

Ex-post evaluation

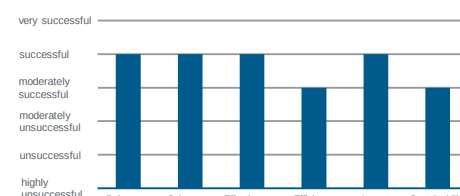
Irrigation Programme Southern Andes IV, Peru

Title	Irrigation Programme Southern Andes IV		
Sector and CRS code	31140 Agricultural water Ressource		
Project number	2003 66 377 and 1930 02 953 (associated basic and advanced training measure)		
Commissioned by	Federal Ministry for Economic Cooperation and Development		
Recipient/Programme executing agency	Plan MERRIS of the regional government of Cusco, Peru		
Project volume/ Financing instrument	EUR 6 million / BMZ budget loan and EUR 0.5 million / grant (basic and advanced training measure)		
Project duration	2007 – 2016		
Year of report	2024	Year of random sample	2019

Overall rating:
Successful

Objectives and project outline

The objective at outcome level was to increase the agricultural production and productivity of smallholder family farms (target group) in the project area of the Cusco region. The objective at impact level was to make a qualitatively measurable contribution to improving the economic living conditions of the rural population in the project area. The project focussed on the construction, expansion and rehabilitation of irrigation systems and their independent and sustainable operation as well as a significant improvement in agricultural production systems.



Key findings

Due to the successful evaluation of relevance, coherence, effectiveness and impact, the programme is rated as "successful" overall, despite the shortcomings in terms of efficiency and sustainability:

- The programme built on decades of successful development cooperation with the relevant executing agency and was therefore able to continue long-term development support. The inclusion of disadvantaged areas in the Andean highlands (up to approx. 4,300 metres above sea level) was new.
- The selected measures and the composition of the three components of the programme were effectively geared towards the target group. The participatory involvement of the communities and users was essential for the high impact and limited successful sustainability of the measure, including the mitigation of potential conflicts.
- In all five irrigation perimeters, considerable increases in yields were observed (outcome), which, in combination with the promising sales market in the Cusco region, contributed to the progressive regional economic integration of the agricultural sector and continue to have a positive impact on economic living conditions to this day (impact).
- The difficult implementation of the project, characterised by a three-year project interruption and the resulting more than doubling of the partner country's financing share, was primarily due to external factors. National specifications for unit prices and procedures did not adequately take into account the topographical requirements of the Andean highlands. Nevertheless, the specific costs of EUR 3,600/ha were reasonable.

Conclusions

- The initial overestimation of the executing agency's capacities led to planning errors, which had to be compensated for by expanding the competences of the implementation consultant.
- The training and support of the water user organisations even after the technical completion of the project was relevant for the effective and sustainable operation of the water infrastructure.
- Irrigation projects offer great potential in the area of climate adaptation. The focus on expanding traditional gravity irrigation systems has brought advantages in terms of implementation and maintenance, but offers lower marginal benefits in the long term compared to more innovative irrigation systems and the necessary water efficiency potential remains unutilised in the long term.

Ex-post evaluation - assessment according to OECD DAC criteria

Overview of the rating per criterion:

Relevance	2
Coherence	2
Effectiveness	2
Efficiency	3
Overall developmental impact	2
Sustainability	3
Overall Rating:	2

Abbreviations:

PCR	Project completion report
ALA	Local Water Authority (<i>Autoridad Local del Agua</i>); as a local department of ANA
ANA	National Water Authority of Peru (<i>Autoridad Nacional del Agua</i>)
GDP	Gross domestic product
AM	Accompanying measure
BMZ	Federal Ministry for Economic Cooperation and Development
DAC	Development Assistance Committee
DED	German Development Service (integrated into GIZ since 2011)
EPE	Ex-post evaluation
EUR	Euro
DC	Development cooperation
FC	Financial cooperation
FC E	FC Evaluation
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GTZ	Gesellschaft für Technische Zusammenarbeit (merged into GIZ from 2011)
HDI	Human Development Index
InWEnt	International training and development (integrated into GIZ since 2011)
MDG	Millennium Development Goals
MEF	Peruvian Ministry of Economy and Finance (<i>Ministerio de Economía y Finanzas</i>)
NGO	Non-governmental organisation
PM	Plan Meriss (programme executing agency)
PA	Project appraisal
PAR	Project appraisal report
PV	Project proposal
SDGs	Sustainable Development Goals
SNIP	National System for Public Investment (<i>Sistema Nacional de Inversión Pública</i>)
TC	Technical cooperation
USD	US dollar

General conditions and classification of the project

Currently, approximately 30% of all employees in Peru are engaged in the agricultural sector. Family [farming](#)¹ is crucial for national development. Agricultural family farms are small-scale producers who predominantly live in extreme poverty. They represent 90% of all agricultural units in Peru, where an average of two to three hectares are cultivated, and they produce the largest share of food nationwide.

In the Cusco region, where all five project sites of the programme are located, 39% of the population live in rural areas [\(2022\)](#)². 47% of all economically active individuals work in agriculture, which remains the most important source of income and subsistence. However, additional sources of income are necessary, especially during the dry season from May to November, so the rural catchment areas around Cusco are characterised by strong seasonal labour migration during these periods. The economic system of the local agricultural family farms is still predominantly agro-pastoral. Agricultural productivity in the region is low and is mainly limited by the lack of irrigation infrastructure, including the capture and storage of more distant water resources. In the Andean highlands of the Cusco region, arable farming plays only a minor role, and land use for livestock farming is limited due to the restricted availability of productive pastureland and fodder during the dry season. At the time of the programme appraisal, the agriculturally developed and utilised area in the project region was mainly used as pastureland (approximately 83%) and only limitedly used as arable land (17%³). The proportion of irrigated agricultural land was only about 15%. This mainly consists of simple gravity irrigation from earth channels, which is fed with high water losses from nearby surface waters. Sprinklers were used on only up to 3% of the irrigated areas. Under these circumstances, agricultural development without external support was severely limited and economically unprofitable.

In the rural areas of the project region, extensive livestock farming of cattle, sheep, and alpacas is the predominant source of income. The production of meat, milk, cheese, and wool is offered on the local market. Even before the implementation of the programme, there was an economic potential for good marketing at the local and regional level due to a general deficit in milk and meat. This condition was also present in all selected irrigation perimeters. Due to the still strongly increasing tourism in the Cusco area, the market for meat and dairy products, as well as other products from arable farming, such as cereals, continues to develop promisingly.

According to the programme appraisal report from 2003, water scarcity on agriculturally used land is the central bottleneck for agriculture and livestock farming in the areas preselected during the programme appraisal. At the same time, a secure water supply for the implementation of potential irrigation perimeters was assumed, even with a simple design predominantly using gravity irrigation. It was mainly pointed out that in the extreme highlands, the predominantly pasture and livestock farming could, based on experience, lead to an increase in productivity and family income through introduced irrigation combined with pasture improvements. In the extreme highlands, the water resources available throughout the year must be made accessible for agriculturally developed areas through suitable irrigation infrastructure, including water reservoirs. In the long term, it can be assumed that water availability in the Andean highlands will decrease due to increased glacier retreat and reduced snow retention, which will require corresponding water-efficient adaptation of the irrigation infrastructure. These circumstances particularly affect the Marampaki and Upis perimeters, as well as the source for irrigating the Aña-huichi perimeter.

The necessity of introducing and expanding agricultural irrigation was also recognised early on by the national⁴ and regional⁵ governments and prioritised in their development policy. According to the programme appraisal, simple and easy-to-control and operate irrigation systems with gravity irrigation were originally to be built in the preselected project perimeters. A partially existing infrastructure for a previously used irrigation area of 1,391 ha (30% of the total area of all irrigation⁶ perimeters) was to be rehabilitated and integrated into the respective over-arching irrigation systems. In the case of the Marampaki irrigation perimeter and in the new irrigation zones in Aña-huichi, various pressure pipelines were planned due to the topographical conditions with steep slopes. The high water pressure potential should enable the introduction of water-efficient irrigation through sprinkling while

¹ Food and Agriculture Organization of the United Nations (FAO), [Family Farming Knowledge Platform, Peru](#); Nov.2024; <https://www.fao.org/family-farming/countries/per/en/>

² [Cusco Regional Development Plan to 2033, 11/2022](#)

³ Programme Review Report, 2003, p.3

⁴ [National Rural Development Strategy 2004](#)

⁵ [Strategic plan for regional development until 2012](#); Cusco Regional Government, 2002

⁶ Final report of Plan Meriss project from 2017; reporting period until end 2016; Informe Final del Programa al 31/12/2016)

simultaneously controlling erosion in the steeper fields. In Marampaki and Añahuichi, the introduction of sprinkling systems should be facilitated by the already partially existing experience of agricultural families in irrigation.

Brief description of the project

The FC programme "Irrigation Programme Southern Andes IV" was implemented as an open programme from 2007 to 2016 (interruption from 2009 to 2011). Within the framework of the programme, medium and small irrigation systems were newly created and partially rehabilitated in marginalised areas of the Cusco region. The already existing irrigation areas accounted for 30% of the total area of the finally completed irrigation perimeters. According to the planning, 26% of the total area was to be irrigated using sprinkling systems in addition to gravity irrigation. The programme financed new infrastructure with 25 river and spring water intakes, main channels totalling approximately 55 km (partially lined and covered; some pressure pipelines), sand traps, six large night water storage basins, side canalisation (approximately 25 km), special structures (culverts, pipeline bridges, distribution structures, pressure break chambers), distribution systems for gravity irrigation and sprinkling, as well as shut-off and control valves. The rehabilitation measures mainly concerned the canalisation in the distribution on the fields, which was primarily carried out by the farming families.

Compared to the predecessor programmes, the programme now also considered project areas in the more remote Andean highlands of up to approximately 4,300 meters. The programme supported the agricultural family farms (target group) in organising and formalising the respective water user organisations. The target group was already involved in the planning as well as in the construction of the water infrastructure (distribution systems on the fields) and was expected to sustainably operate the infrastructure and irrigation agriculture. Compared to the predecessor programmes, the financial participation of the communities was introduced as a new element. According to a study-based adjustment of the project design and project costs (2009), the programme ultimately implemented five medium and large irrigation systems compared to the originally planned 9 small and medium irrigation systems. Over 1,300 families were benefited. All five irrigation perimeters were visited as part of the EPE in April 2024.

The programme comprised 3 components: (1) "Construction and rehabilitation of irrigation infrastructure", (2) "Operation of irrigation infrastructure & promotion of irrigation agriculture", including the protection of water resources, and (3) "Basic and advanced training" (basic and advanced training measure). The basic and advanced training measure contributed to strengthening the advisory capacities of the regional programme executing agency, the development organisation "*Proyecto Especial Regional Plan Meriss*" (Plan Meriss⁷) affiliated with the Regional Government of Cusco, in matters of irrigation agriculture. Component 1 had the largest cost share at 78.1%, followed by Component 3 (5.8%) and Component 2 (2.5%). The costs of the implementing consultant accounted for the second-largest cost share (13.6%). The programme executing agency contributed 69.8% (14.7 million euros) to the actual programme costs of 21.1 million euros.

⁷ Regional Special Programme "Proyecto Especial Regional Plan Meriss Inka", 1975; Basic technical cooperation agreement with Peru; Plan Meriss, Cusco

Breakdown of total costs

The total costs include financing from FC funds amounting to EUR 6.5 million (Table 1). This FC share consists of loan funds of EUR 6 million and a grant for the basic and advanced training measure of EUR 0.5 million (utilised: EUR 0.376 million). All cost increases of the programme were financed from the programme executing agency's own funds.

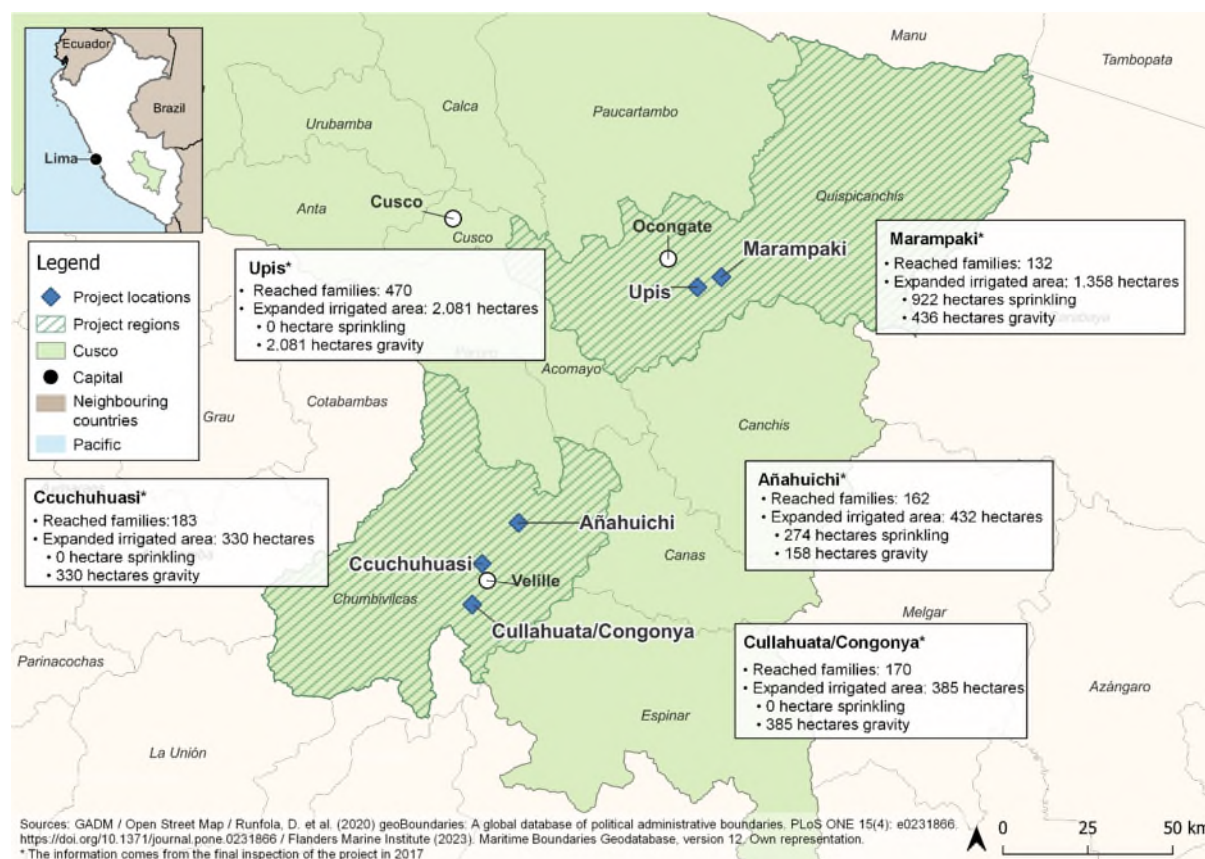
Table 1: Breakdown of total costs

		Investment costs* (plan)	Investment costs* (actual)	AM (plan)	AM (actual)
Total costs	EUR	13,000,000	21,083,400	500,000	426,200
Own contribution	EUR	6,500,000	14,710,600	0	50,000
External financing	EUR	6,500,000	6,372,800**	500,000	376,200
<i>of which budget funds (BMZ)</i>	EUR				
- Loan funds	EUR	6,000,000	5,996,600**		
- Grant AM	EUR			500,000	376,200
(basic and advanced training measure; 193002953)					

* incl. basic and advanced training AM; ** final payment made to the implementing consultant after project completion (EUR 102,700); from remaining AM funds (basic and advanced training)

Source: Information based on project appraisal report (2003), KfW project completion report (2017) and evaluation Mission (2017)

Map of the project country incl. project areas in the Cusco region



Rating according to OECD DAC criteria

Relevance¹. Alignment with policies and priorities

The objectives pursued by the project are in line with the efforts of the Peruvian government to reduce poverty. The project focuses on the disadvantaged rural population in the Andean highlands (target group), which has been classified by the Peruvian Development Fund FONCODES (*Fondo Nacional de Compensación y Desarrollo Social*) as "very poor" and "extremely poor." Thus, the project also fits well into Peru's national strategy for rural development and its legal framework⁸ (*Estrategia Nacional de Desarrollo Rural, 2004*).

The sustainability of agriculture pursued by the project is reflected in the BMZ strategy paper "Promotion of Sustainable Agriculture" from 2013. Particularly relevant is the primacy of promoting smallholder agriculture, the social integration of marginalized groups, and the embedding of agricultural promotion in a comprehensive strategy for rural areas. The strategy of German development cooperation with Peru formulated at the time of the project appraisal also aimed at the rural development of disadvantaged areas, focusing particularly on irrigation agriculture.

At the global level, the programme objectives followed the then relevant overarching goals of the Millennium Development Goals (MDG), particularly MDG 1: "Eradicate extreme poverty and hunger" and MDG 7: "Ensure environmental sustainability." In relation to MDG 1, the sub-goal of productive employment, including for the younger generation and women, is an important aspect. This was intended to emerge as an important element in terms of sustainability after the project. The design of the project was also aligned with international and national environmental requirements and the guidelines of the integrated water management introduced in Peru from 2008, which particularly focused on the efficient use of water resources.

The international and thus also the water management foundations and requirements relevant to the project are generally based on the declaration of the UN Conference on Environment and Development, Rio Declaration, 1992, and the previously defined [Dublin principles of 1992](#)⁹. The orientation of the project is still in line with the later formulated goals of the Agenda 2030 (Sustainable Development Goals, [SDG](#)¹⁰) of 2015, particularly in relation to poverty reduction (SDG 1) and decent work and economic growth (SDG 8).

The project also fits well into the then-promoted national policy of decentralization and strengthening regional competencies.

At the regional level, irrigation agriculture is prioritized within the development strategy of the Cusco region. Through its participatory approach with the active involvement of the target group and communities, the programme follows the guidelines for regional development and the aforementioned regional development plan that existed until 2012. The project's endeavor to increase land yield through the development of irrigation agriculture corresponds to the strategic use of water reserves to increase agricultural production as stipulated in this plan. The (above-mentioned) regional special programme *Plan Meriss*, which has existed since 1975 and is supported by GTZ, but above all the successful implementation of the FC project Irrigation Programme Southern Andes I-III (1980 - 2004), underpin the promising implementation approach through the Cusco region.

2. Alignment with the needs and capacities of the beneficiaries and stakeholders

The objectives of the project were clearly aligned with the needs and capacities of the target group. The core problem of the locally and seasonally limited and inadequate irrigation infrastructure (addressed through component 1) and the correspondingly low-yield agriculture (additionally addressed through components 2 and 3) was clearly and realistically identified and addressed by the project's design. Thus, the project aimed at the construction and sustainable operation of irrigation perimeters as well as the development of irrigation agriculture. In particular, the project aimed at promoting the very needy poorer population in rural Andean highlands with high productive potential.

The beneficiary indigenous agricultural families were only seasonally settled¹¹ before the implementation of the project, as their agriculture could only be practiced during the rainy season through rain-fed farming and the very

⁸ National framework legislation on the economic development of the rural sector; [Ley marco para el desarrollo económico del sector rural, Ley No.28298](#)

⁹ [Dublin Declaration on Water and Sustainable Development, 1992](#); Global Water Partnership (GWP)

¹⁰ [Sustainable Development Goals: KfW Development Bank Portal](#), 2024

¹¹ The sustainable development of agricultural family businesses required an economic development of livestock farming, pastures, and crop cultivation. This was achieved through permanently available irrigation in significantly expanded irrigation perimeters (project) and the corresponding development of permanently secured and increased employment within an expanding agricultural production. This supported organized settlement in the five irrigation perimeters and alleviated the seasonally induced migration pressure.

limited catchment and pipeline systems. Statements made during the evaluation trip clearly indicated that it was the explicit wish of the target group to cultivate agricultural land throughout the year and establish more settled structures. Thus, the project was designed to enable the target group to have permanent productive employment and significantly improved socio-economic development. The target groups and the corresponding irrigation perimeters were pre-selected during the project appraisal. According to the target group analysis at that time, the prevailing living conditions under high poverty were a decisive criterion. On the other hand, the existence of groups of agricultural families who had both experience with irrigation and were willing to contribute to the implementation costs through coordinated work efforts was an essential prerequisite. In the pre-selected programme areas, there were neither structured irrigation systems (with one exception in Anta; not selected) nor existing water user organisations. Moreover, there was a high potential for a significant expansion of irrigation perimeters by integrating the limited existing and to be re-established systems. For the success of the project, simple systems (gravity irrigation) were preferred, as was generally desired by the target group. In this regard, this orientation was logically and target-oriented predetermined.

The target group in the economically poorly connected high-altitude Andean areas is also confronted with difficult climatic cultivation conditions. On the one hand, the more distant water resources were not available due to the lack of infrastructure, especially in the dry season. On the other hand, the climatic conditions combined with the lack of knowledge for improved management limited the agricultural land use potential. These unfavorable living and management conditions were also purposefully addressed by the project approach.

The project pursued the objective of efficient use of irrigation water, which was to be achieved through component 1 (participatory planning of water demand) and component 2 in the operation of facilities and field management. During the project appraisal, it was assumed that the water supply for all potential irrigation perimeters was secured even with predominantly gravity irrigation. This was confirmed within the framework of the project through hydrological studies and the specification of the water demand of the then selected irrigation perimeters. After the project interruption, an improvement in the management of water resources was sought, so the concept now also included the promotion of sprinkler systems in Upis and Marampaki. This was intended to improve economic efficiency and address the increasingly scarce water resources due to glacier retreat (Upis and Marampaki) or the limited spring discharge in Añahuichi.

Integrated Water Resources Management (IWRM) was in its early stages worldwide at the time of the project appraisal in 2003. The National Water Authority *Autoridad Nacional del Agua* (ANA) was only established in 2008. Subsequently, the project was generally aligned with national water management guidelines. Thus, the project was also oriented towards the local availability of water resources and their use. The control of water use in the irrigation perimeters was to be introduced under the supervision of ANA and its local departments *Autoridad Local del Agua* (ALA) according to the legal water management framework. However, there were uncertainties in project implementation regarding the acceptance of the water users/beneficiaries of new regulations (to be achieved through component 2) and regarding new administrative processes and their previously difficult to estimate time requirements. While the overall withdrawals of water resources are to be controlled at the catchment area level through the local ALA as part of the overarching water management planning, the project was to ensure the planned water quantities for all agricultural enterprises within the irrigation perimeters. This was to be guaranteed by the water user organisations strengthened by the project and the operating personnel (water guards).

The target group of agricultural families classified as "very poor" and "extremely poor" was selected according to a target group analysis. In particular, the situation of disadvantaged indigenous farming families in the Andean highlands was evaluated. The main source of income for the agricultural family businesses was extensive livestock farming (cattle, sheep, llamas). The main products were milk, cheese, and meat, which were sold in local markets. On the one hand, the severely limited possibilities and capacities of the target group to achieve improved agricultural production were recognized. On the other hand, the promising potentials of intensive expansion of irrigation infrastructure and the expansion of irrigation perimeters were identified to achieve a rapid impact on the improved living conditions of the target group. This was to be achieved particularly through significantly increased and secured agricultural production and its improved marketing.

The consideration of the traditionally respected position of women and their important role in the family and in the business development of family enterprises were valuable prerequisites for the success of the project. The involvement of women in the later operation of the infrastructure was mainly enabled through the design of component 2. A different design of the concept would not have had any further noteworthy gender impact potentials.

The orientation of the project also took into account the administrative capacities of the Cusco Regional Government, particularly through the targeted involvement and addressing of the capacities of the regional programme executing agency Plan Meriss. The long-term consultancy by GTZ from 1979 to 2002, as well as the implementation of the predecessor FC projects (Irrigation Programme Southern Andes I-III), have so far contributed to improved organizational and technical performance of Plan Meriss. The project purposefully built on these successes through the intensive involvement of the programme executing agency.

3. Appropriateness of design

The design of the measure purposefully addresses the core problem (lack of irrigation capacities and management alternatives) both from the perspective of the past and the present. It was fundamentally suitable to contribute to solving the underlying issue. The project's design focuses on the extensive expansion and extension of existing small irrigation systems. In particular, the partially existing small distribution systems of the already originally used irrigation areas were to be rehabilitated and integrated. The conceptual orientation of the measures was initially limited during the programme appraisal in 2003 to the implementation of simple irrigation systems (small river and spring catchments, main and secondary channels, canal structures, and field outlets) in the highlands, in combination with measures to increase agricultural production. It primarily aimed at improved pasture management and was appropriate to achieve the defined programme objective.

A detailed concept for the introduction of sprinkler technologies was not yet envisaged at the time of the project appraisal. The water supply was assumed to be fundamentally secured for all potential irrigation perimeters, so the leverage of water efficiency was less decisive for the selection of irrigation technology. Thus, simple and operationally reliable irrigation systems were the focus of the concept. The partially open supply channels were also intended to allow better water transparency and thus promote fair water distribution, which fundamentally offered conflict mitigation potential. From today's perspective, the conceptual focus on gravity irrigation is plausible given the user capacities and maintenance advantages, but appears short-sighted in view of the increasing climate adaptation pressure and growing water scarcity. A stronger conceptual consideration of climate-resilient technologies would have offered an approach more oriented towards the durability of irrigation effects.

During project implementation, the focus of the measures on water efficiency was more strongly considered through an adjustment of the concept (inclusion of sprinkling). This was done partly according to the topographical conditions of the finally selected projects (sufficient pressure conditions and erosion protection in the irrigation perimeters Marampaki and Añahuichi). But also due to the agreement with the farming families, a large part of the irrigation perimeter in Marampaki and Añahuichi could be designed with sprinkling. In contrast, the agricultural families in the other three irrigation perimeters insisted on maintaining the traditional, visible water distribution through open earth channels by gravity irrigation. Only the perimeter Upis offered little potential for the introduction of sprinkling systems due to the flat topography. Training of users in the area of water efficiency and water availability was additionally included in the concept after the programme interruption. The conceptual flexibility and the subsequent alignment of the irrigation concept with the topographical conditions of the final selected irrigation perimeters and the needs of the residents are assessed at the time of the evaluation as crucial for the optimal use of irrigation potentials.

The project concept built around the three closely interlinked components was appropriate. The project was designed as an open programme. This was intended to allow a needs-based allocation of funds between the planned components and a targeted selection of the final project areas from the projects pre-selected through feasibility studies. The selection of the final perimeters was to be based on predetermined selection criteria related to the beneficiaries (poverty, financial participation, experience with irrigation of a subgroup¹² in the significantly expandable perimeter). Furthermore, the communities were to be involved in the project (estimated value: EUR 0.6 million). This involved their participation in the construction of the infrastructure with their own earthmoving equipment and participation in land consolidation with the formalized allocation of communal land to individual users. This was intended to promote higher ownership and simultaneously reduce financing costs.¹³

The construction execution of the individual projects was managed by Plan Meriss, who was also the builder and provided a large part of the financing (own funds, regional government). The implementation of the infrastructure

¹² The irrigation areas to be developed and expanded by the project were also only subject to seasonal rain-fed management and very limited irrigation through the existing and inadequate irrigation systems.

¹³ The participation of agricultural family businesses consisted of their coordinated own contribution through the project. This included surveying work, the construction of field outlets and earth channels on the respective fields, as well as the newly formulated land consolidation within the project, including the construction of field boundaries. The participation in the form of labor was expected to reach a value of EUR 1.3 million (approximately 10% of the project costs) (calculated according to planning specifications, established unit prices, and quantity control by the project).

by Plan Meriss was to be supervised by the FC implementing consultant, who was contracted by Plan Meriss. The initial concept did not foresee a complete assumption of responsibility by the consultant for the studies and planning work. From today's perspective, this is considered a weakness given the known weaknesses of the programme executing agency. After the project interruption, the services of the implementation consultant were extensively expanded, and they were now mandated with the complete preparation of studies and planning work.

The investment costs (EUR/ha) of the measures of component 1 were estimated at EUR 1,500/ha during the project appraisal in 2007, which is considered too low from today's perspective. Although this roughly corresponded to the then nationally specified benchmark of USD 1,500¹⁴, it inadequately accounted for the topographical requirements of the Andean highlands.

The concept appropriately included a basic and advanced training measure for training Plan Meriss. This was to be implemented within component 3 by the implementing consultant. The measure was an important prerequisite to ensure user support for achieving sustainable operation of irrigation agriculture. The conceptual provision of linking training and training-on-the-job is still considered target-promoting today, as it created an important prerequisite for the professional and organizational involvement of Plan Meriss in the implementation of the project. The concept envisaged ending the basic and advanced training measure two years before the completion of the project. This is also considered appropriate at the time of evaluation to enable sufficiently qualified user support in component 2 (operation) by Plan Meriss.

The conceptual inclusion of component 2 was essential to ensure a sustainable operation of the irrigation infrastructure as well as efficient livestock farming and agriculture. Under this component, awareness-raising activities and advisory services for farmers regarding the organization and formalization of independent water user organisations and water usage topics were to be conducted. This was intended to dissolve resistance against the introduction of water tariffs and prevent conflicts. To secure sustainable operation, a maintenance and repair concept was to be developed, and the target group was to be trained in it. **The support period for the water user organisations by Plan Meriss, as envisaged in the concept, was ambitiously set at 2 years from today's perspective, as a recommended benchmark of 3 years emerged during the project.** The introduction of water tariffs, intended for the maintenance and operation (e.g., water guards) of the irrigation systems by the water user organisations, was to be based on the experience from previous projects¹⁵ by Plan Meriss. The concept stipulated that major repair and maintenance work should not be borne by the water user organisations but by the communities. This is still considered a crucial conceptual prerequisite today to ensure effective and long-term operation of the irrigation infrastructure.

The objective formulated at the outcome level at the time of the project appraisal (2003) was "Increase in productivity per hectare through sustainable operation of the irrigation infrastructure by organized user groups." This objective was adjusted in 2012 after the project interruption to: "Contribution to the increase in production and productivity in agriculture through the expansion and organized, self-responsible, and sustainable operation of the implemented irrigation infrastructure in the highlands of the Cusco region." During the evaluation, this objective formulation was further adjusted to meet contemporary requirements for target formulation. The outcome level objective underlying this evaluation for the project is thus: "Increase in agricultural production and productivity of smallholder family businesses in the project areas of the Cusco region." The adjustment resulted particularly from the need for objectives to be clearly formulated without "means-target" expressions. Content-wise, the previous objective formulation was fundamentally appropriate and corresponded to the ambition level of the outcome level.

Analogous to the objective at the outcome level, adjustments were also made at the impact level in the objective formulation after the project interruption. The overarching development objective¹⁶, formulated at the time of the project appraisal (2003) was: "Increase the income of the small farmers benefiting from the programme and thus contribute to reducing their poverty." After the resumption of the project in 2012, marginal changes were made, leading to the following formulation: "Satisfactory contribution to improving the socio-economic situation of the rural population in the Andean highlands of the Cusco region." During the evaluation, the objective at the impact

¹⁴ Formal requirements were stipulated by the Peruvian Sistema Nacional de Inversión Pública (SNIP). The predetermined and underestimated benchmark according to the Peruvian Sistema Nacional de Inversión Pública (SNIP) at the time of the project appraisal, according to the project completion report, p.4; benchmarks according to SNIP are average values and do not take into account more difficult topographical conditions, such as in Marampaki and Upis, which were not known at the time of the project appraisal due to the not yet finally selected project perimeters.

¹⁵ For example, in the area of tariff recognition by users; professionally assisted joint determination of minimum tariffs; periodic and coordinated adjustment of tariffs according to the statutes of the water user organisations.

¹⁶ At the time of the project appraisal, there was not yet the political steering instrument of development cooperation programmes, so the overarching development objective formulated at that time is used as a reference here.

level was adjusted again, as the formulation "satisfactory contribution" is too vague and leaves the qualification of the term and thus the achievement of the goal level open. Ultimately, the objective at the impact level should be at least qualitatively measurable and verifiable in relation to the project area. The objective underlying this evaluation at the impact level is thus: "Provide a qualitatively measurable contribution to improving the economic living conditions of the rural population in the project area."

The target system, including the underlying assumptions of impact, is fundamentally comprehensible and sufficiently plausible. It logically builds on the problem analysis and the appropriately identified core problem (lack of irrigation capacities and management alternatives). The impact chain is based on the assumption that the newly created and rehabilitated irrigation infrastructure can increase the yield on the cultivated fields (70% of which are newly created irrigation areas) and thus increase agricultural production and productivity (outcome level). The complementary introduction of improved management practices, including in the areas of management form (e.g., cultivation methods, health of plants and breeding animals, genetic improvement through new animal breeds), irrigation techniques, as well as production and marketing, should equally aim at increasing the production and productivity of agricultural management (outcome level). These operational improvements should lead to an increase in the income of users in the programme area and thus contribute to improving the economic living conditions of the resident population (impact level).

The originally chosen indicators and the indicators adjusted after the programme interruption and their value assignment were appropriate in their entirety. However, due to the lack of quantitative data, indicators had to be adjusted or supplemented with perception-based indicators at the time of evaluation. This mainly concerns the less extensive and insufficiently differentiated statistics of the water user organisations but also of Plan Meriss regarding agricultural yield or the absence of permanent monitoring of flow rates with corresponding measurement data. The evaluation was conducted at the end of the rainy season during operational adjustments (less necessary and used flow rates). Thus, measurements at this time would not have been meaningful.

The interplay of the social, ecological, and economic dimensions of sustainability was already considered in a holistic approach in the concept during the programme appraisal. The sustainability of the measure with the economic success of the target groups and the farming communities is determined, among other things, by the difficult climatic and topographical conditions in the Andean highlands, which naturally limit¹⁷ the management potentials of arable land and pasture areas to this day. The orientation of components 2 and 3 of the project therefore focused on corresponding agricultural management approaches effective for the topography, which should simultaneously adequately account for soil protection.

4. Adaptability – response to change

Various reasons led to a three-year project interruption. National guidelines for unit prices and procedures inadequately accounted for the topographical requirements of the Andean highlands, the programme executing agency capacities were initially overestimated, and the Peruvian Ministry of Economy and Finance (MEF) attempted to reduce the costs and services of the consultant, resulting in delayed payments. Due to the interruption of the project, some adjustments concerning the scope of the measures were made: The originally planned 9 irrigation perimeters at the time of project appraisal (2003) were reduced to 5; the irrigation area was reduced by about 20% from 5,940 ha to 4,740 ha, and the target number of beneficiaries was corrected from 2,142 to 1,434 families (a reduction of approximately 33%). Additionally, the scope of the basic and advanced training measure was adjusted and expanded to include the performance aspects of "sufficient water availability" and "application of improved agricultural production techniques by the target group." However, the general project concept remained unchanged. The response to the changed conditions regarding the implementation of the project and the adjustment or reduction of the projects and beneficiary families was necessary and appropriate. These adjustments particularly accounted for the updated and realistic costs of the finally selected irrigation perimeters. The implementation approach of the open programme was an important prerequisite to make these adjustments in a needs-oriented manner.

The time frame estimated during the project appraisal for supporting users in the operation of facilities and in the development of irrigation agriculture and livestock farming (component 2; reference value of 3 years without DED support) was insufficient. The concept did not provide an opportunity to subsequently extend the interim support of the rehabilitated and created irrigation infrastructure by the programme executing agency according to actual needs, as this was terminated by the project completion. The delayed completion of the perimeters Upis and

¹⁷ For example, due to the risk of erosion in steep zones; temperatures too low for animal husbandry and for the growth of soil products; no use of greenhouses.

Marampaki thus inevitably led to a shortening of the respective support times by the programme executing agency.

Rating summary

The defined objectives of the project are highly aligned with Peruvian national and regional, as well as German and international development policies and their strategies. The project's design and target orientation plausibly focus on the core problem and the needs and capacities of the target group. The content orientation of the project's components appears coherent and appropriate to this day. The design, due to its structure as an open programme and the financing structure based on FC and the partner's own funds, provided the necessary flexibility to respond appropriately to changed conditions.

The target system was subject to a plausible impact chain, and the chosen indicators (before and after the programme interruption) were overall appropriate. The distribution of tasks between Plan Meriss and the consultant did not correspond to the actual capacities of Plan Meriss. However, these could be corrected after the interruption by increasing the scope of services of the consultant. The overall duration of the programme was too ambitious and therefore weighs negatively. The overestimated capacity of Plan Meriss during the design and the resulting ambitious cost calculation led to a significant reduction in the planned measures. The open programme approach allowed for an adaptation of the project to the changed conditions, but it only foresaw a significantly smaller scope of measures. The national guideline for unit prices according to SNIP referred to average experience values. Especially the unfavorable topographical conditions, which required higher infrastructure costs (water storage, culverts, bridges, and special structures), were not foreseeable at the time of the project appraisal and the then not yet selected irrigation perimeters (particularly the extensive perimeters Upis and Marampaki). Thus, a large part of the additional costs was difficult to estimate and could finally be adjusted through the sensible design as an open programme. Despite the conceptual weaknesses, particularly at the time of the project appraisal, the relevance is still considered successful due to the design adapted to actual needs and the targeted orientation of the measures.

Relevance: 2

Coherence

5. Internal coherence

The project coherently builds on a decades-long successful collaboration of German development cooperation with the regional development organisation and programme executing agency, Plan Meriss. The objective of the development cooperation was already then the promotion of smallholder irrigation agriculture as well as the professional and organizational strengthening of Plan Meriss. Here, the regional special programme of Plan Meriss, "Inka," which has existed since 1975 and was supported by the former GTZ from 1979-2002, is particularly noteworthy. The predecessor projects "Irrigation Programme Southern Andes I-III" especially demonstrate a close integration of FC and TC and underscore the synergy effects involving GTZ and DED. The long-term collaboration with Plan Meriss enabled the targeted use of experiences that could flow into the design and implementation of the project. The follow-up support by DED of the completed FC projects after 2000, including in the preceding Irrigation Programme Southern Andes Zone III, had proven to be very successful, and a continuation was recommended during the project appraisal. Furthermore, the respective predecessor projects could be equipped with a consolidation fund for potentially occurring significant infrastructure damages. Corresponding funds were conceptually considered in the present project. Regarding the financial resources proposed during the project appraisal for the consolidation of the preceding project (Southern Andes Zone III) and the recommended follow-up support by DED, the project was integrated into a long-term development cooperation in the project region.

In the interplay of FC and TC within the framework of preceding and parallel agricultural and environmentally relevant programmes, synergy effects could be created in favor of the project. From 2005 to 2008, InWEnt conducted the project "Integrated Agricultural Development and Resource Management in the Andes." This, as well as the present project and the FC project "Agro-Environmental Programme Jean-San Ignacio-Bagua," were coordinated with other relevant projects within the development cooperation focus "Sustainable Management of Natural Resources."

The measure is consistent with international norms and standards, which are also represented by German development cooperation. The protection of human rights is upheld concerning the choice of the target group, which was classified as extremely poor and very poor. The ownership of the beneficiaries was intensively promoted

through their close involvement in planning, the construction of irrigation systems, and training for sustainable operation. This is also in line with the Federal Government's concept for cooperation with indigenous peoples in Latin America and the Caribbean. The involvement of women was particularly considered within the framework of component 2, which also adheres to the principle of "leave no one behind."

6. External coherence The project supports Peru's own efforts, particularly those of the Cusco Regional Government, to improve the living conditions of the particularly disadvantaged rural population through the development of irrigation agriculture.

Multilateral donors, such as the World Bank, the Inter-American Development Bank IDB (*Banco Interamericano de Desarrollo*), and the Andean Development Corporation CAF (*Corporación Andina de Fomento*), were also engaged in resource protection and rural development in Peru at the time of the project appraisal. However, program-specific and in terms of financing, no particular need for coordination with other donors was mentioned at the time of the project appraisal (2003). According to the survey of stakeholders (consultant, programme executing agency), no other projects in the area of agricultural irrigation were known during the implementation of the project. Therefore, no necessary coordination of the project with other donors arose. According to information from interviews with stakeholders, there was indirect cooperation with local non-governmental organizations (NGOs) within the framework of various informal exchanges of experience.

The design envisaged intensive involvement of regional and local capacities. This particularly concerns the distribution of tasks in the project and especially the use of existing capacities of the regional programme executing agency. It is particularly noteworthy that the monitoring system of Plan Meriss, which was promoted by TC over several years, was used for the purposeful and professional monitoring of the project measures. The recourse to and use of existing local programme executing agency capacities were already formulated as important requirements for the operationalization structure at the time of the project appraisal. This use and close involvement of existing local capacities have a positive impact on external coherence.

Rating summary

With regard to internal coherence, the project measures followed international standards and norms both in design and implementation. During the project appraisal, the project was logically integrated into a long-term development cooperation in the project region, utilizing important long-term effects and results from complementary development cooperation instruments, such as capacity building of the programme executing agency, professional follow-up support (e.g. DED), or the provision of consolidation funds. During the implementation of the project, there was no significant need for coordination with other projects or donors. In terms of external coherence, the project capitalized on existing regional capacities, including those already created by development cooperation, particularly those of the programme executing agency Plan Meriss. The project's measures utilized the competencies and capacities (monitoring, technical advice, infrastructure construction capacities) of the programme executing agency, which had been further developed in the meantime, demonstrating a high degree of subsidiarity orientation, which positively impacts the assessment of external coherence. Due to the fully satisfactory results and the absence of significant deficiencies, coherence is overall evaluated as successful.

Coherence: 2

Effectiveness

7. Achievement of (intended) objectives

The objective adjusted as part of the EPE was to increase the agricultural production and productivity of family smallholder farms (target group) in the project area of the Cusco region. The achievement of this objective along the ex-post adjusted indicators is summarized in Table 2.

Table 2: Achievement of outcome level

Indicator ¹⁸	Status at project appraisal (2012)	Target value according to project appraisal / evaluation	Actual value at project completion (2017)	Actual value at evaluation (2024)
(1) Expansion of irrigation systems in project areas (hectares)	1,391ha ¹⁹ (five irrigation systems foreseen under the 2017 concept adjustment)	4,739 ha	4,586ha	4,636ha ²⁰ (98% of target value; five irrigation systems) Value fulfilled - during the EPE, farmers and Plan Meriss also point to a progressive expansion and intensification of irrigated areas due to the current development dynamics.
(2) NEW: Central local stakeholders and small farmers confirm the general availability of irrigation water as planned and agreed (component 1).	0 l/s	PA: Marampaki: 860 l/s Upis: 1,150 l/s Añahuchi: 300 l/s Cullahuata ²¹ : 380 l/s Ccuchuhuasi: 315 l/s EPE: Qualitative assessment of the increase in available water	Marampaki: 960 l/s Upis: 1,670 l/s Añahuchi: 300 l/s Cullahuata: 385 l/s Ccuchuhuasi: 350 l/s Mostly achieved	Value fulfilled - In all irrigation areas, the majority ²² of users confirm the general availability of irrigation water as planned and agreed.
(3) NEW: Key local stakeholders and small farmers predominantly confirm a significant increase in agricultural yield (milk yield) due to	3,400 litres/farm/year	PA: Increase of land use, productivity and production (each by at least 30% to approximately 4,400 litres/farm/year)	10,000-20,000 litres/farm/year	Current estimated value of 11,000-21,000 litres/farm/year Value fulfilled - In all 5 irrigation areas, users and representatives clearly

¹⁸ Outcome level indicators (2) and (3) have been adjusted due to insufficient recent statistics

¹⁹ Irrigated area of systems already operated before the project; KfW final report December 2016; Plan Meriss, September 2017

²⁰ The value stated in the final report by Plan Meriss from 2017. An updated survey of irrigation areas was not conducted after 2017. The difference to the target value of 2% also lies within the measurement error range of the corresponding surveying work. According to statements from farmers and Plan Meriss, a limited expansion of irrigation areas is additionally assumed, especially in the largest irrigation perimeter Upis due to positive agricultural development.

²¹ Technical design of the irrigation system (distribution) of Cullahuata-Congonya (new reference value to be achieved): 380 l/s (Cullahuata: 160 l/s and Congonya: 120 l/s) according to the consultant's report for the mission, A. Zapata, 2024, p.4. The value of 400 l/s stated in the final inspection report from 2017, on the other hand, refers to the amount of the associated river water intake. This would, considering the average efficiency of the subsequent supply line of 90% indicated in the final inspection report, result in a usable average flow for distribution of 360 l/s (old reference value). According to the on-site inspection and the survey of operators, the value of 385 l/s indicated in the final inspection report is still considered a valid measurement and is deemed plausible.

²² In conversation with the agricultural families in Ccuchuhuasi, a water user mentioned an insufficient availability of irrigation water. During the discussion, it was also mentioned that the water guard must ensure fair distribution when controlling the gates.

Indicator ¹⁸	Status at project appraisal (2012)	Target value according to project appraisal / evaluation	Actual value at project completion (2017)	Actual value at evaluation (2024)
implemented project measures.		EPE: Qualitative assessment of the increase in yield.		confirmed to irrigation organisations and communities a significant increase in agricultural output, including for Upis and Marampaki.
(4) Increase of agricultural productivity (green fodder) by at least 30% (tons/hectare)	20-30 tons/ha	30-40 tons/ha	100-150 tons/ha	Value fulfilled - 88-152 tons/ha (increase of 340-400%) ²³
(5) Increase in the intensity of land use by at least 30% (land use in%)	30-40%	40-50% ²⁴	100%	Value fulfilled - at least 100% (based on observations and interviews during EPE, a further increase can be expected ²⁵)
(6) Families benefiting from the project (number of families)	0	1,434 ²⁶	1,306	Value partially fulfilled - 1,306 (91% of the original target)
(7) NEW: The irrigation infrastructure is functional and is sustainably operated by the water user organisations (components 2 and 3).	Plan Meriss rates the operation of the irrigation infrastructure as good.	Good rating of operations by Plan Meriss EPE: Quality assessment of the holding	Operational well except for the not yet operational Upis and Marampaki systems	Value fulfilled - Generally well-functioning infrastructure with professional operation in all five irrigation perimeters by the established water user organisations, including in Upis and Marampaki (confirmed according to the ex-post evaluation inspection of the infrastructure and operation, as well as through conducted interviews with operators and other stakeholders).

²³ Data according to statistics of Plan Meriss Cullahuata: 88 tons/ha, Ccuchuhuasi: 152 tons/ha, Añahuichi: 104 tons/ha, Upis: 120 tons/ha, Marampaki: 100 tons/ha; presentation of Plan Meriss during the EPE mission

²⁴ Value according to the final inspection report, 2017; corresponds to the prescribed increase of the baseline value (30-40%) by 30%

²⁵ Particularly in Upis, based on observations and interviews with stakeholders.

²⁶ According to the addendum of the Acuerdo Separado from 2012 and the final inspection report from 2017, but not according to the underlying planning documents: Expedientes Técnicos, Memorias descriptivas, CES, 2011 and 2012 (1,306 families).

8. Contribution to the achievement of objectives

Regarding indicator (1): Expansion of irrigation systems and area

A total of five irrigation perimeters were expanded according to the adjustment of the project (2012). The predetermined total area (target value) of 4,739 hectares was achieved at 98%. This proportion refers to the total area of 4,636ha reported by Plan Meriss in its final report from 2017. The small difference to the target value (2%) lies within the measurement error range of the areas to be determined for the irrigation perimeters. Additionally, there is ongoing intensification and limited expansion of irrigation areas due to the current development dynamics, as particularly witnessed in the largest irrigation perimeter Upis during the ex-post evaluation by the farmers and Plan Meriss. Thus, this indicator at the outcome level is considered fulfilled.

Regarding indicator (2): Availability of irrigation water

"Never did the water reach down here, now we have water to work on our fields" - quote from a farmer from Marampaki.

The irrigation water is still available today as planned and agreed with the users in all irrigation perimeters. This was particularly due to the work of the implementing consultant, which included participatory planning, hydrological studies, and construction planning. The involvement of users in the construction execution (component 1) and targeted measures for water efficiency during operational support (component 2) allowed for a targeted technical design of the irrigation systems. Above all, they also created the professional basis and the necessary capacities of the operators for fair distribution to the users. The water quantities are managed according to the agreed specifications²⁷ by the water guards paid by the users through the water user organisations.

During the on-site inspection of the ex-post evaluation, the water users in all irrigation perimeters unreservedly confirmed the planned and agreed availability of irrigation water. Only operators in the irrigation perimeters of Ccuchuhuasi and Cullahuata/Congonya mentioned a possible reduction in water efficiency due to the distribution channels not being lined everywhere. However, this was already accepted in the technical design for cost reasons under the condition of achieving the specified flow rates and quantity distribution.

The training of users facilitates a gradual future expansion of water-saving irrigation, especially through sprinkling. Through the project, sprinkler technology was introduced, particularly in Añahuichi (at the time of the ex-post evaluation, over 63% of the total area with an increasing trend) and Marampaki (at the time of the ex-post evaluation, approximately 68% of the total area). At the time of the ex-post evaluation, the irrigation perimeter Marampaki had one of the largest sprinkler areas (922 ha) in the Andean highlands. The training and support of operators in the operation of infrastructure and in the development of agriculture (component 2), as well as the necessary preparatory training of Plan Meriss (component 3), were crucial for the professional distribution of irrigation water according to the agreed water quantities, which also applies to the projects Upis and Marampaki.

Before, our fields looked sad yellow, now everything is a green joy"; "Every day I buy 450 litres of milk and produce 140 cheeses" - quotes from a farmer and a cheese manufacturer in Upis.

Since the commencement of the irrigation systems, all five project areas, including Upis and Marampaki, have shown a significant increase in agricultural yield. Table 3 indicates a substantial rise in all listed indicators from 2012 to 2024, suggesting that the measures implemented under the project made a significant contribution. In all five irrigation perimeters, the development in pasture productivity and the increase in green fodder production due to now permanently secured water availability and irrigation (infrastructure measures and operational strengthening through the project) is remarkable. This was also achieved by introducing new grass varieties on the irrigated areas. This development has led to a corresponding increase in livestock farming and milk production, which is a crucial economic factor.

²⁷ As part of the studies for the water requirements of individual farms and for the technical design of the water infrastructure, as well as during the construction of the secondary distribution systems, the water users were involved. The required water quantities were jointly and bindingly determined (users, Plan Meriss, implementing consultant).

Table 3: Specific productivity indicators

Indicator		without projects, 2012*	Outturn by project, 2024*	
				Increase (factor)
Green fodder productivity	to/ha/year	10	34-60	3.4 - 6.0
Productivity of pasture land	to/ha/year	1	19	19.0
Capacity of pasture land (cows)	animal/ha/year	0.16 - 0.28	2.2 - 2.8	10.0 - 13.7
Average milk production	litres/cow/milking	1.5 - 3.0	10	3.3 - 6.7
Milking period (1 milking/day)	Days per year	90-120	270	2.25 - 3.0

Source: Monitoring data Plan MERISS; * Individual values: averages for all five irrigation perimeters and ranges of values taking into account different values of the different perimeters

"Ccuchuhuasi is the showcase of Velille" - representative of a user committee in Ccuchuhuasi

It can be assumed that the milk production, which is significant for family farms, has continued to increase following the rise of 30-60% (30% specified benchmark) identified in the project completion report (2017). The newly introduced breeds through the project, such as *Swiss Brown and Holstein*, for example in Añahuichi, can even produce peak values of up to 15-25 litres of milk per day²⁸. The increasing milk production is also noticeable in the numerous dairies with various cheese varieties (e.g., 32 dairies in the [Ocongate](#)²⁹, district, many of which are in the adjacent perimeters of Upis and Marampaki).

According to the current statistics from Plan Meriss, the efficiency of milk production (litres/cow/milking session) has increased by 3-7 times, alongside a simultaneous increase in the milking period by 2-3 times (see Table 3, rows 4 and 5). Based on the more intensive pasture management (approximately 2-3 cows/ha, see Table 3, row 3) and an average number of 4-10 cows per family farm, it can currently be concluded that there is an extraordinary increase in milk production to approximately 11,000-21,000 litres per family per year³⁰. This represents a further increase since the project completion report, now also including Marampaki (11,000 l/family/year) and Upis (19,000 l/family/year). Starting from a baseline of 3,400 l/family/year, milk production in all perimeters has increased at least threefold.

In the highlands, such as in Marampaki, significant sheep farming is conducted. The permanent breeding of alpacas has also been made possible in extreme high altitudes of up to 4,300 meters above sea level in Upis due to the irrigation of fields. In agriculture, a diversification and increase in production and yield have generally been achieved in all irrigation perimeters. At the time of the evaluation, good progress was particularly noted in the production of oat flour (as animal feed), especially in Ccuchuhuasi and Cullahuata (20% of the irrigated area). As animal feed, alfalfa and white clover are now also cultivated due to the project measures. Additionally, the project enabled a strong intensification of potato cultivation and the introduction of bean and vegetable production through irrigation, particularly in Upis and partially in Marampaki.

The coherent and target-oriented coordination of the three components contributed to the increase in agricultural yield. In relation to each component, besides the fundamental implementation of functional irrigation systems (components 1 and 4), the organisational and technical strengthening of users (component 2) in irrigation operations and specifically in the improvement of agricultural practices remains significant to this day.

Regarding indicator (4): Increase in agricultural productivity

Agricultural productivity, in terms of annual green fodder production (tonnes/hectare), was expected to increase by at least 30%. With a baseline of 20-30 tonnes/hectare (project appraisal 2003), Plan Meriss recorded values of 88-152 tonnes/hectare (reported in 2024 during the ex-post evaluation)³¹. These values, as already noted in the project appraisal report, are far above the baseline of 2012. Thus, an increase factor of 3.4 to 6 times the baseline value is achieved (see Table 3, first row). The increase in annual green fodder production of at least 300% significantly exceeds the specified minimum increase of 30%. The expansion of the irrigation water available for the management of agricultural land in the perimeters continues to contribute significantly to the increase

²⁸ After the irrigation measures were implemented, the average milk production was 10 litres/day (see also table data).

²⁹ See Exhibition of the Asociación SUMAC in [Ocongate](#) (at Upis and Marampaki) of cheese producers, 2023 (YouTube video)

³⁰ Minimum: 10,800 litres/family/year with 4 cows/family farm, averaging 2,700 litres/cow/year; Maximum: 21,600 litres/family/year with 8 cows/family farm, averaging 2,700 litres/cow/year.

³¹ Presentation of the project and its results (PowerPoint), Plan Meriss, April 2024 (Presentación a la Misión de Evaluación Ex-post de proyectos de riego implementado con la Cooperación financiera del Banco KfW de Alemania, Rolando Huiza, 08 abril 2024)

in agricultural productivity. The expansion of the irrigation system created essential conditions for season-independent management of the land, as the cultivation of pastureland, and to a lesser extent crops, can still take place independently of rain-fed agriculture.

Regarding indicator (5): Increase in land use intensity

The intensity of land use was expected to increase by at least 30%. The value of a 100% increase indicated in the project completion report was confirmed as significantly exceeded during the on-site inspection. Before the implementation of the measures, the utilized areas could only be irrigated to a limited extent and were mainly used under rain-fed management. The expansion of the irrigation perimeter made it possible to manage previously fallow agricultural land throughout the year. According to Plan Meriss, livestock farming (animals/ha/year) on pastureland has increased by at least 10 times the baseline value (see Table 3, row 3). This was also confirmed during the evaluation trip through observations and interviews. For example, there was a frequent expression of the need for higher water efficiency, which is becoming increasingly important due to the ongoing intensification of land use and the increase in production in all perimeters.

Regarding indicator (6): Families benefiting from the project

With the completed infrastructure measures, the project benefited 1,306 smallholder families. As indicated in Table 2, the original target was 1,434 family farms. Thus, only 91% of this target was achieved. According to the detailed planning documents of the implementing consultant³² from 2011 and 2012 (before and at the time of the project adjustment in 2012), it can already be concluded at this point that the total number of 1,306 family farms corresponds to the number of families in the respective irrigation perimeters mentioned there. Therefore, a corresponding correction of the target to 1,306 families is plausible and justified and is considered achieved within the framework of the evaluation.

Regarding indicator (7): Implementation of functional irrigation infrastructure and sustainable operation of irrigation systems by water user organisations

All five irrigation systems were fully implemented according to the adjustment in 2012 and remain functional to this day (Component 1). After the official end of the project (December 2016), small remaining works in the newly added irrigation perimeters, Upis and Marampaki, were completed³³ in 2017. While the formal handover of the infrastructure in Marampaki took place in 2019, it was still pending for Upis at the time of the evaluation. Until the publication of the corresponding resolution, scheduled for mid-December 2024³⁴, Plan Meriss remains the formal responsible owner of the infrastructure in Upis. Consequently, there has not been an opportunity for potentially necessary major investment projects by the municipality or province³⁵. However, this was not necessary up to the time of the evaluation. It is positive that despite the formal ownership transfer still pending, a high level of ownership by the water user groups in Upis was observed at the time of the evaluation. This is primarily due to the intensive participation of the target groups in planning the water requirements, designing the infrastructure, and constructing the infrastructure in the perimeter. It is negative that at the time of the evaluation, the formalisation of water rights for users of the irrigation perimeters Upis and Marampaki had not yet been completed by the National Water Authority (ANA). Many users insist on their traditional water rights and fear water privatisation. The awareness-raising efforts conducted by Plan Meriss until 2016 under Component 2 had not decisively changed this stance among users. However, during the evaluation trip, the two water user organisations mentioned their current initiatives for the corresponding formalisation. It is therefore assumed that formalisation with ANA will occur in both cases.

"In our organisation, we have a set of rules for water use, which we strictly adhere to", "Each sector has a water steward" - quotes from Upis.

The water user organisations were defined and established in all five irrigation perimeters of the project, including the systems Upis and Marampaki, together with the water users as part of Component 2. For the management of all irrigation perimeters, a water user commission was introduced to oversee and operate the overarching water infrastructure (water intakes, main pipelines, and central water reservoirs) and to control the water quantities

³² Expedientes Técnicos, Memorias descriptivas, CES, 2012 (Upis, Marampaki, Cullahuata), 2011 (Añahuichi)

³³ Information is based on statements from Plan Meriss during the evaluation trip and the project completion report from 2017 (Acta de Misión de Evaluación, A. Schweitzer, septiembre 2017).

³⁴ According to the message from Plan Meriss to the then implementing consultant (07/11/2024), including the note of previous formal errors in handling the corresponding financial accounting.

³⁵ Until the formal handover of the irrigation infrastructure from Plan Meriss to the water user organisation Upis (planned for mid-December 2024), Plan Meriss remains the legal owner. Consequently, the water organisation does not have the rights to apply for and carry out potentially necessary projects and financing with the responsible municipality of Ocongate or at a higher level.

there and distribute them to several user committees (divided according to territorial administration). The committees manage and maintain the secondary infrastructure (lateral distribution channels) and ensure precise distribution to each irrigation plot, primarily through the employed water stewards. As administrative tools of these committees, their statutes, internal regulations, and operating manuals were introduced and implemented. Under the signed regulation for water use under the control of ANA (via their local ALA), the water user organisations (Upis and Marampaki still pending) have committed to the rational use and fair distribution of irrigation water. Thus, the water user organisations have also formally taken responsibility for the maintenance and preservation of the infrastructure. As part of the studies and planning conducted by the consultant, the necessary counterpart contributions to be provided by the agricultural families (cleaning work on the water infrastructure and the water tariffs to be paid) for each of the five irrigation perimeters were determined and introduced. The water tariffs, generally responsibly paid by all users, cover, as planned, only the operating and maintenance costs and primarily relate to the costs of the water stewards. The work of the chairpersons and administrative staff is performed voluntarily. Additionally, a small fee is paid to ANA for each irrigation perimeter (except Upis and Marampaki) according to the maximum derived water quantities, which is apportioned to the users.

Except for the Upis system, all irrigation systems have been formally handed over by Plan Meriss to the water user organisations. The capacity-building measures provided by the project at the regional programme executing agency, Plan Meriss, allowed for the establishment of the water user organisations and their training and support in operation. On-site inspections and interviews conducted with the involved parties, operators, and users showed that all five systems, including Upis and Marampaki, were professionally and sustainably operated by the water user organisations at the time of the evaluation. The technical and administrative tasks, including the fair distribution of water, are responsibly carried out.

Maintenance and servicing of all systems are carried out independently by the water user organisations without significant complaints from a technical perspective. This is also evident from the generally good condition of the inspected facilities. Twice a year (at the beginning and end of the rainy season), all channels and facility parts are cleaned and inspected in a joint large-scale action involving all users, according to the operating manuals. In the event of major structural damage, the financial and practical support of the water user organisations by the municipalities proves effective. For example, a siphon pressure pipeline in Upis was satisfactorily repaired with the help of the municipality of Ocongate.

In Añahuichi and Ccuchuhuasi, the respective water user organisations, with the support of the municipalities, plan to replace the open main channels in the urbanised sections with pipelines. The financial contributions of the users to the water user organisations are generally paid properly, with few exceptions. These revenues are not fully cost-covering and can at most cover the operation of the infrastructure with water distribution, maintenance work, and fees to the national water authority ANA. Major structural damage or renovations and renewals are financed with the help of the municipalities.

The participatory planning of the infrastructure allowed for a fair distribution of the available irrigation water in all five projects. For example, the parcelling and formalisation of agricultural land were carried out in close collaboration with the users and municipalities. An effective and even distribution of irrigation water was ensured through the counterpart contribution of the users, who physically participated as helpers in the construction measures.

The effective interlocking of the three appropriately implemented components of the project was crucial for achieving the objectives. In all five perimeters, the creation and rehabilitation of the water infrastructure under Component 1 were fundamental for providing irrigation water. The participatory planning and especially the technical support (studies, planning, construction management, programme executing agency consultation) of the implementing consultant contributed to this. The training of the programme executing agency through the basic and advanced training measure conducted under Component 3 was an essential contribution to the capacity building of the users, which remains significant for the sustainable operation of the irrigation infrastructure and effective land management.

At the target group level, the agricultural family farms, the project has decisively contributed to long-term secured agricultural production. Through the interventions of Plan Meriss with the system operators and the joint dimensioning of water quantities, conflicts that arose before the project regarding fair water distribution were generally eliminated. Due to time constraints, the content and organisational support by Plan Meriss for the users of the Upis and Marampaki perimeters was shorter than planned. As a result, sufficient sensitisation for the legalisation of water rights among the beneficiaries could not be achieved, which is reflected in the still pending support and control by the regional water authority ANA and negatively impacts the evaluation.

The project-internal factors crucial for achieving the objectives were the design as an open programme with corresponding flexibility in increasing financing by the programme executing agency and in the distribution of tasks between Plan Meriss and the implementing consultant. The financing of the project, partly based on counterpart contributions from the regional programme executing agency, was critical for success, allowing access to additional necessary financial resources due to cost increases, ensuring the full implementation of the measures (especially Component 1, systems Upis and Marampaki). The somewhat lower financial contributions from the municipalities also had to be compensated. The expansion of the tasks of the implementing consultant after the project adjustment was decisive for the qualitatively appropriate implementation of the infrastructure. The long interruption of the project of about 3 years had a negative impact due to cost increases, particularly for the implementation of the infrastructure (Component 1). However, the interruption was also used to carry out the time-consuming land reorganisation with the formalised division of communal land among the respective agricultural family farms. This had a favourable effect on the faster execution of the project after the interruption.

9. Quality of implementation

At the beginning of the project, Plan Meriss's project management was overwhelmed by the required national regulations (e.g., underestimated unit prices required by the national planning system SNIP) and in the selection of projects. This had a counterproductive effect on the implementation time of the targeted measures and was exacerbated by the politically induced personnel changes at Plan Meriss. Only after the project adjustment post-2012 and the expansion of the implementing consultant's competencies could the project management under Plan Meriss's leadership be effectively strengthened. The monitoring of the project, including the basic and advanced training measure, was satisfactory. In accordance with the directive not to extend the project's duration beyond 2016, the project management was able to implement an adjusted but temporally insufficient package of measures for Component 2 in the Upis and Marampaki projects. Specifically, this materialised in a shortened support of the water user organisations in the operation of the water infrastructure by Plan Meriss of six months, and compared to the other 3 perimeters, even 18 months.³⁶ Consequently, Plan Meriss was unable to fully carry out important measures, such as strengthening the water user organisations in administration, operation, and water rights, among the users. As a result, the process of regulating water use between the water user organisation and ANA after the end of the project proved very difficult. This reduces effectiveness, although the users' resistance at the time would have been very difficult to overcome even with longer support, and although efforts are now being made by both organisations to implement this regulation.

The participation of the municipalities and their coordinated collaboration can be considered satisfactory. The respective municipalities were involved in the new land reorganisation of the formally allocated fields, which was a prerequisite for the implementation of Component 1. The municipalities also provided construction and land machinery for the construction measures as well as tree plants for erosion protection. The constant involvement of the municipalities as sovereign authority in the formalised parcelling of fields (which transitioned from communal property to private ownership by farming families) and in conflict resolution at the time of the evaluation is considered crucial for success. It is negatively noted that the municipalities' counterpart contribution to the infrastructure measures was only 65% of the originally agreed values due to their limited capacities.

10. Unintended effects (positive or negative)

The positive unintended effects are diverse. During the evaluation, it was found that many farming families wish to improve productivity and water efficiency through irrigation on their own initiative. This applies to both farming families in perimeters where irrigation was not planned (Upis, Ccuchuhuasi, Cullahuata) and perimeters where a mixed form of irrigation was implemented (Añahuichi and Marampaki). In the future, this should also be possible in many cases through a redesign of the irrigation systems with pressure pipelines. Further positive unintended effects materialised in the form of improved traffic routes in the perimeters, which were previously created as access roads during the construction of the hydraulic infrastructure under Component 1. Additionally, the project contributed to improved nutrition for farming families, especially children. This was indirectly facilitated by the diversification of agricultural products through activities within Component 3. During the evaluation, no negative unintended direct effects and results were identified. This conclusion is based on interviews with project officials and user communities.

³⁶ According to the project appraisal, a support period by the programme executing agency of 2 years was planned, although the Añahuichi perimeter was even supported content-wise and organisationally by the programme executing agency for 3 years after completion.

Rating summary

The overall achievement of target values at the outcome level is considered successful. Particularly decisive is the generally satisfactory condition of the infrastructure in all 5 irrigation perimeters of the project (Component 1) observed during the evaluation. This created a crucial prerequisite for widespread access to irrigation water, which enabled significantly higher crop yields on the land around the perimeters up to the time of the evaluation. However, the lack of and delayed formal handover of the system in Upis (announced for mid-December 2024) leads to deductions in the assessment of effectiveness concerning Component 1, which, despite significant production increases, is only deemed successful. The contribution and quality of the input from the implementing consultant are evaluated as successful in terms of achieving the intended objectives. The satisfactory application of capacity development by Plan Meriss (basic and advanced training measure, Component 3) in Component 2 and its measures was significant for achieving the objectives but shows deficiencies. The impact potential in the operation of irrigation systems and agriculture fell short of expectations, as the operational support and supervision time by Plan Meriss for the Upis and Marampaki perimeters was reduced. This results in a limited successful evaluation of Component 3. The project unfolded a multitude of positive unintended effects. No negative unintended effects were identified. According to the overall and partial assessment, the effectiveness of the project, despite some existing deficiencies, is still evaluated as successful due to the significantly dominant positive results in the area of productivity and production increase.

Effectiveness: 2

Efficiency

11. Production efficiency

The total costs of the project amounted to approximately EUR 21.1 million instead of the originally planned EUR 13 million. The FC contribution was EUR 6.0 million (loan funds) plus a grant of EUR 0.4 million for the basic and advanced training measure. The counterpart contribution of EUR 14.7 million consists of contributions from the regional programme executing agency amounting to EUR 14.0 million, the target group amounting to EUR 0.3 million, and the municipalities amounting to EUR 0.4 million. **Thus, the project was approximately EUR 8.1 million more expensive (+62%) than planned during the project appraisal. With an almost unchanged FC share, the financing share of the programme executing agency (capital investments) increased from EUR 4.6 million to EUR 14 million.** This increase also includes compensation for the lower contributions from municipalities and users (together +1.6 million compared to project appraisal). The majority of the project costs (approximately 78%) were estimated and spent on the implementation of the water infrastructure (Component 1). The cost share for the development of the operation of irrigation facilities and the improvement of agriculture (Components 2 and 3) amounts to 8.3%. Due to the increased total costs, the share for project management and the implementing consultant decreased to approximately 14%. Thus, the estimated cost share of the consultant fell to approximately 11%. The distribution of total costs across each component is shown in Table 4.

Especially at the beginning of the project, national regulations (e.g., underestimated unit prices according to SNIP) hindered a swift and proper planning process for the infrastructure measures (Component 1). Regarding cost adjustment, the chosen financing structure of the open-designed project proved effective. Due to the directive of the non-extendable project duration, the most important measures for users were carried out in the Upis and Marampaki projects according to an adjusted implementation package of Component 2. The financing and swift execution of the measures of Component 3 were carried out after the interruption of the project by the programme executing agency Plan Meriss. For this purpose, Plan Meriss was significantly relieved by transferring extensive planning work from itself to the consultant. Part of the planned basic and advanced training measures could not be completed on time by the end of 2016, leaving residual funds of EUR 123,494 (24.7% of the grant). These residual funds were used to settle the outstanding final invoice of the consultant.

Table 4: Shares of costs per component according to the Special Agreement (2006) and its Addendum (2012) versus actual costs (2017).

Component	Estimate of costs Special Agreement, 2006		Addendum to the Specific Agreement, 2012		Real cost 2017	
	EUR million	%	EUR million	%	EUR million	%
Component 1: <i>Irrigation systems construction</i>	10.29	72.3%	16.29	80.3%	16.48	78.1%
Component 2: <i>Consulting Farm & Agriculture</i>	0.43	3.0%	0.57	2.8%	0.52	2.5%
Component 3: <i>A+F Measure & Equipment</i>	0.98	6.9%	1.20	5.9%	1.22	5.8%
<i>Project Management & Consultant</i>	2.53	17.8%	2.22	11.0%	2.86	13.6%
Total	14.23	100.0%	20.28	100.0%	21.08	100.0%

Sources: Special Agreement (2006) and its Addendum (2012) and Completion Report (2017)

The additional costs incurred by the project, which were exclusively borne by the programme executing agency, particularly concern Component 1 and correspond to a cost increase of Component 1 compared to the originally estimated cost (Special Agreement 2006) of approximately 60.2%. It is noteworthy that the original rough cost estimate was based on a too low reference value of national unit prices according to SNIP of 1,500 USD/ha. After the interruption of the project, the cost estimate in the Addendum of 2012 had to be adjusted (approximately 3,440 EUR/ha). The actual average specific construction costs amounted to approximately 3,600 EUR/ha. Considering the overall inflation in Peru of about 14% (period 2013-2016), these are below the adjusted value of 2012 and are thus deemed appropriate at the time of evaluation. This particularly took into account the remote highlands and hydraulic conditions (e.g., compensating steeper slopes with necessary reservoirs). The costs of Components 2 and 3 do not differ significantly from the estimates of the Special Agreements. Due to the necessity to expand the services of the implementing consultant and extend the duration by 1.5 years, higher costs resulted. The appropriate share of the consultant's costs (13.6%) was still below the sum of financing estimated during the project appraisal of 2003. **Generally, the actual costs of the implemented measures are within the estimated costs of the 2012 update.** Already at the beginning of the project in 2003, the progress of the project was hindered. The main reasons were the difficult final selection of project sites with an inadequate initial cost estimate according to SNIP and the overwhelming of Plan Meriss in conducting studies and planning. This bottleneck could not initially be resolved by the implementing consultant, who initially only had an advisory role. After the interruption of the project, the consultant, now also responsible for studies and planning, had a justified additional time requirement for the necessary revision of Plan Meriss's studies. Consequently, the progress of construction measures was also delayed, especially for the Upis and Marampaki projects, which partially affected the full implementation of the planned project measures. Due to the unforeseeable time requirement for the consultant's planning work at the time of programme adjustment (planning deficiencies of Plan Meriss only became visible after the consultant took over), the resulting delay is plausible and acceptable. Due to this delay and despite staggered implementation according to construction progress in the perimeters, users in the Upis and Marampaki perimeters could only be supported and advised by Plan Meriss for 1.5 years, instead of the tested three years (PP: ambitious 2 years) until the programme end (December 2016) within Component 2. Despite these delays, the specific costs (3,600 EUR/ha) were within the adjusted cost estimate of 2012.

12. Allocation efficiency

"We are the users of the "rich Añahuichi", the best of the district of Chamaca. Those who have no water envy us."
- Farmer from Añahuichi

The intended impacts of the project at the impact level, with the improvement of the socio-economic conditions of the poor rural population, particularly through the increase in operating income of the project's beneficiaries, are crucial for assessing allocation efficiency. For this purpose, the assumed average value of operating income (net) of the respective irrigation perimeters before and after the project is compared. The increase in estimated income after project completion is related to the corresponding financial inputs of the project. The table in Table 5 shows that the estimated average net income of all beneficiary families increased by more than threefold on average five years after the irrigation infrastructure was commissioned. This average gain of approximately 220% exceeds the indicator of the overarching development objective (project appraisal) of at least 100% after five years. The high increase in income in Ccuchuhuasi and Cullahuata/Congonya of approximately 400% is mainly due to the much lower baseline value before the commissioning of the irrigation systems.

According to current information and statements from users, a continued secure increase can be assumed (see sustainability). The cost increase is directly related to the significant increase in productivity (see also Table 3). A

complete amortisation of investment costs³⁷ could be achieved approximately 6-7 years after the systems were commissioned. Thus, a very high allocation efficiency of the project is achieved. The significantly higher financing participation of the programme executing agency compared to the FC loan is also considered appropriate in terms of this economic efficiency at the time of evaluation. The programme executing agency also had to compensate for the cost difference between the originally estimated counterpart contribution of municipalities and users and their actual contributions (lower shares in investment costs: municipalities: 1.8% and users: 1.4%).

Comparing the respective irrigation perimeters, it becomes apparent that particularly in Marampaki, the proportional total costs of the project were amortised about two years later than on average. This is partly due to higher specific investment costs, e.g., due to necessary reservoirs, special structures, and long main channels, pipelines, and the division into irrigation zones according to altitude differences, with many pressure pipelines for irrigation (similar to Añahuichi but much more extensive) being laid. On the other hand, similar to Upis, the average much larger plots (approximately 4.3 ha/family) are not yet fully irrigated and efficiently used. The predominant design of the new water infrastructure for gravity irrigation, incorporating the smaller, existing, and rehabilitated structures (secondary channels), is cost-effective compared to infrastructure for irrigation with pressure pipelines (Marampaki and Añahuichi). However, the ratio of necessary infrastructure (especially long main pipelines) to the total area must also be considered. Thus, for the large perimeters Upis (2,700 EUR/ha; without irrigation) and Marampaki (3,980 EUR/ha; irrigated area: 68%), lower specific investment costs resulted than in the smaller perimeters (Ccuchuhuasi or Cullahuata).

Generally, the high gain in net income in all perimeters is attributed to the increased capacity and production efficiency of pastureland and the increase in green fodder production (see also Table 3). The development of profitable livestock farming, including significantly increased milk production and the marketing of dairy products, is a decisive business and socio-economic factor for the development of the affected farms or project areas.

The allocation efficiency, reduced only to the actually expended FC funds, is rated as very high. Although the total costs of the project increased by nearly 62%, the cost increase was solely borne by the counterpart contributions of the Peruvian partner institutions. Consequently, the leverage efficiency of the total FC funds³⁸ increased from originally approximately 100% to now around 231%. The willingness of the Peruvian partner institutions to fully assume the significant cost increases also demonstrates the good content and technical allocation of the FC funds, as the planned investments were assessed as promising.

Table 5: Comparison of average investment costs (total costs of the project) per irrigation perimeter and family versus estimated average gain.

	Operating income (netto)								share of the total costs of the project	time of cost equalisation
	before project	before commissioning	at the time of the evaluation	after 5 years of operation	gain in profits	gain in profits/year	commissioning			
	(2012)	(2017) adjusted for inflation	(2024)	(2022)	(since 2017)	since				
	EUR/fam./month	EUR/fam./month	EUR/fam./month	EUR/fam./month	EUR/fam./month	%		EUR/fam./year		
Upis	69	113	375	327	214	190%	2.571	16.086	6,3	
Marampaki	74	121	375	327	206	170%	2.474	20.850	8,4	
Anahuishi	48	78	320	279	201	257%	2.411	13.505	5,6	
Cuchuhuasi	31	50	300	262	212	423%	2.540	12.882	5,1	
Cullahuata/Congonya	28	46	250	218	172	372%	2.063	13.440	6,5	
Average/Total	57	93	341	298	205	220%	2.457	16.143	6,6	

Source: Comparison estimate based on data and information from the project appraisal of 2003, the study documents of the implementing consultant, and interviews with the target groups and other stakeholders.

At the time of the evaluation, no alternative institutional implementation structures are known that could have ensured better cost or time efficiency. The implementation and involvement of Plan Meriss were crucial to leverage the institutional experience of the regional programme executing agency from previous FC projects and its existing capacities for infrastructure construction effectively. Simultaneously, this implementation structure also contributed to strengthening local capacities. **Regarding the implementation approach, which primarily focused on the expansion and rehabilitation of traditional gravity irrigation within the project measures instead of the widespread introduction of innovative irrigation systems, a mixed picture emerges.** In the medium term, and thus from today's perspective, the expansion of traditional, yet less water-efficient gravity

³⁷ The information refers to the total investment costs of the project (see cost breakdown in Table 1), consisting of counterpart contributions from Plan Meriss, the municipalities, and the users/target group, plus BMZ funds, consisting of loans and BMZ grants.

³⁸ Loan and grant fund share.

irrigation was more cost-efficient, as its investment and maintenance costs are significantly lower compared to more complex irrigation systems. Assuming that the market potential for agricultural products in the Cusco region continues to rise and the regional water supply becomes increasingly scarce due to climate change, the introduction of innovative irrigation technologies would have been more allocation-efficient in the long term. The marginal benefit of irrigation systems is significantly higher in the long term than that of gravity irrigation systems, as they offer greater water efficiency potential. Although the investment and maintenance costs of irrigation systems would have been many times higher and would have shown a significantly longer amortisation period for the financed irrigation infrastructure, long-term increases in operating income can only be achieved through further productivity increases.

Rating summary

The production efficiency of the project is evaluated as moderately successful. The decisive factors are the significant delays in project selection due to underestimated costs in the preliminary studies and the three-year project interruption, which resulted in substantial additional costs, particularly concerning Component 1. While the FC contribution remained unchanged, the counterpart contribution increased by more than double, approximately 126%. The assumption of additional costs by the programme executing agency Plan Meriss ensured the essential delivery of Component 1 for the project. The allocation efficiency is very high despite the significantly increased total costs of the project, corresponding to the substantially improved operating income. Overall, the efficiency of the project is evaluated as only partially successful, particularly reflecting the unsuccessful production efficiency and thus the weighting of individual components according to relative financing (end of the project: C1: 78.1%, C2: 2.5%, C3: 5.8%, C4: 13.6%). This primarily considered the increased financing costs of Component 1, which were mainly due to implementation delays in Upis and Marampaki.

Efficiency: 3

Overarching developmental impact

13. Overarching (intended) developmental changes

The objective adjusted as part of the EPE was: "to make a qualitatively measurable contribution to improving the economic living conditions of the rural population in the project area." The achievement of the objective at the impact level can be summarised as follows:

Table 6: Impact level achievement

Indicator ³⁹	Status project appraisal (2003) ⁴⁰	Target value according to project appraisal	Actual value at project completion report (2017)	Actual value at evaluation (2024)
Central local stakeholders confirm a positive development in the operating income and profits of local small-holder farms due to the measures implemented by the project	340 - 860 USD/year per family business USD 1 ≈ EUR 1	PA: minimum doubling of operating income five years after commissioning (2022). EPE: Qualitative assessment of the development of average operating income.	Unlimited positive improvements in socio-economic conditions. ⁴¹	Value fulfilled - according to the interviewees, operating income has increased significantly.

The impacts of the project at the impact level were already evaluated as unreservedly positive during the project completion report in 2017 based on the impressions gained at that time (only qualitative information), excluding

³⁹ In the EPE, the adjusted indicator; the preceding 2012 adjusted indicator (Addendum to the Special Agreements, 2012) was: "Improvement of socio-economic parameters compared to the year of programme start."

⁴⁰ Mentioned metrics concerning the specified indicator from the programme appraisal report of 2003, which was adjusted in 2012.

⁴¹ Qualitative statement at the project completion report; no quantitative data available.

statements about Upis and Marampaki. During the evaluation, a positive impact of the project was also observed in these last two irrigation perimeters.

Within five years (from the commissioning of the facilities in 2017 to 2022), the estimated average operating income of family farms (average across all irrigation perimeters) increased by more than threefold (approximately 220%, inflation-adjusted) (see Table 5 under Efficiency). This increase significantly exceeds the income growth targeted during the project appraisal (within 5 years) of 100%. Compared to the baseline value mentioned in the project appraisal of 340-860 EUR/year (average: 685 EUR/year or 57 EUR/month, not inflation-adjusted), the increase in the average value of operating income after 5 years to 3,576 EUR/year (298 EUR/month) is even more substantial. Interviews reported monthly peak values of 750-1,000 EUR/farm/month (Upis). At the time of the evaluation, a very dynamic business development was also observed in the regions around the 5 irrigation perimeters. Various interviews indicated that the significantly increased agricultural production of milk, dairy products, meat, and vegetables has led to increased and expanding commercial sales in local and regional markets (Ocongate, Velille, Cusco) of agricultural products. The profitable agricultural production also attracts milk producers who buy milk from farmers and process it into cheese on-site. New jobs are created, and the local population benefits from an expanded range of agricultural products. Thus, at the time of the evaluation, it seems plausible that not only directly but also indirectly large parts of the population on an expanded spatial level benefit from the generally observed economic development of agricultural family farms⁴². The improved income opportunities of agricultural family farms have also contributed to reducing inequality and poverty. The comparison of absolute poverty rates at the time of 2013 and 2018⁴³, shown in Figure 1, allows for concluding the widespread socio-economic development in the Cusco region until the completion of the project. It is evident that poverty in the governorates immediately adjacent to Cusco decreased between the two observation points, already indicating the regional economic dynamics still observable at the time of the evaluation in 2024. However, the poverty rates of the governorates where the irrigation perimeters Marampaki, Upis, and Añahuichi are located remained in a consistently high corridor of 40.8-67.3% even in 2018. The Velille governorate, which includes the Cullahuata/Congonya and Ccuchuhuasi perimeters, even shows an increase in poverty to 38.3-48.7%. However, the data do not allow valid conclusions about the specific poverty distribution in the perimeters, as the poverty rates of the individual governorates represent smoothed average values, and thus actual poverty rates in the perimeters may be lower or higher.

⁴² According to statements from farmers, cheese producers, and market vendors (e.g., cheese market in Cusco), this impression is reinforced.

⁴³ More recent data at the disaggregated governorate level were not available at the time of the evaluation, so data from 2018 are used here.

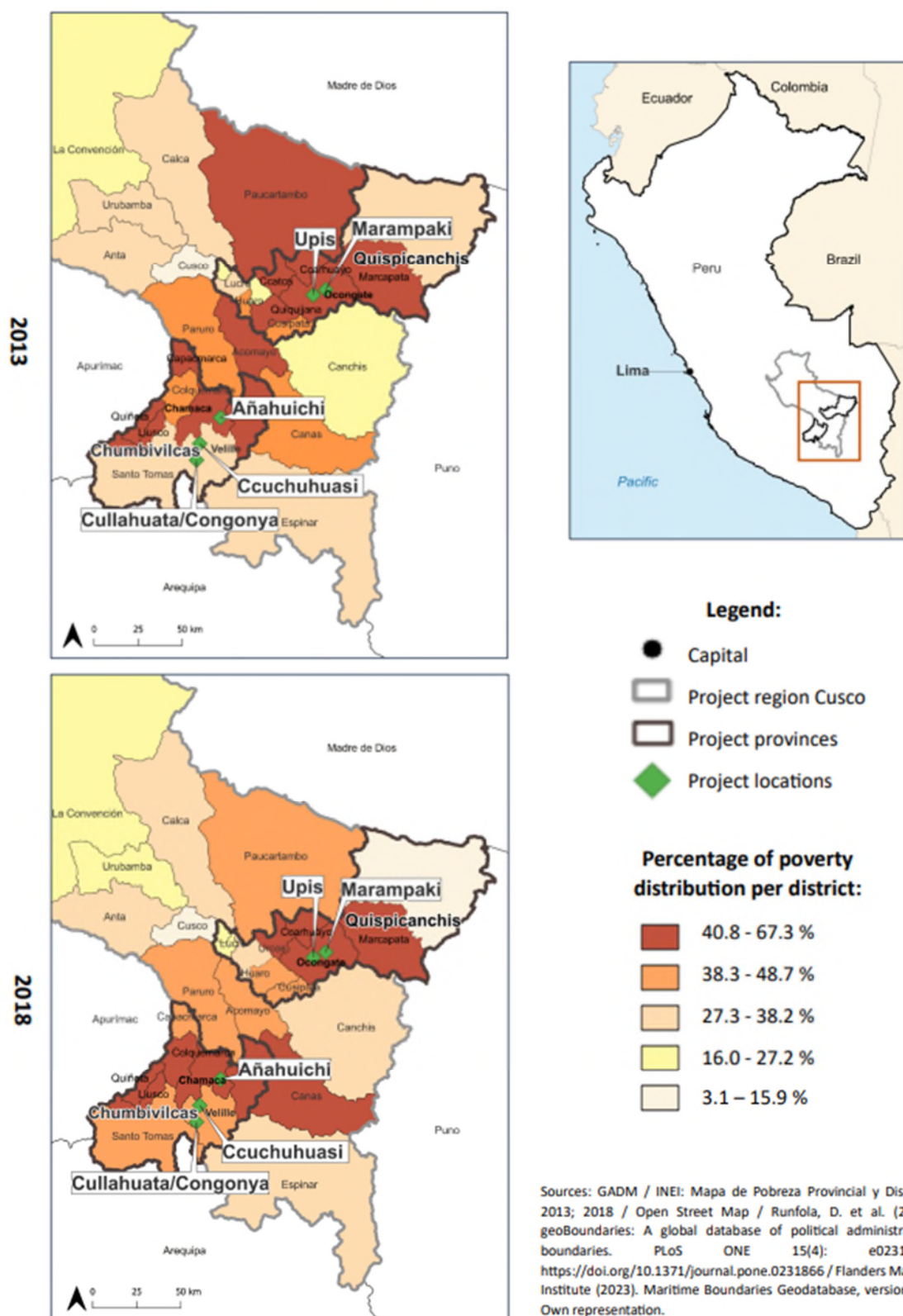


Figure 1: Percentage, absolute poverty distribution per project governorate and project at the time of 2013 and 2018 in comparison. Own illustration.

Agriculture is a crucial sector for the economic development of the region around Ocongate, where the two project areas, Upis and Marampaki, are located, and contributes to meeting the demand for dairy products and meat. The market has expanded particularly to the significant tourist centre of Cusco. The region around Velille

has been economically dominated by the mining industry since 2012. Especially due to the settlement that has arisen (workers in mining and involved commercial sectors), a significant additional market for agricultural products has emerged. This particularly benefits the farmers from Añahuichi, Ccuchuhuasi, and Cullahuata/Congonya, as observations during the evaluation trip confirmed: Agriculture is intensively practiced in this region, and activities for marketing improved dairy and meat products are conducted in Velille.

14. Contribution to overarching (intended) developmental changes

"Without the programme (project) Añahuichi would not survive" - "Wherever you look, you can see the better income of families from agriculture. You can see children going to school, all dressed up in uniforms, and wearing good shoes" — quotes from beneficiary water users in Añahuichi

The implementation of the irrigation infrastructure has laid the foundation for the development of profitable agriculture and its impact on the intended beneficiaries. This was confirmed both in interviews with various stakeholders and observed during the inspection of the irrigation perimeters⁴⁴. The project, particularly with Components 2 (support and training of users in production on-the-job and in marketing) and 3 (basic and advanced training measure with preparatory training of Plan Meriss, e.g., courses on marketing agricultural products), created the basis for dynamic potential development of yields and their marketing. Thus, employment, yield, and business development were firmly anchored regionally. The parcelling of agricultural land and the transfer of ownership rights from municipalities to family farms was a prerequisite created by the project.

The training conducted under Component 2 of the project on marketing agricultural products was crucial for leveraging the potential of regional market integration⁴⁵. Additionally, Plan Meriss, through the capacity strengthening received, was able to prepare users for the sustainable operation of irrigation systems and particularly for profitable agriculture with significantly increased operating income. The intensive participatory involvement of users and municipalities from the beginning in the construction and design of the irrigation infrastructure was essential for the high ownership and responsibility observed today in the use and maintenance of the perimeter systems.

An important external factor for the profitable marketing of agricultural products is the geographical proximity to consumer markets such as Ocongate and Velille, as well as the city of Cusco⁴⁶, whose economy is strongly influenced by continuous tourism. The well-developed regional road network is significant for the rapid transport of products. Another external factor is the marketing of natural⁴⁷ through social networks, which contributed significantly to increased sales, especially after the general setback under COVID-19 in 2021. In the meantime, the sale of dairy products from the project areas has also expanded to the cities of Arequipa and Lima⁴⁸. Various NGOs⁴⁹ are also supporting the marketing of agricultural products.

The water user organisations of the five perimeters of the project are subordinate to the watershed committees (controlled by ANA/ALA). Since the completion of the first three systems of the project Añahuichi, Ccuchuhuasi, and Cullahuata/Congonya, the local division of ANA (ALA) has been monitoring the authorised water quantities and supporting the water user organisations in increasing water efficiency. In 2018, the operators of the Cullahuata/Congonya system were awarded the National Prize (3rd place) for the Culture of Water by ANA, which is subordinate to the Ministry of Agriculture, for exemplary practices in water management. At the regional level, the project, as well as its predecessor phases⁵⁰, is considered a model reference for the development of the regional irrigation programme. This is supported by the reference manual for irrigation systems⁵¹ created by Plan Meriss in 2016, which particularly prepared the essential insights of the project. This mainly concerns the content

⁴⁴ The farmers and responsible persons from the user organisations and municipalities interviewed during the evaluation in all irrigation perimeters unanimously confirmed the positive economic and social development brought about by the project.

⁴⁵ The agricultural families, especially women, market the agricultural products in exhibitions, such as in Ocongate; see <https://www.youtube.com/watch?v=dd2yLlt9fcY> or <https://www.facebook.com/100064697661249/videos/165524615585402/>

⁴⁶ According to statements from market women at the central market in Cusco, the significantly increased (also international) tourism in recent years has influenced the increased demand for dairy products, such as cheese, which also comes from Upis and Marampaki.

⁴⁷ The natural dairy products produced and marketed by the farming families enjoy a market position with higher appreciation compared to industrially processed dairy products.

⁴⁸ See message in El Comercio: <https://elcomercio.pe/peru/queso-de-ocongate-participa-de-una-de-las-ferias-de-productores-mas-importantes-del-peru-a-fin-de-abrirse-paso-en-lima-noticia/>

⁴⁹ NGOs such as "Caijo" (<https://ghatu.ccajio.org.pe/>), "Acción contra el Hambre" (see video: <https://www.youtube.com/watch?v=oG8oFbMeFu4>), "SUMAC Ausangate" (<https://www.facebook.com/sumacausangate/?rdc=2&rd=1>) or the platform "Work4ProgressPeru"

⁵⁰ South Andes I-III Irrigation Programme (BMZ No. 1993 66 170)

⁵¹ Handbook for the Systematisation of the Model for Implementing Irrigation Projects ("Modelo de intervención del PER Plan Meriss en sistemas de riego para ámbitos andino-amazónicos"), Plan Meriss, 2016, with the involvement of the implementing consultant.

orientation of the training conducted under Component 2, focusing on the preparation of success-relevant techniques for production increase and the marketing of agricultural products.

15. Contribution to overarching (unintended) developmental changes

The beneficiary farming families are increasingly becoming part of an interacting, consolidated community within the irrigation perimeters through collaboration within the water user organisations established by the project (Component 2). This process promotes the joint operation and maintenance of the irrigation systems while reducing potential conflicts in the controlled distribution of water quantities⁵². The dynamic economic development in the project areas has increased the willingness to intensify agricultural production and to use innovative irrigation technologies (sprinklers, pipelines instead of channels). The higher demand for agricultural products provides incentives to develop and manage the remaining fallow land, for which more efficient irrigation technologies are necessary to optimally use the limited water supply during the dry season for year-round field management. The technical training and educational measures through Components 2 and 3 have laid a significant, albeit unintended, foundation for this. Unintended changes, which can be particularly attributed to the positive economic stimulation in the project areas, include the expansion of public and private infrastructure, encompassing schools, roads, animal shelters, dairies, and residential buildings.

"Now our children are studying in universities and higher schools in Cusco". - Quote from Marampaki

The project generated stable working conditions, a healthy social structure with a resident younger generation, improved nutritional conditions for families, especially children, and not least a responsible role for women in agricultural family farms (e.g., production and marketing of dairy products).

The surrounding municipalities also benefit from the positive economic development. They are directly and indirectly involved in the operation of irrigation agriculture and irrigation infrastructure. This includes financial and mechanical support for major structural damages, support in the marketing of dairy products (e.g., in Ocongate for Upis and Marampaki), and the organisation of fairs with events for the advancement of practices in livestock farming (in Velille for the benefit of Añahuichi, Ccuchuhuasi, and Cullahuata/Congonya). The year-round agricultural production⁵³, within a long-term secured operation of more productive irrigation agriculture allows for stability of supply in local and regional markets. The very dynamic economic development in agriculture is accompanied by other improvements by the respective authorities and institutions. Due to the increase in settlement as a result of the now settled farming families, many residential houses, barns, and dairies have been built. This also led to an expansion of schools in all project areas. Especially in the perimeters Upis and Marampaki, a widespread organised expansion of sanitary facilities on farmers' premises (within the framework of a public sanitation programme) and an expansion of the public electricity grid resulted.

All beneficiaries of the project, especially women and children, benefit from the economic development in the project areas. The economic dynamics offer the younger generation good prospects in agricultural work, as well as in the production and marketing of dairy products. Additionally, this enables family members to access higher education in cities like Cusco. Many return to the project areas, where good opportunities for development in the modernising agriculture (livestock farming, dairy farming) arise.

"Now many women are entrepreneurs in the production of dairy products. They are also involved in organising fairs" - President of a user committee in Añahuichi

Through the project, the previously disadvantaged indigenous population (target group) has achieved an improved social status, primarily through their established residency and the organised marketing of demanded products. The scope of activities for many women has significantly expanded after the completion of the project. For example, many opportunities have materialised in the production of cheese and yogurt, newly created due to the diversification of dairy products. Women are also leading professionals and entrepreneurs in the marketing of dairy products and organise already established regional markets and events in collaboration with the municipalities (Velille, Ocongate). Children have improved access to healthier nutrition, partly from their own production but

⁵² The active participation of all users in the elections of the boards of the respective water user commissions and committees strengthens the control of the water stewards and ensures a fair distribution of water; for example, according to a farmer in Ccuchuhuasi, a president was voted out who had abused his position for personal gain in water distribution.

⁵³ The project enabled the transition from the original seasonal agriculture (rain-fed irrigation and very limited gravity irrigation) to year-round agriculture with gravity irrigation and partial sprinkling, thus establishing settled farming families. For this, available water resources had to be tapped through the project (structures for river and spring water capture).

especially through access to agricultural products offered in the local and regional market. Schoolchildren benefit from new schools and newly created transport routes.

With a continued expansion of the regional agricultural sector, a scarcity of water resources as a negative unintended change due to the project cannot be fundamentally excluded. The risk is particularly high if traditional gravity irrigation continues to be primarily used.

Rating summary

During the evaluation, a significant improvement in the economic living conditions of the population residing in the project areas was observed, which was particularly facilitated by the ongoing regional market integration since the project's completion. The irrigation systems introduced by the project made a substantial contribution to the expansion of agricultural products and thus to leveraging the potential of regional market integration. Crucial was the accompanying training offer, which provided farmers and the established water user organisations with targeted marketing potentials and strategies for agricultural products. The economic interdependencies resulting from the advancing regional market integration continue to favour various investment measures in the project areas and, in turn, create better economic potentials in the project areas. Lessons learned from the project were compiled into a handbook, which is intended to serve as a guiding basis for comparable irrigation projects and thus has a model character. The overarching impact of the perimeters, Upis and Marampaki, which were only put into operation after the project's completion, was also observed during the evaluation. Due to the significant improvement in economic conditions alongside the absence of deficiencies, the overarching development impacts of the project are evaluated as successful.

Overarching developmental impact: 2

Sustainability¹⁶. Capacities of the beneficiaries and stakeholders

In all five irrigation perimeters, the water user organisations are well-organised (see Effectiveness, Indicator 6) and can ensure the operation of water distribution as well as minor repairs and maintenance independently in the long term by paying water usage fees. Major structural damages or interventions are generally covered by the municipalities, as assumed since the project appraisal in 2003, although their financial capacities are not sufficient for extensive investments. At the time of the evaluation, however, the Upis perimeter was still excluded from this advantage, as the formal resolution regarding the ownership status of the irrigation system by the water user organisation Upis is only scheduled for mid-December 2024. Thus, the water user organisation has not yet been able to carry out any potential investment projects with the municipality or other donor institutions, such as the regional government of Cusco. At the time of the evaluation, however, there were no indications that such investments had been necessary to date.

The dynamic economic development in the Cusco region has led to the younger generation remaining in the supported perimeters or partially returning after studying or training. This particularly favours the introduction of many advanced management practices, including in the areas of management form, irrigation techniques, production, and marketing, which positively influence the further development and sustainability of irrigation impacts. The target group continues to develop independently of the programme executing agency Plan Meriss, which does not have a mandate for further technical support of the water user groups.

In all five systems, long-term technical or operational requirements can arise, requiring more technically In all 5 systems, technical or operational requirements may arise in the long term, for which more sophisticated solutions through external support are needed. This concerns, for example, the necessary changes to certain parts of the transport pipeline in Añahuichi. The main motives are protective measures against pollution and accidents in urban sections of the main pipelines, as well as increased water efficiency. For this purpose, parts of the open channels are to be replaced with pipelines using public funds. For the concrete implementation of these measures, the water user organisation, together with the local municipality and district administration, commissioned a study⁵⁴. In discussions with farmers, the desire was often expressed to manage or expand the existing irrigation areas more intensively compared to the planned and implemented design, especially through an expansion of sprinkling. During the evaluation, it was found, as in the case of Añahuichi, that the water user organisations, in cooperation with the municipality and district, are fundamentally capable of organising and financing

⁵⁴ During the interviews conducted as part of the evaluation with the Añahuichi water user organisation and representatives of the municipality and district, a corresponding current study was presented and discussed.

future expansion measures at the perimeters with external support. The economic incentive and the ambition of many successful farmers in Upis to expand production may also lead to at least a partial transition to water-efficient sprinkling in the future. This approach demonstrates the interest of all parties involved in securing an efficient and well-functioning irrigation system and, above all, profitable agriculture in the long term. At the same time, it also addresses the potential future limitation of water resources, e.g., due to glacier retreat (Upis and Marampaki) or possible changes in spring discharge in Añahuichi.

17. Contribution to supporting sustainable capacities

The training of Plan Meriss personnel promoted by the project laid the foundation for the establishment and proper training of water user organisations as well as for the agricultural development of farms. For example, the water user organisations were enabled to organise and carry out the necessary tasks for the operation, maintenance, and upkeep of the irrigation infrastructure according to the introduced operating manual. The average two-year support and consultation of the water user groups⁵⁵ was a crucial contribution of the project to strengthen the technical capacities of the target groups and their ownership. A key factor for the pronounced ownership was also participation in planning and the legalised division of land (parcelling).

The technical expertise gained from the consultation by Plan Meriss enables and motivates farmers to participate in technical and operational development, such as at the time of evaluation in the area of modern livestock farming at a fair in Velille. Except for the irrigation perimeters Upis and Marampaki⁵⁶, the project contributed through Components 2 and 3 (training on water efficiency and the institutional water management framework of users) to a permanently closer collaboration (especially in controlling water efficiency) with the local representation (*Autoridad Local de Agua, ALA*) of the national water authority. This supports the water user organisations in the long term in controlling the water supply and improving water efficiency within the framework of water management planning. In the case of Upis and Marampaki, it is assumed that the resistance of water users against formalisation and their concern about their traditional water rights would not have been resolved even with longer consultation. Strong concerns could only be slowly dispelled in comparable cases, such as in Cullahuata, after a longer operating period and observing successful collaboration with ALA.

The institutionally integrated implementation approach of the project represents an important building block for the long-term cost-covering existence of the irrigation perimeters. According to the operator organisations, the costs for water stewards, administration, maintenance, and cleaning of facilities, as well as minor repairs, are covered by the revenues from water tariffs and also by counterpart contributions (especially in large maintenance actions and administration by user communities). The respective municipalities cover the costs of major structural damages or the replacement or modification of larger facility parts, as they are also highly interested in the economic development of irrigation agriculture and thus show a high willingness to provide financial support. The formal involvement of municipalities in the project and their subsequent willingness to support the water user organisations remains crucial for the sustainable operation and maintenance of the irrigation infrastructure.

Ultimately, the knowledge gained by users through Component 2 in the area of water efficiency has increased the awareness of the target groups to introduce new water-saving technologies in the medium and long term and to reduce⁵⁷ current water losses in open channels through pipelines or surface irrigation. Thus, adaptation strategies to limited water availability were already developed at the time of evaluation, which is a key prerequisite for resilient management of a potentially decreasing water supply in the region in the future. The training of beneficiaries in modernising agricultural practices and marketing agricultural products has sparked interest in ongoing innovations, such as the additional introduction of valuable and high-yield fodder plants or the improvement of animal breeds, and has raised awareness of their necessity.

18. Durability of impacts over time

"Now we want to install greenhouses to grow other products" - User from Añahuichi

At the time of the evaluation, it is assumed that the ongoing regional market integration of the project areas will continue to stimulate the production of agricultural products and generally promise a good development of operating income. To meet the growing demand for agricultural products, more innovative

⁵⁵ The support period after the completion of the project varied in the individual perimeters: Ccuchuhuasi: 2 years, Añahuichi: 3 years, Cullahuata Congonya: 2 years, Upis: 1.5 years, and Marampaki: 1.5 years.

⁵⁶ According to Plan Meriss and the implementing consultant, there are currently efforts by the user organisations to formalise water rights and sign the corresponding resolution with ANA/ALA.

⁵⁷ This is planned, for example, in Añahuichi (funding pending).

irrigation technologies must be used in the future, which will enable the expansion of irrigated agricultural areas despite limited water availability. Already today, corresponding investments are being planned in some project areas, such as in Añahuichi. Additionally, statements from interviews, particularly with the younger generation (e.g., according to statements in Añahuichi and Cullahuata), indicate a strong awareness of the importance of innovative irrigation technologies for the development of agricultural farms and a general willingness to invest.

During the evaluation, a high awareness among agricultural farms for the sustainable operation of irrigation facilities was generally observed, which is essential for securing year-round income. This also concerns more economical water use and soil protection. The municipalities also have an economic interest in continuing successful irrigation agriculture, so at the time of the evaluation, it is assumed that there will continue to be a high willingness to support the water user organisations. This also concerns the future expansion of sprinkling according to technical possibilities and topographical conditions. It can be assumed that ANA/ALA will profitably contribute to water efficiency in all irrigation perimeters (including Upis and Marampaki) in favour of safe operation concerning water availability in the fields.

Due to the high motivation and conviction of all parties involved, as well as the favourable economic conditions in the region, the long-term existence of the irrigation systems financed by the project and the durability of the resulting impacts are largely considered secure. However, risks still exist today. The formal handover of the Upis irrigation perimeter from Plan Meriss to the municipality, which only took place in December 2024, resulted in no major investment projects being carried out by the Upis water user organisation until then, as formal ownership is a key prerequisite for this. Generally, the financial capacities of the municipalities for more extensive investments are limited, so the willingness to finance from higher administrative levels (e.g., district administration) is crucial for the long-term preservation of the structures. **Furthermore, cooperation with local water authorities in the Upis and Marampaki irrigation perimeters still needs to develop due to the delayed implementation and formal handover.** Integrating the perimeters into the regional water management framework is essential to ensure water withdrawal aligned with national guidelines and water supply, thus preventing overuse of water resources. **At the time of the evaluation, there were still reservations about formal integration into the regional water management framework among the Upis and Marampaki water user organisations, so a lengthy integration process and conflicts regarding water rights cannot be fundamentally excluded.**

The recommendation made in the project completion report (2017) to continue supporting the users of the Upis and Marampaki perimeters by Plan Meriss in operation and agricultural development even after the project's completion could not be followed. Support for the perimeters in the area of water efficiency and the consolidation of irrigation systems is important, not least due to the positive development of irrigation agriculture and the associated continuous expansion of irrigation areas.

The continuation of the capacities of the regional programme executing agency Plan Meriss, particularly enhanced through the basic and advanced training measure, is uncertain and depends on access to future funding. Conversations during the evaluation trip conveyed the impression that the focus of service offerings has shifted from target group-oriented irrigation infrastructure to larger infrastructure projects in the area of dams. This is also due to the political priorities and the associated provision of funding for such projects by the regional government of Cusco. At the time of the evaluation, there were no indications of follow-up funding for the programme executing agency in the area of irrigation projects by FC or other donors. Although Plan Meriss continues to provide technical support for smaller irrigation projects, a significant need for support in the introduction and implementation of modern irrigation technologies was identified at the time of the evaluation. Expanding technical capacity in this area is essential to continue leveraging regional economic potentials in line with climate change-induced reduced water resources. The programme executing agency's willingness to continue playing a key role in the implementation and development of irrigation systems is strong. Plan Meriss explicitly expressed the desire to be considered for future development cooperation engagement.

A significant risk to the durability of the project's impacts is the climate change-induced scarcity of water resources, which is particularly evident in the Andean highlands due to increased glacier retreat. If the agricultural water demand continues to rise due to ongoing economic development in the region and the sustainable use of water resources along the water supply remains pending formal integration into the regional water management framework, then at the time of the evaluation, a lasting impact cannot be assumed. The water-intensive gravity irrigation, compared to innovative sprinkling systems, exacerbates these risks, making the shift away from traditional gravity irrigation essential for preserving long-term impacts.

Rating summary

Through participatory involvement in their water user organisations, agricultural farms have developed strong ownership regarding the water infrastructure and exhibit high (economic) resilience due to regional economic integration. This is particularly evident through the pronounced awareness of the importance of irrigation facilities for ongoing agricultural production and the continuous development of production and marketing of agricultural products. The advancing regional economic integration of the project areas and the resulting good economic prospects for agricultural farms particularly favour the durability of the project's impacts. During the too-short support of users by Plan Meriss in the irrigation perimeters Upis and Marampaki, due to implementation delays, sufficient willingness of water users and thus the water user organisations to formalise water rights could not be achieved. Therefore, there has been no collaboration with the local water authority (ALA) so far, but at the time of the evaluation, both water user organisations were making efforts to complete the formalisation. With a constant or climate change-induced long-term reduction in water supply, collaboration with ALA to control water quantities and water efficiency and generally for sustainable use of water resources is crucial. Due to economic sustainability, many farms now welcome the expansion or introduction of sprinkling and the advancement of water rights formalisation. Despite the predominantly high resilience of water user organisations and municipalities, significant sustainability risks exist due to the increasing scarcity of regional water supply. Ultimately, the continuation of the capacities of the regional programme executing agency Plan Meriss, particularly enhanced through the basic and advanced training measure, is uncertain and depends on access to future funding. Due to political priorities of the regional government, the service offerings of the programme executing agency, supported by public funding, increasingly focus on large projects, such as dams, in the area of irrigation. At the time of the evaluation, there were neither follow-up fundings by FC nor other donors, nor were they promised. Despite generally qualified personnel, continued donor support in the area of modern irrigation technologies is crucial for the programme executing agency to meet the demands of resilient, climate change-adapted irrigation systems in the future. Due to these existing deficiencies, the sustainability of the project is overall evaluated as moderately successful.

Sustainability: 3

Overall rating: 2

From today's perspective, as well as at the time of the project appraisal, the project demonstrates high relevance. The chosen objective to improve the living conditions of the marginalised Andean population in high altitudes of up to 4,300 meters above sea level posed a challenge. The concept is coherent and aligned with the objectives and core problem (lack of irrigation capacities and management alternatives). It was intended to increase the agricultural yields of the target group (agricultural family farms) and improve their income through the extensive expansion of irrigation systems. During the project appraisal (2003), project areas with predominant gravity irrigation were provisionally selected. A precise specification of the irrigation form could only be made with the corresponding studies of the implementing consultant (2012) based on criteria to be considered (willingness of water users, hydraulically favourable topography and pressure heights, and erosion control). In approximately 30% of the total area of all five irrigation perimeters, irrigation systems (gravity) already existed, which were to be rehabilitated by the project.

The components were complementary to each other and allowed for a target-oriented implementation of the project. The experiences and capacities built up through long-term development cooperation engagement of the programme executing agency could be used purposefully. However, the extensive task allocation of the programme executing agency (studies and planning), which had to be compensated by an adjusted responsibility of the implementing consultant, negatively impacts the evaluation of the project concept. The project demonstrates high external coherence, as the measures were closely aligned with the self-efforts of the regional government of Cusco. Existing regional capacities, especially those of the programme executing agency Plan Meriss, could be used and expanded purposefully, but they lose relevance prospectively due to the shift in focus of the programme executing agency's service offerings.

The effectiveness of the project, evaluated as successful, refers to the achievement of the intended objectives at the outcome level. The agricultural yield of local smallholders has significantly increased after the introduction of the irrigation infrastructure they operate. In the perimeters of Upis and Marampaki, the potential for agricultural development could not be fully exploited due to the limited time support of water-using farmers and established water user organisations (Component 2). Nevertheless, yield increases are also very high there. The infrastructure is in a satisfactory condition, and the operation is acceptable. The effectiveness is also diminished by the lack of formal water management integration of user communities (formal regulation of water rights and corresponding control under ANA) in Upis and Marampaki. The success is further reduced by the formal handover of

the infrastructure to the user community in Upis (Component 1), which is still pending at the time of evaluation but is expected to occur in December 2024.

During the implementation of the project, which was interrupted from 2009 to 2012, significant additional costs were incurred. A substantial part of this increase is due to underestimated unit prices according to national guidelines (SNIP) and the inadequately conducted feasibility studies and preliminary planning of infrastructure measures by Plan Meriss (Component 1). The expansion of the tasks of the implementing consultant after the project interruption was crucial for a more efficient implementation of the project thereafter. The reduced support of users in Upis and Marampaki due to time constraints also diminishes production efficiency. This limits the value creation from the successfully implemented Component 3 (basic and advanced training measure) and the utilisation of existing development potentials there. Nevertheless, a significant increase in operating income was achieved in all perimeters, which is well above expectations.

The significant increases in operating income and their interactions with the support of adjacent municipalities and the region have triggered high dynamics of social and economic development in all perimeters. The participatory involvement of users and municipalities in the project from the beginning was crucial for this. The improved incomes now allow for further education of the younger generation. Due to the limited training of users and water user organisations in Upis and Marampaki, the successful impacts regarding untapped potentials in agricultural development were impaired. The project, including its results and lessons learned, is used as an important reference for the further development of Plan Meriss.

The sustainability of the project is primarily supported by the motivation and ownership, as well as the promising social and economic development in the project region. This also translates into the user communities' striving for a functional maintenance and operation of the irrigation infrastructure and the willingness to expand it for higher water efficiency. The developing structures for marketing agricultural products and their diversification promise ongoing positive economic development in the project areas. The financial and technical involvement of municipalities remains crucial for the long-term preservation of the irrigation infrastructure. However, the increasing scarcity of regional water supply and the currently insufficient financial and technical capacities in the area of water-efficient irrigation technologies among all parties involved pose a significant sustainability risk, leading to deductions in the sustainability assessment.

Overall, the project is rated as "successful" (Grade 2). This rating reflects the criteria of effectiveness, overarching development impacts, relevance, and coherence, while also considering deductions under efficiency and sustainability. The basic and advanced training measure (Component 3) is also rated as successful (Grade 2). The decisive factor for this success is the coherent target- and project-oriented specification of training and education of Plan Meriss and the utilisation of its already existing capacities. The application of these skills among users and water user organisations has generally promoted sustainable impact.

Contributions to the 2030 Agenda

Universality, shared responsibility and accountability

At the time of the project appraisal, the project was also aligned with the then relevant Millennium Development Goals (MDG), particularly focusing on MDG 1 "Eradicate extreme poverty and hunger" and MDG 7 "Ensure environmental sustainability." Referring to the 2030 Agenda and the Sustainable Development Goals, (SDGs⁵⁸) of 2015, the project made a significant contribution to poverty reduction (SDG 1). The target group was able to significantly increase operating income, which was accompanied by a substantial improvement in quality of life and social status. Through increased production and diversification of agricultural products, nutrition with natural and high-quality foods was also improved (SDG 2). This benefits especially the children of farming families and their health (SDG 3), as well as consumers. The achieved settlement and positive socio-economic development allow the younger generation of agricultural families to pursue higher and further education (SDG 4).

Particularly through their participation in training for modernised agricultural operations and marketing, women play an important role in the production and marketing of dairy products. This also demonstrates the indirect contribution of the project to gender equality (SDG 5). The development of irrigation agriculture allows the now settled farming families, especially the younger generation, to have long-term secure and decent work. The marketing of agricultural products takes place in an expanding market organised at local, regional, and even national levels. This development aligns with the goal of "Decent Work and Economic Growth, SDG 8." Through the water

⁵⁸ Reference is made to the following SDGs: SDG 1: No Poverty; SDG 2: No Hunger; SDG 3: Health and Wellbeing; SDG 4: Quality Education; SDG 5: Gender Equality; SDG 6: Clean Water and Sanitation; SDG 8: Decent Work and Economic Growth.

management integration of user communities of the created irrigation systems into the new national water management system, the project contributes to integrated water resource management pursued under SDG 6.

The project's design particularly utilises existing regional structures for the development of irrigation agriculture. The structures and capacities were built with the support of long-term development cooperation. The project programme executing agency Plan Meriss operates a monitoring system, which was previously promoted by technical cooperation, and uses the technical manuals created by Plan Meriss. The relevant experiences of the project have been incorporated into these efforts.

The interplay of economic, ecological, and social development was already considered in a holistic approach during the programme appraisal in the project's concept. It was also adhered to during implementation, in the creation of studies, the implementation of infrastructure, and particularly in the training of target groups. The notably ecologically effective positive impact is the awareness-building for increased water efficiency and the initiatives that have developed from it. This is driven by the limited availability of water resources and the economic incentive to expand and modernise irrigation agriculture. The resulting agricultural productivity particularly supports socio-economic development at the local level.

Inclusiveness/Leave no one behind

The project successfully promoted the socio-economic development of the disadvantaged indigenous population in the Andean highlands according to the conceptual guidelines. Although a gender-specific focus was not explicitly pursued, the role of women and their integration into society were significantly strengthened through their participation in production and marketing. The quality of life for children was also notably improved. The remaining and integrated younger generation, due to the favourable economic development, assumes the role of guarantor for a long-term promising societal development of the beneficiary regions.

Project specific strengths/weaknesses and general conclusions/lessons learned

The strengths and weaknesses of the project include in particular:

- The project addressed for the first time project areas in the Andean highlands, where the development of irrigation agriculture posed a challenge. This allowed previously unreached target groups to be successfully promoted.
- Another strength of the measure is its design as an open programme. This allowed for flexible and necessary adjustments due to unforeseen developments in the implementation of a demanding project. This also includes the necessary expansion of the tasks of the implementing consultant in a complex project process with technical challenges.
- The concept considered the participation of target groups and municipalities from the beginning. This enabled the development of strong ownership among users and user communities. Additionally, it achieved the important bond with supporting municipalities after the project's implementation. Both aspects positively impact the project's sustainability.
- It is also positive to note the utilisation of existing capacities of Plan Meriss in the construction of infrastructure and in targeted training (basic and advanced training measure) for the practical application of acquired knowledge for the operation of facilities and agricultural development.
- From the outset, the project benefited from previous development cooperation projects (TC and FC predecessor projects), including the successful cooperation with the programme executing agency, and was able to make good use of the synergies and complementarity created.
- Weaknesses of the project included the management of the selection process for the funded individual projects by the programme executing agency and the insufficient involvement of the implementing consultant in preliminary planning and corresponding cost estimation. The project's duration was not sufficient to carry out necessary planning work, environmental permits, and construction work. This particularly applies to the recently included projects Upis and Marampaki, where the prescribed timeframe for supporting users in the operation of facilities (Component 2) could not be adhered to. In the case of Upis and Marampaki, the potential to increase acceptance of the water user organisations regarding water rights regulation was not sufficiently utilised due to the shortened training period. For the Upis perimeter,

there is a risk until the evaluation completion at the end of 2024 that the functionality of the infrastructure could have been impaired by the still pending formal handover (*Liquidación*).

- The programme executing agency had neither the opportunity nor the mandate to carry out the operational support recommended at the project completion for the projects in Upis. External support for consolidation, as practiced in predecessor projects by the DED, was no longer possible due to changed areas of responsibility within development cooperation.

The results of the evaluation lead to the following conclusions and lessons learnt:

- (1) Due to long-term development cooperation, the project was able to achieve the desired development impact in marginalised Andean highlands. Thus, important potentials created by the programme executing agency and the synergy effects of development cooperation could be utilised. If a project cannot be embedded in long-term development cooperation, cooperation with other development cooperation programmes, possibly even cross-border, would be effective.
- (2) The training and further education of target groups, especially during the operation of irrigation systems and in improving agricultural practices, are crucial for the successful immediate impacts of the project.
- (3) Technical follow-up support for newly created or rehabilitated irrigation infrastructure is essential to ensure the long-term use and existence of the systems. If the programme executing agency cannot be obligated to do this, corresponding funding and possibly technical support (e.g., consultant) should be reserved and agreed upon within the project concept.
- (4) National guidelines for unit prices of infrastructure works do not adequately account for topographical peculiarities, as they often adhere to average values. For realistic cost planning of infrastructures, additional alignment and consideration of international guidelines and experiences are essential.
- (5) A balanced distribution of tasks and responsibilities between the programme executing agency and the implementing consultant allows for the utilisation and expansion of existing regional capacities. On the other hand, the capacities, skills, and competencies of the programme executing agency must be realistically assessed. In this case, a sensible and expanded task allocation of the consultant, especially after the project interruption, significantly contributed to more efficient project implementation and appropriate technical execution.
- (6) In open programmes, it is crucial to conduct an organised selection process of individual projects based on detailed and clear criteria. If weaknesses of the programme executing agency are identified, an external consultant should accompany or conduct this selection together with the programme executing agency.
- (7) The promising regional market and the ongoing regional economic integration around Cusco have increased the demand for more water-efficient irrigation systems. Affected farmers are willing to move away from traditional "transparent" but also loss-prone open channels. They now favour pressure pipelines and new water-saving technologies. During the project appraisal, assessing this economic dynamic and regional changes was difficult. In the case of an already agreed follow-up support for irrigation systems in the project concept, priority measures to further increase water efficiency could have been included simultaneously.
- (8) Irrigation agriculture projects have very versatile, broad, and far-reaching impacts. Agriculture is by far the largest water consumer and can also be a significant water polluter. Thus, integrating irrigation into integrated water management through corresponding projects is of great significance. Consideration in water management planning is also important regarding resource scarcity, e.g., due to climatic changes, and for mitigating potential water conflicts. Irrigation projects can make a significant contribution to sovereign and especially healthy nutrition. Technology and knowledge transfer in agriculture (e.g., efficient irrigation, ecologically compatible cultivation methods) can be of economic, social, and ecological importance within development cooperation. This can especially strengthen economic relations with partner countries.
- (9) Irrigation projects offer great potential for climate adaptation. The choice of respective irrigation technologies is crucial, as they often show significant differences in water efficiency and maintenance effort. Focusing on expanding traditional gravity irrigation systems brought advantages in implementation and maintenance in this specific case, but offers less marginal benefit in the long term compared to more innovative irrigation systems, and water efficiency potentials remain untapped prospectively. The design

of future projects thus requires better balancing the tension between the user-friendliness of simpler irrigation systems and the water efficiency gains of more complex, maintenance-prone systems. Constant, intensive support of water user organisations and programme executing agency, even beyond project completion, must therefore play an increasingly decisive role to enable and permanently secure the introduction, development, use, and existence of more complex, water efficiency-oriented irrigation systems. Corresponding support services can also be provided through coherently planned technical cooperation modules in advance.

- (10) The continuation of state programme executing agency capacities enhanced through basic and advanced training measures depends on the development of institutional service offerings, which are strongly oriented towards funding determined by political priorities. Therefore, in future development cooperation projects, long-term regional priorities in the orientation of basic and advanced training measures should be examined and considered at the time of project appraisal to ensure that created capacities can be used as long as possible.

Evaluation approach and methods

Methodology of the ex-post evaluation

The ex-post evaluation follows the methodology of a rapid appraisal, i.e. a data-supported, qualitative contribution analysis and represents an expert judgement. This involves attributing impacts to the project through plausibility considerations based on the careful analysis of documents, data, facts and impressions. Where possible, this also includes the use of digital data sources and modern techniques (e.g. satellite data, online surveys, geocoding). Causes of any contradictory information are investigated, attempts are made to eliminate them and the assessment is based on statements that are - if possible - confirmed by several sources of information (triangulation).

Documents:

KfW project documents of KfW, implementation consultant project documents, comparable evaluations of relevant projects, comparable ex-post evaluations, strategy papers of the German development cooperation, development strategy documents of Peru and the Cusco Regional Government, context analyses and literature on the agricultural sector in the project region and in the agricultural irrigation sector, relevant press releases, videos and websites of relevant organisations

Data sources and analysis tools:

Qualitative interviews with relevant stakeholders, monitoring data and manuals of the institution, GPS data and satellite images (Landsat Explorer and Google Earth) of the project regions

Interview partner:

Cusco Regional Government Plan Meriss, implementation consultant, KfW project manager, KfW Technical Experts, focus groups with users, focus groups with water user organisations, municipal representative, representative of the National Water Authority ANA

The analysis of impacts is based on assumed interdependencies, documented in the impact matrix developed during the project appraisal and, if necessary, updated during the ex-post evaluation. The evaluation report presents arguments as to why which influencing factors were identified for the identified results and why the analysed project presumably made which contribution (contribution analysis). The context of the development project is taken into account with regard to its influence on the results. The conclusions are set in relation to the availability and quality of the data basis. An evaluation design is the reference framework for the evaluation.

For project evaluations, the method offers a - on average - balanced cost-benefit ratio, in which the knowledge gained and the evaluation effort are in equilibrium, and allows a systematic assessment of the effectiveness of FC projects across all project evaluations. The individual ex-post evaluation can therefore not fulfil the requirements of a scientific assessment in the sense of a clear causal analysis.

The following aspects limited the evaluation:

There were no issues that limited the evaluation

Methodology of the performance evaluation

A six-point scale is used to assess the programme according to the OECD DAC criteria. The scale values are assigned as follows:

- Level 1** Very successful: result significantly above expectations
- Level 2** Successful: result fully in line with expectations, without significant deficiencies
- Level 3** Moderately successful: below expectations, but positive results dominate
- Level 4** Moderately unsuccessful: is significantly below expectations and negative results dominate despite recognisable positive results
- Stage 5** Unsuccessful: despite some positive partial results, the negative results clearly dominate
- Level 6** Highly unsuccessful: the project is useless or the situation has worsened

The overall rating on the six-point scale is based on a project-specific weighting of the six individual criteria. Levels 1-3 of the overall rating indicate a "successful" project, while levels 4-6 indicate an "unsuccessful" project. It should be noted that a project can generally only be considered developmentally "successful" if the achievement of the project objective ("effectiveness") and the impact on the overall objective ("overarching developmental impact") as well as the sustainability are rated as at least "partially successful" (rating 3).

The annex to this report is available upon request (German only).

Imprint

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