, the sales prices, and the percentage of produce that is sold in the Project's intervention areas.

In the ·with project· scenario, the analysis considered the increase in irrigation efficiency and the impact of applying good agricultural practices when projecting yields.

The model calculates incremental net benefits over a period of 20 years, holding constant the inpu and output prices to capture the effect of the change in productio . Ir Incremental net benefits were modeled first at the level of the eight sub-projects. Financial viability was positive for all eight subprojects, with financial internal rates of return (FIRR) between 12.7 percent and 25.2 percent. As shown in the table below, profitability indicators are the result of the product of the agricultural output price, yields (magnitude and number of cycles per year), and cultivated area, less input, labor, and management costs.

A cost-benefit analysis was performed to assess the economic viability of the production models proposed by the Project, considering economic prices (shadow prices) and economic value of carbon.

This methodology calculates the flow of annual incremental net benefits over a 20-year period, considering an economic discount rate of 8 percent (which includes inflation and risks), compatible with the maturation time of principal investments. For a 20-year horizon, the incremental economic benefit for the entire Project is estimated to be US$60.6 million, with an economic internal rate of return of 17.2 percent (representing the net present value [NPV] of agricultural production). The economic analysis shows positive profitability indicators, with economic internal rates of return (EIRR) between 13.2 percent to 21.6 percent.

Net incremental benefits were summed across each of the production models, and then multiplied by a scaling factor, defined as the share of the total Project area that these subprojects represent.

The value the volume of water recovered in economic terms was included in the flow of incremental benefits and costs of this equivalent area. The adoption of precision irrigation as well as sustainable agronomic practices promoted by the Project, will boost the productivity of the agriculture undertaken in the subprojects· areas and is expected to free up water for other uses or to be returned to the environment (return flows to surface water bodies as well as groundwater recharge. For this purpose, an estimation of the current situation (·without project·) in terms of water consumption and possible return flows, with the aim of estimating how much efficiency gains could be ·internalized· through intensification and potential expansion of irrigated areas (see the technical analysis below for further details).

To ensure the long-term robustness of the economic behavior of the Project, a sensitivity analysis was performed to evaluate how the economic indicators of the overall Project changes with a variation of key variables: (i) reductions in yield; (ii) delays in benefit generation; (iii) cost overruns; (iii) changes in the shadow price of carbon.1 ·1 2 The table below shows that the Project·s overall NPV presents a positive economic return even when considering a delay in benefits· generation of 3 years, significant cost overruns, or a 5 percent reduction of expected benefits.

Guidance Note on shadow price of carbon in economic analysis: a range of US$40-80 per ton of CO2eq, with an annual incremental rate of 2.25 percent.

In addition, a scenario analysis was performed under a pessimistic scenario to evaluate the economic performance of the Project: reduction of 10 percent of the expected yield in with project situation, cost overruns of 10 percent of the investments, a shadow price of carbon US$0/t CO2eq, and a delay in the implementation of the Project that would permit the generation of one-year benefits.

These results represent a robust performance in economic terms and, considering the productive and climatic impacts, create societal economic value.

The FGs and WUOs will benefit from the TA activities planned under the projects to improve the design of tariffs, the commercial and operational efficiency.

Both charges would be in average S/673 (US$ 177) per hectare per year, which seems achievable as the financial evaluation showed.

The proposed investments, through the improvement of the off-farm infrastructure and the installation of efficient on-farm irrigation systems (such as multi gates, drip, micro sprinkler, or sprinkler irrigation), will enable farmers to use less water and other inputs to their crops, improving irrigation performance, boost agricultural productivity, and increase agricultural water efficiency from 35 to 80 percent.

The adoption of precision irrigation, promoted by the Project, is expected to boost the agricultural productivity of the subprojects.

For this purpose, an estimation of the current situation (without project) was carried out (in terms of water consumption and possible return flows), with the aim of estimating the efficiency gains that could be ·internalized· through agricultural intensification and potential expansion of irrigated areas without affecting return flow that might be used by other users downstream.

To monitor the PDO level indicators, the Project will include, as part of the monitoring framework, different actions to measure water flows and volumes in specific locations and a temporary basis to calculate the following:

- the increase of operational efficiency of each irrigation system, and
- the increase in water productivity (US$/m3) measured as farm income per cubic meters of water consumed, or (kg/m3) measured as crop yield per cubic meters of water consumed.

Moreover, the activities focused on strengthening the management capacity of WUOs and Farmer·s Groups to improve the O&M of a water delivery system would also allow an increase in operational efficiency of irrigation canal systems managed by participating WUOs by 10 percent (operational efficiency measures a reduction in physical water losses in canal systems).

The Project's immediate benefits are linked to the increase in productivity associated with the extension of efficient irrigation systems over 8,014.38 hectares of agricultural land. With access to efficient irrigation systems, farmers are expected to be able to grow higher-value crops, utilize water more efficiently, reduce labor costs, and better withstand droughts and erratic rain patterns. In addition, by supporting the implementation of FGs' business plans, the Project will directly increase farmers' capacity to market and sell their products effectively.

In addition to the immediate or direct benefits related to the improvement in efficiencies, the Project will generate, among others, the two following additional benefits: (i) reduction in degraded soils: efficient on-farm irrigation systems will reduce soil erosion, particularly in the Sierra region with high slopes; and (ii) potential expansion or productive intensification based on improved water use efficiencies.

The integrated approach of the Project coordinates (i) improving water services through technified irrigation and (ii) agricultural water productivity through enhanced management of available water and soil resources to counter water-related risks and increase the resilience of agricultural production systems.

To that end, a portion of the TA to be provided to producers (through FGs) in the 130 sub-projects (sub-component A.3) includes (i) improving the efficiency of water management at the parcel level and (ii) agronomic management for both annual and perennial crops.

All the above seek to generate behavioral change in producers when it comes to the management of their respective productive units by promoting and developing improvements in the production of crops to obtain improvements in productivity and profitability.

Agricultural resilience can deliver measurable economic value in terms of cost-savings and risk reduction to farmers (and, by extension, their communities). Farmers can reduce their input costs and increased their bottom lines by choosing to invest in soil health.[114] As a result, more people can be fed at a lower cost, which is a major factor in alleviating the globa food crisis.

[114] Irrigation water productivity, as a ratio between the marketable yields and irrigation amount used during a growing season, can be used to determine economic profit.

All activities under the program are on the Universally (Paris) Aligned list. [8] The Project is also aligned with the public investment recommendation of Peru·s Climate Country Diagnostic Report·s (CCDR) to improve access to efficient irrigation systems to build resilience in the agriculture sector and boost economic growth while protecting vulnerable populations.

The project aims to address these climate change vulnerabilities through investments to improve the existing off-farm and on-farm irrigation systems as an adaptation measure. These infrastructure investments will ensure the integration of climate-resilient design to enhance resilience against climate change-exacerbated floods and droughts.