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Guidance for operation and maintenance (O&M) of irrigation systems

Maximizing local resources and community participation, Nepal and the Philippines

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▶ Foreword

The World Water Development Report 2016 on Water and Jobs[1] found that three out of four jobs worldwide are water-dependent. From its collection, through various uses, to its ultimate return to the natural environment, water is a key factor in the development of job opportunities either directly related to its management (supply, infrastructure, wastewater treatment, etc.) or in economic sectors that are heavily water-dependent such as agriculture, fishing, power, industry and health.

The ILO is not only the custodian of SDG 8 (decent work and economic growth), it also contributes to SDG 6 "Water and Sanitation" by increasing the impacts of infrastructure investments in the water sector on poverty reduction and livelihoods, through creating job opportunities, using employment-intensive and local resource-based approaches (LRB).

The ILO's Employment Intensive Investment Programme (EIIP) works with partners to promote the use of participatory- and human rights-based approaches. They involve the most vulnerable populations in communities in the identification, implementation, and operation and maintenance (O&M) of water supply systems. Among some of the most affected groups are women and infrastructure is a field where women have always been under-represented. EIIP approaches focus on targeting women through infrastructure development and construction, thereby increasing their participation and gender empowerment.

Following the publication of a general report on Local Resource-Based (LRB) approaches in Water Works[2] presented at the World Water week in 2019, there was a request from the Partners of UN-Water to identify effective O&M approaches for irrigation systems, by illustrating experiences, good practices and lessons learnt. The aim of O&M is to improve effectiveness and efficiency, in order to maximize the intended benefits of public investments. Field experiences suggest that effective O&M of infrastructure works should consider local government participation, the private sector and community organizations.

Over the years, the EIIP has gained important experience in the development of LRB and participatory O&M systems for community irrigation schemes. To capture these experiences, EIIP had envisaged commissioning a global study, but because of the Covid-19 safety and travel restrictions, the study was limited to two countries - Nepal and the Philippines. The aim was to assess the operational status of irrigation schemes implemented 10 to 25 years ago. It also reviewed the effectiveness of the O&M systems that were developed at the time the schemes were constructed or rehabilitated, and assessed the impact this had on community water operations. In total, six irrigation projects were assessed, three per country[3]. The assessments used a combination of qualitative methodologies, site visits to irrigation schemes in Nepal, remote interviews with water user associations, interaction with present-day irrigation officials and with experts who were involved in the concerned ILO programmes and the secondary documentation review.

This Guidance for the O&M of irrigation systems presents findings and lessons learned from the studies in terms of the relevance and sustainability of the LRB approach, particularly in relation to O&M. One of the projects studied in Nepal was the Dhaulagiri Irrigation Development Programme (DIDP), implemented from 1990-1995. It constructed and rehabilitated 65 small-scale irrigation schemes in four hill districts in the Dhaulagiri zone. The ILO provided technical assistance to local authorities and communities in strengthening O&M, technical, institutional, financial and organizational capabilities. DIDP adopted

1 UNESCO, World Water Development Report 2016 Water and jobs.

2 ILO 2019 LRB approaches in Water Works

3 Nepal: DIDP-Dhaulagiri Irrigation Development Project,1990-1995; EmPLED-Employment Creation and Peace Building based on Local Economic Development, 2007-2010; JfP- Jobs for Peace, 2009-2011. The Philippines: Busao Communal Irrigation System and Cabawan Communal Irrigation System (CIS), in Bohol 2014 and Mambuaya CIS, Cagayan de Oro

participatory methodologies, from planning to implementation and O&M, through technology choices, capacity building (including learning by doing) and management of the small-scale irrigation schemes. In addition, local water related organizations also included women to safeguard the sustainability of the interventions.

Six DIDP schemes were visited and it was confirmed that all six are still operational after all these years. It revealed that the acquired capabilities and continued access to external support allowed communities to maintain the schemes in operational condition. Important lessons were highlighted to develop initial assessments on what communities, local construction services and irrigation related agencies were capable of implementing in terms of design, construction management, construction skills, supervision and budget, before deciding on technologies and approach. Similarly, the design of O&M included capacity building, and training was undertaken by communities, agencies and construction services. A maintenance trajectory was forecast to include possible major repairs after 10 years and rehabilitation after 20 years.

The three case studies in the Philippines also reveal the importance of the LRB approach in projects implemented in disaster-hit areas. The selected areas were agrarian reform communities with communal irrigation systems (CIS) damaged by typhoon and earthquake events. The interventions provided an effective channel to share new information, transfer practical skills and build self-confidence among affected individuals during critical times. In this case, 134 men and 124 women of the farmer-irrigators' associations received training for the restoration, repair and/or rehabilitation of infrastructure, with the aim to ensure that they continued to be functional. The LRB approach applied to the O&M of irrigation systems proved to be effective and sustainable. By transferring practical skills to both men and women in the agriculture sector, the LRB approach contributed to strengthening technical, financial and organizational capacities and nurturing a culture of maintenance. Similarly, the participatory approach endorses transparency in dealing with local communities, especially those affected by disaster, which is crucial in gaining their trust and confidence, reinforcing the stand of the Philippine farmer.

Especially now, facing some of the socio-economic recovery needs stemming from the COVID-19 pandemic, one cannot neglect the potential and opportunity that these schemes offer. In addition, the "Guidance for the operation and maintenance of irrigation schemes" validates the importance of appropriate technological design and implementation. It also calls attention to the role that women could play in the sustainability of irrigation interventions and in the provision of sustainable water schemes when women are included. The projects in the Philippines show their active involvement in capacity building activities and as members of the irrigators associations. Similarly, and based on observations, the Nepali report found a slight correlation between active water users' associations, women's involvement, user satisfaction, ability to attract external aid and being able to ensure the sustainability of these schemes. Having access to sustainable water provision for production and consumption can make a significant difference to many people in the communities, but especially to women. When women benefit from access to irrigation technologies, this can also lead to significant improvements in livelihood, health, and nutrition outcomes.

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Chief
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Geneva, August 2021

▶ Acknowledgments

This Guidance was commissioned by the Employment Intensive Investment Programme (EIIP) of the ILO as part of its work on promoting local resource-based approaches in water-related infrastructure.

This report has been prepared by Arend Van Riessen and Nori Palarca, under the overall supervision of Maria Teresa Gutierrez. The work has benefitted from contributions from Bas Athmer and Chris Donnges.

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Operation and maintenance of irrigation systems: maximizing local resources and community participation Philippines **47**

Lessons from Nepal on Irrigation Scheme O&M Findings from a short assessment of 12 formerly ILO-supported irrigation schemes

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March 2021

▶ Abbreviations

CA	Command Area
DIDP	Dhaulagiri Irrigation Development Programme
DIO	District Irrigation Office
DoI	Department of Irrigation (nowadays: DWRI-Department of Water Resources and Irrigation)
EIIP	Employment-Intensive Investment Programme
EmPLED	Employment Creation and Peace Building based on Local Economic Development
Ha	Hectare
HDP	High Density Polythene
HH	Household
JfP	Jobs for Peace
NPR	Nepalese Rupee
O&M	Operation & Maintenance
RCC	Reinforced Concrete
RM	Rural Municipality
WUA	Water User Association

▶ 1. Introduction and Objectives

The study is commissioned by ILO's Employment-Intensive Investment Programme (EIIP) to improve programming for optimal Operation and Maintenance (O&M) in rural infrastructure interventions.

The objectives of the mission are:

1. Assess the present status of Operation and Maintenance of diverse irrigation systems in Nepal that have been supported by ILO in the past and extract lessons on Local Resource-Based Approaches (LRB) and Human Rights-based (HRB) approaches that EIIP can use in future approach development.

2. Following the LRB approach in Water Works report, develop a document that can serve as a guide "to encourage a positive and pro-active approach" to effective operation and maintenance of the diverse irrigations systems, by providing illustrations of experiences, good practices and lessons on: employment potential/income earning opportunities of O&M operations, involvement of community, local governments and private sector, capacity-building, use of local resources and technologies, covering crosscutting subjects like gender, environment, vulnerable groups, and good working conditions, and covid-19 related measures, if available.

The tasks leading to these objectives will include review of available secondary information, to determine and to address information gaps, and to prepare an annotated table of contents based on a categorisation of O&M factors to be addressed in future O&M-focused EIIP guides. The proposed document should include prescriptive illustrations of O&M experiences from ILO-supported community irrigation schemes, covering e.g. the use of employment-intensive technologies and local resources and community participation in developing and implementing O&M systems.

▶ 2. This Study and Document

Due to the extremely short time available for the assessment, this report should be categorised as a quick-and-dirty assessment. It only touches lightly on the more complex and time-consuming issues of operation, equitable benefit distribution, gender and social inclusion, and the environmental impacts of irrigation canals on natural drainage and slope stability, and focuses mainly on simple indicators of scheme condition and functionality and an attempt to extract lessons for implementation programmes on how to increase the chances that community irrigation schemes will be better maintained. The six visited schemes form the core of the assessment, while the telephone interviews provide context mostly.

The document shortly describes first the three programmes that originally supported the studied irrigation schemes (chapter 3), and then the approach to the study (chapter 4), and proceeds (in chapter 5) with the findings of the study of twelve formerly ILO-supported schemes, consisting of six visits to irrigation schemes, telephone interviews with users of six more schemes, and interactions with present day irrigation officials and with experts who were involved in the concerned three ILO programmes. It proceeds with a summary and conclusions, before it extracts key lessons and guidance related to O&M for irrigation programming.

The findings chapter covers the socio-economic context of community irrigation schemes, the findings on scheme condition, scheme functionality, community scheme management, community O&M capabilities (technical, institutional, financial), and external relations.

▶ 3. The ILO Programmes that supported irrigation Interventions

The consultant collected information about 70 irrigation schemes that were supported by ILO, of which 65 by DIDP (Dhaulagiri Irrigation Development Programme 1990-1995, 2 under JfP (Jobs for Peace), 2 under EmPLED (Employment Creation and Peace Building based on Local Economic Development).

▶Table 1 – The three ILO-supported programmes

Programme	Years since project support	No. of schemes	Study Visit 2021	Telephone interview
DIDP	25+ years	65	6	2
EmPLED	10+ years	3	-	3
JfP	10 years	2	-	1

DIDP-Dhaulagiri Irrigation Development Project. DIDP supported 65 schemes between 1990-1995 in four districts of the Dhaulagiri zone (Parbat, Baglung, Myagdi and Mustang), which fall presently under Gandaki Province. When reading the 1995 final evaluation report (which can be found on the internet) and reviewing field findings, it is clear that it was a programme that was much in line with other irrigation programmes of those times in Nepal. This study is not a study of DIDP and how it was implemented, so there will not be a detailed description.

The context for programmes like DIDP is formed by hill districts with numerous, often hundreds of very small, small and larger canal systems that are built by the communities themselves. Most of these are never assisted by irrigation programmes, and many others are only occasionally assisted by small financial grants from municipalities. In general ,these communities can manage the repairs themselves. And then there is a smaller number of schemes that are taken up by projects like DIDP. Often these schemes have technical problems for which the communities cannot manage the skills, materials, technologies or finances. The project tries to maximise the sustainability of the intervention results through technology choices and capacity building, but will be able to guarantee sustainability. Infrastructure-related government agencies in Nepal use structure life times of 25 years, but are aware that a flood or earthquake can occur within one year already. The project will apply selection criteria that include scheme size, technical feasibility, probable sustainability, benefit-cost ratio, cost criteria, and community interest, while a less visible implicit criterion will be whether the community leaders are active and resourceful enough to promote their application with the concerned authorities.

Normally the DIO with ILO technical assistance will do the survey and design and manage the construction by communities and petty contractors through supervision by field engineering staff. Side-by-side, trainings are conducted for the beneficiaries on WUA management, construction skills and agriculture. Often communities state that compared to trainings, the more important part of capacity building actually takes place while they work together for one or two years with project staff and skilled labourers from outside during project construction. Most of these communities have never experienced such a major event in terms of external assistance, budget, capacity building and direct benefit, and to this day it remains often the most defining experience for most community members till the more recent times, when not only local government budgets and local investments but also community incomes started to increase.

JfP- Jobs for Peace, 2009-2011. This was a United Nations Peace Fund for Nepal (UNPFN) programme in which ILO was a partner. It aimed to contribute to national peace building and poverty reduction through engaging youth in productive employment activities and empowerment, and had as immediate objectives:

1. Targeted young women and men engaged in productive employment and economic opportunities with increased gender and disadvantaged group equality in work opportunities
2. Youth empowered to address youth priorities while contributing to dialogue and mutual understanding for peace building

Support to two irrigation schemes in Parsa district generated temporary employment and assets for agricultural development and employment. Irrigation was one of a wide range of interventions with many different partners. JfP also provided agricultural training. ILO"s Final Programme Narrative Report (2011) can be found on the internet.

EmPLED-Employment Creation and Peace Building based on Local Economic Development, 2007-2010

The project ran in one lowland district (Dhanusha) and one hill district (Ramechhap) and had as immediate objectives:

1. Local stakeholders implement Local Economic Development strategies aimed at job creation more effectively and contribute to Local Economic Development policy making
2. District residents have better access to productive assets and (new) jobs
3. Private enterprises are more competitive, create more jobs and local income

Three major irrigation interventions were part of a wide array of interventions. Beside the scheme construction-related temporary employment, irrigation schemes improved access to productive assets, to be used for market-oriented agriculture and employment generation. For the biggest intervention, the project worked together with the Kamala Irrigation Improvement Project, under the Department of Irrigation, which would ideally copy ILO's approach in the other scheme branches.

▶ 4. Approach and selection of schemes for O&M study

4.1 Study approach

The setup of the study was based on the time limitations (a very short study of only two weeks in total), COVID-19 related travel restrictions for the consultant and the three irrigation-related programmes listed in the ToR.

Which schemes? Document study resulted in a list of 70 irrigation schemes supported by ILO programmes. Of these 65 fell under the ILO-DoI Dhaulagiri Irrigation Development Programme (DIDP), three under EmPLED and two under Jobs for Peace (JfP.

Because the consultant could initially not trace the details or proper contact persons for the JfP and EmPLED-supported schemes and because 65 of all 70 schemes fell under DIDP, the focus would be on DIDP schemes. Limited scheme data (names, acreage, costs) were found in online documents (evaluation report 1995 and a list of schemes from 2003). Because the consultant was asked not to travel, but data would not be reliably collected through telephone interviews only, two local field researchers (Naba Raj Dahal (of RCRDC-Baglung) and Nirmal Tiwari) were hired to visit a number of sites, which was fixed at six because of time and budget limits. As more information was available for the schemes that Torsten Berg had studied for his PhD, the initial idea was to revisit these on condition that they could be visited in the available time, that they were not recently or being rehabilitated by DIO (as this would complicate O&M lesson learning) and that they could contacted beforehand over telephone. The irrigation divisions/sub-divisions were by far the most reliable source of WUA member telephone numbers.

1. Kurgha, Phalebas RM,Parbat district. Berg study. Not working (soon to be rehabilitated by DIO)

2. Lampata, Kushma NP, Parbat district. Berg study. Working.

3. Chisti, Jaimini RM, Baglung district. Replacing rehabilitated Arjewa. Advantage: 2nd Magar village

4. Amalachaur, Baglung NP, Baglung. Berg study. Working partly.

5. Kushmisera, Jaimini RM, Baglung. Replacing Berg study's Pakuwa, being rehabilitated.

6. Chhiswang, Mangala RM, Myagdi, a Magar village. Replaced Berg study Pipalbot (not found)

Only during the visits the team found out that actually four other visited schemes also had been rehabilitated recently, and that another (Kurgha) was scheduled for this year. Selected replacements were nearby similar schemes with which telephone contact could be made in time.

For telephone interviews (also done by a field researcher), all the possible JfP (2) and EmPLED (3) schemes were tried. Only one JfP scheme (Biruwaguthi) could not be contacted. Also two DIDP mountain district schemes were added; the third one (Khinga) could not be contacted in time. Together these telephone interviews would add the perspective of mountain irrigation schemes (DIDP Mustang), lowland irrigation (JfP, EmPLED) and irrigation in a programme where it was just one of the many types of interventions (JfP, EmPLED). Finding the right person and telephone number took many days for most of all 12 schemes.

1. Tiri, Baragaun Muktichhetra RM, Mustang district, DIDP. Studied by Berg.

2. Thini, Ghopojhong RM, Mustang district, DIDP. Studied by Berg.

3. Dora Sinchai, Bahusdarmai RM, Parsa district, JfP

4. Bharmajhiya branch, Kamala IP, Ganesh Man Charnath RM, Dhanusha district, EmPLED

5. Juri Maai Pokhari, Ganesh Man Charnath RM, Dhanusha district, EmPLED

6. Goshwara IP, Doramba RM, Ramechhap district, EmPLED

The names of one respondent per scheme plus telephone number are given in the Annexes.

▶ **Figure 1 – Location of the irrigation interventions of the three ILO programmes**

Visit and interview protocol. The site visits consisted each of a short meeting with users, a scheme check and a longer post-scheme check meeting with users. All data were collected through the KoboCollect app1, with data, geo reference and photos that loaded on to the consultant's laptop as soon as the field researchers had access to internet. A number of photos obtained through the app are shown in the Annexes. It should be noted that some of the works in the photos are from recent repairs and rehabilitation work by e.g. DIO. The village visits lasted between 2 and 4 hours normally. The telephone interviews covered a more limited set of questions and lasted between 30 and 45 minutes.

Review. A last set of interviews was conducted with Dhaulagiri and EmPLED-related experts of those times(Bas Athmer, Lex Kassenberg, Torsten Berg and Khem Raj Sharma (all experts formerly related to DIDP), Shailendra Jha (EmPLED)), and three Irrigation Department officials (two DIOs and the Kamala Irrigation Management Office chief) to get their perspectives on the findings.

The usefulness of study results. It should be realised that the villagers' answers are influenced by the fact that only the irrigation leaders could be asked these questions and that potential future aid by external agencies like ILO (even if it was explicitly said that this was only a study) is always also on their minds. From the first reactions over phone upon making contact to the final suggestions for

1 KoBoCollect is based on the open source Collect app by getODK and is used for primary data collection in humanitarian emergencies and other challenging field environments, and supported by UN OCHA. See www.kobotoolbox.org

improvement that the field researchers asked, nearly all users want to talk first about more aid, more repairs, more infrastructure and maintenance funds provided by the project. So a short field survey like this does not provide the in-depth discussion with villagers that might result in good ideas and real innovations, but still most information about the scheme condition, WUA functioning, O&M and functionality is reliable and very useful.

4.2 Definitions used

The study uses an approach and terms that borrow from major functionality studies in Nepal's water supply sector in recent years. It distinguishes:

- Scheme condition, i.e. the state of repair
- Scheme functionality, i.e. whether water reaches the fields as intended

E.g. a scheme that is in bad condition can be still 100% functional, while scheme in that is for 99% in good condition might not function.

Scheme condition is rated as per the need for repairs:

"**Good condition":** only needs cleaning and earthwork

"Needs minor repairs": repairs that the users can do with extra investment of labour and cash

"Needs major repairs": repairs that need technical and/or financial assistance from outside

"Needs Rehabilitation": a complete reconstruction of (parts of) the scheme

These terms are useful, because in practice farmers and engineers often easily agree on the condition of a scheme or scheme part.

The scheme condition affects functionality if it renders the scheme unable to convey water through reduced intake, water losses and canal damage disruptions.

Functionality is often expressed as a percentage, based on a combination of factors like water quantity and reliability (timeliness, flexibility, seasonality), which can be measured by looking at e.g. water quantity per hectare, irrigated acreage for each season, fairness of water distribution, and the ability to adjust water distribution to specific needs of farmers, crops or command area sections. If done correctly, functionality can be calculated through complex formulas, but especially for this very short and simple study, it is more practical to use a simplified formula focusing on irrigated command area. In this study Functionality is the sum of the actual winter and summer command areas divided by the sum of the intended winter and summer command areas. So if Amalachaur was intended to irrigate 35ha in both summer and winter and could only irrigate 5 in summer and winter, than the functionality is 14%. Of course that does not say anything about water quantity, reliability and disruptions, but it is at least something, and the measure by which most evaluations review success.

▶ 5. Study of Twelve Schemes in Nepal

5.1 The Community Context of Irrigation

For an extensive coverage of the communities, socio-economic trends, irrigation management and agriculture one should read Torsten Berg's PhD dissertation (Berg, Torsten Rødel, Irrigation Management in Nepal's Dhaulagiri Zone, Institutional Responses to Social, Political and Economic Change, 2008) and other papers of him that can be found on the internet. His work among others highlights possibly increasing O&M problems because of outmigration and economic diversification, which can lead to lower availability of labour in the village, reduced importance of irrigation for some villagers and more complicated irrigation management due to a diversification of crops. For reference and context, just a few questions were asked during the field survey about the communities and their relation to the irrigation scheme. Verification of these trends would require more in-depth study than the short village visits under this study.

Irrigated agriculture is rated as the most important livelihoods source by all the visited communities. It is possible that the subject of the interview (irrigation!) has influenced the answer, but it is clear that irrigation is still very important.

▶ Table 2 – Livelihoods Sources

Rank	Can you rate your sources of livelihoods for the community as a whole	Rating
1	Irrigated food crops	5.00
2	Irrigated vegetables and other cash crops	5.00
3	Livestock	4.17
4	Other village-based income (timber, herbs, crafts, trade, etc.)	3.67
5	Remittances from outside district	3.67
6	Non-agricultural jobs in district	3.33
7	Rainfed agriculture	3.00

It may seem obvious that the main perceived benefits of the projects are less breakdowns and more water, but it is nevertheless important to mention. Five of the schemes were rehabilitation schemes; only Chisti was a new scheme.

▶ Table 3 – The actual benefit of the intervention, as seen in hindsight

What do you now consider the most important benefit of the ILO project 25 years ago?	Scheme
Reliable irrigation (less breakdowns)	6
Higher production (more water)	6
Higher production (more area)	3
Cost saving (maintenance)	1
More community skills	1

The six other schemes. Less questions were asked. In general, in the mountains non-agricultural incomes are relatively more important, while cash and vegetable crops (for export to India) are less important in the lowlands because those areas do not have a climatic advantage over neighbouring India.

5.2 Scheme Basic data

See Table 3 for a summary of command areas, users, scheme condition and functionality .

▶ **Table 4 – The Schemes, Acreage and Users**

	Kurgha	Chisti	Amalachaur	Kushmisera	Lampata	Chhiswang
User HHs, 1995	234	63	119	121	58	85
CA 1995 (ha)	80	50	35	21	30	19
Scheme Condition	Major repair	Minor Repair	Rehab	Minor Repair	Minor Repair	Minor Repair
Functionality	No	Yes	Partly	Yes	Yes	Yes

Kurgha (Khurga Chirdi Khola) needs major repair and has a functionality of 0%. It has not irrigated fields since breakdowns 2 years ago due to old age of pipes, disruption by road construction and an inability of the WUA to get problems addressed. In summer the area is irrigated from another source. This year DIO will help with major repair. The number of user households mostly remained the same (234 to 260)

Amalachaur (Dhapa khola Sarangi) requires rehabilitation as the scheme suffers from slope stability problems. Functionality is about 15%. The number of user households mostly remained the same (119 to 110).

Kusmisera has been substantially repaired by DIO one year ago and is in reasonable condition, only needing major repair at the intake. It's functionality is nearly 100%. The DIO intervention extended the canal and enabled the CA (21 to 51ha) and user numbers (121 to 350) to increase. The extension includes a part of Kusmisera town where many households own small plots with only minimal irrigable area.

In Lampata (Lampata Khahare Khola) only the intake needs major repairs. Functionality of the scheme is 58%, because the canal is too risky in the monsoon, but users always use another source in summer. The repair of this scheme, close to Kushma town, is partly funded on a near annual basis by various offices (DIO, municipality, MP's fund). The annual relatively small fund contributions are helpful but not enough for major repairs or rehabilitation. The number of user households mostly remained the same (58 to 52)

Chhiswang is in general good condition after a major DIO-supported rehabilitation and expansion four years ago. This also resulted in an increase of command area (19 to 40ha) and number of users (85 to 120HH). Functionality is 100%.

So, in total the irrigated area (summer plus winter) has decreased from 470ha to 331ha. After possible future DIO interventions at Kurgha and Amalachaur this could be 551ha. Without any recent DIO interventions, it would probably have been somewhere below 200ha.

The other six schemes. Some comparable data for the other schemes is provided in the table below.

▶ **Table 5 – The Six Other Schemes, Basic Information**

	Thini	Tiri	Dora	Bharmajhiya	Juri Maai	Goshwara
District	**Mustang**	**Mustang**	**Parsa**	**Dhanusha**	**Dhanusha**	**Ramechhap**
ILO Intervention	**1991**	**1991**	**2010**	**2010**	**2009**	**2010**
User HHs, now	225	18	130	200	50	100
CA, max (ha)	125	18	150	152	100	13
Scheme Condition	Rehabilitation	Rehabilitation	Major repair	Minor repair	Major repair	Major repair
Functionality, sum	50-90%	50-90%	<50%	>90%	50-90%	>90%
Functionality, wint	25-50%	25-50%	<50%	<25%	>90%	>90%

The assessment was too short to trace some inconsistencies in answers, notably discrepancies between what was said about the scheme during the initial contact call and during the interview. It shows the limitations of telephonic interviews with WUA members who, in spite of explanations to the contrary, still expected that the interview could influence decisions about future aid to the scheme. Visits and scheme checks are essential.

5.3 The type of scheme interventions

The six visited schemes provide a good picture for all the schemes as built under DIDP, as well as for all the irrigation schemes supported by government projects in those times, if not also at present. Typically in a hill irrigation scheme, the water is taken from a mountain stream, possibly with a regulator, possibly with a weir to guide the water in to the canal. The canal that runs along the slope to the command area can be between 200m and 10,000m, but for schemes supported by irrigation programmes normally between 1000 and 5000m. Challenges are posed by landslides, seepage, hard rock cliffs, stream crossings, road and trail crossings and sections with a steep gradient.

▶ **Table 6 – Scheme Details**

Name of project	Kurgha	Chisti	Amalachaur	Kushmisera	Lampata	Chhiswang
Length of canal, 1995	3350m	4800m	1200m	3000m	1500m	1540m
Length of canal, 2021	2000m	5000m	1200m	3000m	1500m	2500m
Weir/dam intake (no.)	1	1	1	1	1	1
Drainage crossings (no.)	10	10	2	5	2	1
Aqueducts (no.)	0	1	0	0	1	0
Road/ trail crossings (no.)	4	2	2	3	2	2
Instable area crossing (m)	4	20	150	500	150	100
Seepage control (m)	800	1500	400	800	1700	60
Hard rock section (m)	0	500	40	350	30	50
Drop structures	0	0	1	0	17	0
User HH, 1995	234	63	119	121	58	85
Command area, 1995 (ha)	80	50	35	21	30	19

The other six schemes. The other hill and mountain schemes are comparable to the DIDP hill schemes. In the lowlands schemes canal sizes are generally larger and many of the typical hill canal structures are not needed. Canal lining is more important, and in one scheme (Juri Maai) a reservoir was built. Lowland rivers however can wreak much damage to weirs, intakes and canals along river banks. Canal lengths were 1000-1500 for the mountain schemes, 2500 for the Bharmajhiya branch canal system and less than 800m for the other schemes. Water management is only mentioned as an issue in the Kamala IP's Bharmajhiya branch, mostly because it is part of a larger system.

5.4 Scheme Condition in 2021

Generally, DIDP design and construction quality were seen as okay. In Kurgha people said that maybe the construction quality of one wall should have been better and in Amalachaur they said the canal widening in instable area had led to problems.

The table below shows that the scheme condition differs between the four schemes that had been repaired with DIO help in recent years and the two who hadn't. The former four reported mostly a need for minor repairs that they could handle themselves, while the latter two reported need for major repair and rehabilitation.

▶ **Table 7 – Scheme Condition**

Name of project	Kurgha	Chisti	Amalachaur	Kushmisera	Lampata	Chhiswang
Last External Aid: year	X	2013	2014	2020	annually	2017
Last Aid cost: $/hh	0	1,458	47	342	493	819
Condition of:						
intake	minor repair	minor repair	major repair	major repair	major repair	minor repair
Intake work as intended	Partly	Yes	No	No	Partly	Partly
main canal	major repair	minor repair	rehabilitation	minor repair	minor repair	minor repair
instable area crossings	minor repair	minor repair	rehabilitation	minor repair	minor repair	minor repair
level drainage crossings	minor repair	minor repair	major repair	minor repair	good	minor repair
aqueducts, if any	good	good	rehabilitation	good	good	minor repair
seepage control sections	major repair	minor repair	rehabilitation	minor repair	minor repair	minor repair
overall scheme	major repair	minor repair	rehabilitation	minor repair	minor repair	minor repair
What do you consider your scheme's weaknesses?	Instable slope, seepage, silt	intake, instable slope, rock, streams	intake, instable slope, seepage	intake, instable slope	intake, instable slope	Instable slope
How many years without outside help?	No answer	5-10 years	5-10 years	5-10 years	5-10 years	5-10 years

Intakes and instable slopes are most often mentioned as the main headaches, because every year heavy rainfall can trigger floods and landslides. Even a scheme repaired a year ago may need major repairs once more at the intake. The occasional scheme also listed seepage, hard rock, stream crossings and siltation as scheme weaknesses. Concrete aqueducts appeared to have done the best.

When asked after how many years schemes like theirs on average would need major repairs and help from outside, 100% answered that the average DIDP-style scheme will need major repair after 5-10 years only. This fits generally with the repair history of most schemes, i.e. moderate repairs by outsiders after about 10 years and major repairs or rehabilitation by outsiders after 20 years.

That DIO often helped these schemes, and not many others, is because DIO considers these as their "own" schemes.

The other schemes. Except for Bharmajhiya which is co-managed by the government, all schemes need major repairs (10-year old schemes) or rehabilitation (DIDP's 30-year old schemes).

Name of project	Thini	Tiri	Dora	Bharmajhiya	Juri Maai	Goshwara
ILO works quality	Moderate	Good	Good	Good	Moderate	Good
Scheme Condition	Rehabilitation	Rehabilitation	Major repair	Minor repair	Major repair	Major repair
Major repair since ILO	Rehabilitation	Major repair	Minor repair	Yes	No	No
O&M Priority Issue	Intake	Source discharge	Intake	Water management	Reservoir	Canal
Issue's main cause	Old age, flood	Flood	Flood	Flood	Old age	Old age, flood
How many years without outside help?	5-10 years	5-10 years	5-10 years	11-20 years	5-10 years	5-10 years

5.5 Scheme Functionality in 2021

As explained above functionality is calculated as the sum of the actual irrigated winter and summer areas divided by the sum of the maximum (intended) winter and summer areas. The table below indicates that the functionality of the DIDP-supported schemes is 57%, which is increased to 74% if adding the use of other sources. These figures will increase after DIO assists Kurgha and Amalachaur, and will thereafter again slowly decrease.

▶ Table 8 – Scheme Functionality

	Kurgha	Chisti	Amalachaur	Kushmisera	Lampata	Chhiswang	Total
User HHs, 1995	234	63	119	121	58	85	680
User HH, 2021	260	85	110	350	52	120	977
CA 1995 (ha)	80	50	35	21	30	19	235
CA, max. 2021	80	50	35	51	30	40	286
CA actual 2021, winter	0	50	5	51	10	40	156
CA actual 2021, summer	0	50	5	50	30	40	175
Functionality (DIDP)	0%	100%	14%	100%	58%	100%	57%
Summer + winter, any source	50%	100%	14%	100%	100%	100%	74%

Communities see the canal reliability and extra water as main benefit from the DIDP intervention. The schemes are still the most important water source. In none of the schemes water is seen as year-round sufficient. But only in summer some extra sources can be, and are, tapped.

Only in one scheme (Kusmisera) quite a few fields were not cultivated, because people had left the area or considered their plots to be used or building houses only.

The other six. See Table 4 on page 7. The range of functionality figures is roughly the same as for the visited schemes.

5.6 WUA Management

Farmer-managed Irrigation schemes in Nepal have a wide range of organisation forms, which often depend on e.g. the need for management (level of water scarcity), community structure, scheme size. Many schemes do not have formal Water User Associations (WUAs) with constitutions, record keeping, elections and irrigation fees and other elements that the government and average irrigation programme asks from communities before they provide aid. It is therefore not surprising that communities soon start to deviate from those promoted WUA forms. But still 50% of schemes operate a WUA in DIDP-style, while two have no formal WUA anymore, although they still hold meetings. This picture matches the rest of Nepal. In many cases such programmes as DIDP were a major event in village history and some communities hold on religiously to what they agreed with the project. Villages with ethnic minorities (like Chhiswang and Chisti), who often have stronger communal cohesion and mutual trust and a stronger role of women, do this more than others.

Whether a WUA is strong or weak may depend a bit on how it was supported by the project, but normally that quite similar for all schemes. It likely much more defined by the existing cohesion and leadership of the community. The 1995 DIDP evaluation report shows that e.g. the in 2021 underperforming Kurgha scheme is the one scheme among the six that had not registered its WUA at district level and had contributed less than 100% of the agreed labour contribution, while it also introduced the lowest monthly user irrigation fee (NPR 5/m/hh versus NPR 10 in four others, and NPR 15 in Chhiswang).

Even with such a small sample one can see a relation between the WUA, scheme condition and functionality. And although it is fair to say that scheme condition and functionality depend heavily on support from government agency help, the strength of a WUA may also play a role in getting that government aid. Statistically this relation cannot be said to be there, but the data certainly do not hint that the relation is not there.

▶ **Table 9 – The O&M Organisations**

	Kurgha	Chisti	Amalachaur	Kushmisera	Lampata	Chhiswang
Who manages O&M	Meetings, No WUA	WUA, 1995-style	Informal WUA	Meetings, No WUA	WUA, 1995-style	WUA, 1995-style
Did users meet in 2020?	yes	yes	Yes	yes	yes	yes
That meeting attendees?	Few active users	All users	Few active users	Few active users	All users	All users
You keep WUA records?	Few years, not now	Few years, not now	Still keep records	Still keep records	Still keep records	Still keep records
You keep financial records?	No	No	No	Yes, quite okay	Yes, quite okay	Yes, quite okay
Women have more or less say in O&M ?	Much less than men	Equally or more	Equally or more	Bit less than men	Equally or more	Equally or more
WUA rank	-	+	0	++	+	++
Users satisfied with WUA repairs in monsoon?	-	0	-	+	+	+
Interviewer impression			+	++	+	++
Functionality, all sources	50%	100%	14%	100%	100%	100%

Note: other sources are included for functionality, as it indicates whether a WUA can manage water

The other six. All six schemes said they still have a WUA in the style used during implementation, while five having held a meeting less than a year ago and still keeping WUA and financial administration. Only in Goshwara IP (EmPLED) the WUA, the meetings and the administration have stopped since a few years.

5.7 Technical Capability

Most communities can manage enough technical skills and resources for work with local materials (e.g. dry stone walls), cement masonry and small pipes, but cannot manage enough skills and resources for repair of RCC, large pipes and gabion walls. Only Kusmisera hires outside skilled labour frequently, while only Chisti says it has itself enough skilled labourers for most types of work. Two communities have a O&M worker who gets paid mostly in shares of the harvest.

Why communities do not manage the major repairs themselves is due to a combination of skill issues, cost issues, mutual trust, leadership and a tradition and mentality that the government should be asked for costly major repairs.

▶ **Table 10 – Community Repair Capabilities (six visited schemes)**

	Kurgha	Chisti	Amalachaur	Kushmisera	Lampata	Chhiswang
Type of repairs since 1995?	Minor and Major	Major	Minor	Major	Minor Major	Minor Major
Too difficult for users	RCC	RCC	RCC, gabion, big HDP	RCC, gabion, big HDP	RCC, large HDP	RCC, large HDP
Need SKILLED outsider	RCC, Pipes, Gabions	No	RCC, Pipes, Gabions	RCC, Pipes, Gabions	RCC, Pipes	
Too expensive to repair	RCC, pipes, gabions	RCC, pipes, gabions	RCC, pipes, gabions	RCC, pipes, gabions	RCC, pipes, gabions	RCC, pipes
Ever hired SKILLED outsiders	Yes, once or twice	No	Yes, once or twice	Yes, frequently	Yes, once or twice	Yes, once or twice
Did outside agency help after 1995?	More than once	More than once	Once	More than once	More than once	More than once

▶ **Table 11 – Community Repair Capabilities (the other six schemes)**

Scheme Name	Thini	Tiri	Dora	Bharmajhiya	Juri Maai	Goshwara
Type of repairs since ILO intervention?	Rehab	Major	Minor	Major	No	
Too difficult for users	RCC	RCC	RCC, gabion, big HDP	RCC, gabion, big HDP	RCC, large HDP	RCC, large HDP
Need SKILLED outsider	RCC, Pipes, Gabions	No	RCC, Pipes, Gabions	RCC, Pipes, Gabions	RCC, Pipes	
Too expensive to repair	RCC, pipes, gabions	RCC, pipes, gabions	RCC, pipes, gabions	RCC, pipes, gabions	RCC, pipes, gabions	RCC, pipes
Ever hired SKILLED outsiders	Yes, once or twice	No	Yes, once or twice	Yes, frequently	Yes, once or twice	Yes, once or twice
Did outside agency help after 1995?	More than once	More than once	Once	More than once	More than once	More than once

5.8 Willingness-to-Pay and Ability-to-Pay

The fact that communities cannot manage major repairs, let alone rehabilitation, is for a big part a financial issue.

Contributions during DIDP. The ability to pay for repairs was tested during DIDP by asking for cash contributions beside the labour ones. Because in those times the availability of cash in the village was too low, often cash contributions in such programmes were arranged through working extra (paid) labour days. It was also possible for a community to arrange for all community contributions (often 15-25% of total cost) by hiring a petty contractor to do all the paid and unpaid work for 75%. This was possible

because the government labour rates used in cost estimates were often much higher than the labour rates at village level, so that ultimately neither community nor petty contractor felt it in their pockets. So, the project could not always test the ability to pay comprehensively.

Nevertheless, the contributions during DIDP provide a useful reference for ability-to-pay and willingness-to-pay assessments. The 2021-value of total contributions to scheme construction per household during DIDP was in the order of 3,500 NPR to 21,000 NPR (see the "Same, per hh" row in the table below). The differences between schemes were caused by the overall scheme costs, which were much higher for e.g. Chisti with its 5km long canal.

▶ Table 12 – Community Contributions during scheme construction

Construction	Kurgha	Chisti	Amalachaur	Kushmisera	Lampata	Chhiswang
NPR Cost estimate 1995, corrected for inflation & devaluation	16,370,862	19,878,530	6,796,370	5,925,960	7,822,928	2,844,310
1990s labour days contribution value	140,758	295,331	195,000	167,902	116,954	62,458
Labour contribution '21 value (infl. & deval. corr)	664,378	1,393,962	920,400	792,497	552,023	294,802
1990s cash contribution	47,732	15,000	15,281	5,796	16,629	2,644
Cash contribution '21 value (infl. & deval. corr)	225,295	70,800	72,126	27,357	78,489	12,480
Total 2021 value of community contribution	889,673	1,464,762	992,526	819,855	630,512	307,281
Same, per hh	3,631	20,925	7,089	5,856	10,871	3,841
% of total scheme cost	5%	7%	15%	14%	8%	11%

The table below shows that an average household provides 5-10 days free labour per year on O&M, which is equivalent to roughly NPR 2000-4000 per year[2]. Cash contributions are more irregular. While some have annual fees or pay the maintenance worker a proportionate share of the harvest, cash for labour, transport or materials is only occasionally required.

O&M Labour. An increasing shortage of labour for O&M, mainly created by outmigration of youth, has been reported for many schemes in Nepal, and was raised for the DIDP schemes as early as the PhD study by Torsten Berg. Feminisation of agriculture has been another effect of migration, although increased feminisation of O&M is still rarely reported. Berg also discussed how the overall increase of alternative income opportunities as well as crop diversity also started to complicate and affect the willingness to pay for O&M costs. The required deeper study of this important subject fell outside the possibilities of this short study, but it appears these issues have started to play a role in the six schemes too. A few findings:

- HH annually contribute 5-10 days of labour to O&M
- Only three schemes report that users are fully able to provide enough labour for O&M
- Only Kurgha saw outmigration of youth as an issue affecting scheme O&M
- Communities have never hired unskilled labourers from outside the community

2 Unskilled labour minimum wage is about NPR 500 per day ($4/d)in 2021, but it varies per district and at village level lower rates are prevalent

▶ Table 13 – O&M labour

O&M	Kurgha	Chisti	Amalachaur	Kushmisera	Lampata	Chhiswang
Average O&M labour day/HH last year?	7	5	10	6	5	5
Community provides enough repair labour?	Not enough at all	Nearly enough	Nearly enough	Yes	Yes	Yes

O&M Fees. The schemes started in 1995 with maintenance workers and periodical O&M fees. Only two schemes, the Magar community Chisti and Chhiswang schemes have continued this system, paying NPR 500 per year for the WUA and a share of the harvest for the maintenance worker. Like in many schemes across Nepal, these fees are only enough to pay for WUA and maintenance worker costs, not for repair itself.

Paying for emergency and long-term repair. Cash contributions for larger repairs are done as per the need. No scheme has built up a maintenance fund that can be used for emergencies. Willingness to pay ranges from NPR 1,000/HH/emergency to 20,000/HH (i.e. 260,000 to 2,400,000 NPR for the whole community). This is much higher than cash contributions during DIDP but much lower than the money required for the major repairs as done with DIO-support and also much lower than what people state as income losses when the canal irrigation is lost. The annual financial loss of canal dysfunction would be 5x to 100x the willingness to pay. As a result some communities say the DIDP-scheme has made them more dependent on outside help than other schemes in the area. Without comparing with other schemes in the area, a conclusion is not possible.

▶ Table 13 – Willingness and Ability to Pay findings

O&M	Kurgha	Chisti	Amalachaur	Kushmisera	Lampata	Chhiswang
Average cash/HH for O&M last year (NPR)?	0	500	0	0	0	500
% HH that paid any cash last year?	None	Practically All	None	Practically All	None	Practically All
Cash that HH can pay for emergencies (NPR/HH)?	1,000	5,000	5,000	5,000	20,000	20,000
Cash community can pay in emergency (NPR total)	260,000	425,000	550,000	1,750,000	1,040,000	2,400,000
HH Income loss if no irrigation (NPR/HH/Yr)	100,000	100,000	100,000	80,000	110,000	150,000
Is income loss higher than willingness to pay?	Much Higher	Much Higher	Much Higher	Much Higher	Much Higher	Much Higher
Why willingness to pay so low?	Not get water nowadays	low cash Income	low cash income	people hesitate to pay		Not needed
Have you become more dependent on outside help than other irrigation schemes in the area?	Yes	Yes	Only a bit	Only a bit	No	No

Why the willingness to pay is so much lower than the income loss from a dysfunctional canal is a major issue in achieving any form of self-reliance. Some villagers mention themselves the low access to cash at village level, which is a valid reason, but it is more important to assess what the Kusmisera people say: “people hesitate to pay”, meaning they see risks to doing it all alone (not enough organisational or technical skills, not enough unity, high chance of failure and fund misuse), while seeing at the same time realistic alternative options (let the government pay)

- **Difficulty to prepare a WUA for repair needs of ten years later.** The aided communities are made responsible for all canal maintenance, as per Nepalese tradition, but are hardly ever instructed what that entails in terms of planning and costs.
- **Construction quality-related risks.** Hesitation to invest in O&M can also come from a very realistic risk assessment regarding major repairs. Many farmers will assess the risk that their cash investment in repair of an intake or landslide crossing too high, if the community has to do it alone rather than the DIO-engineers, who also cannot guarantee 100% success because some floods, earthquakes and other disasters cannot be prevented.
- **Construction management-related risks.** The communities learn a lot about WUA management, repair skills and resource mobilisation, but often projects like DIDP are their first ever experiences with these. They assess themselves as incapable of pulling off by themselves such a complex operation as a major repair or rehabilitation.
- **Institutions break down before the infrastructure.** The community institutions and mechanisms that take care of O&M and financing that are established and strengthened during the project, often break down before the canal breaks down. During the first 10 years, when managing large repairs and financial operations are often not needed, the discipline and leadership required for major repairs often slowly erode.
- **Diverging interests in the community.** This erosion of willingness to pay can also be caused by an increased divergence of interests within the village. In the old days, a poor family with a small irrigated plot still depended very much on that scheme, through land lease and labour on better-off families' land. In 2021 such poor families have many more income opportunities and might find an investment of labour and money in a canal be comparatively less profitable. Irrigated agriculture might also have become less important for better-off families if a larger portion of their income comes from business, service jobs or remittances from family members abroad.
- **Government has money.** The key government agencies in the project area, the DIO itself and new municipalities have cash available for infrastructure, much more than in 1995. Attracting those monies to your community is a political game that enhances the election chances of any local leader. For the DIO and municipalities investing in canal repairs is also a relatively low risk and politically visible investment option compared to more complex investments like agricultural value chains or small scale industries, even if much money has gone to those same villages before, and even those villages because of that irrigation are often better off than many other villages.

The other six. With slight differences for mountains and lowlands, the six other schemes confirm the findings for the six visited schemes. In five of the other schemes, user households are said to only contribute labour, while in Bharmajhiya branch they pay an irrigation fee.

The amounts of money contributed to O&M are in all cases minimal. Labour contributions are said to be adequate in two schemes (Dora, Goshwara). Contrary to the visited six schemes, four schemes (Thini, Tiri, Bharmajhiya and Dora) often hire unskilled as well as skilled labourers for repairs. Goshwara and Juri Maai never hire outsiders. In larger lowlands this is more normal, while depopulation of mountain villages and alternative livelihoods have made hiring unskilled labour more common.

Nearly all say that RCC and cement masonry are too difficult and expensive for the community. Although the availability of skilled labourers in the lowland villages can be good, they may also see cement masonry difficulties because of the larger scale of structures.

To the question "In emergencies, what can community HH pay for really important repairs?" the answers are similar to for the visited six schemes: 2x "up to NPR 5000/HH" and 4x "up to NPR 1000/HH". Because most say that cash contributions are less but not problematic, the expectations for cash contributions are probably very low.

5.9 External Aid

All schemes have had at least once outside help since 1995, and all at least once within the last 7 years. Nearly all cases involve either Municipalities or DIO. Typically the size of aid by municipalities goes up to NPR 600,000 (<US$ 5,000), while support by DIO can go up to NPR 13,000,000 (>US$ 100,000). So, the support by DIO was often comparable to what was invested by ILO during DIDP. [3] The data suggest the following O&M timeline:

1. Users state that schemes like this can be run without major repair for 5-10 years

2. After about 10 years, most schemes received external aid once, mostly at a moderate scale

3. After about 20 years, most schemes received substantial rehabilitation-like aid

4. In rehabilitated schemes, functionality is roughly 100%, in others less than 20%

This timeline for supported schemes actually validates what projects in those times often used as intervention lifetime, namely the 25 years after which the scheme works would have to be rehabilitated. It was always left in the middle who would have to do that rehabilitation and who would have to pay for it. It is now clear that it is not the communities who will act or pay.

▶ Table 15 – External Aid

Name used by project	Kurgha	Chisti	Amalachaur	Kushmisera	Lampata	Chhiswang
No. of user HH (1995)	234	63	119	121	58	85
Aid from any agency since 1995	More than once	More than once	Once	More than once	More than once	More than once
Aid, last time: Agency Name	DIO	DIO	Municipality	DIO + Municipality	DIO, Mun, others	DIO
Last Aid: year	2021	2013	2014	2020	annually	2017
Last Repair Aid cost (US$)	85,470	123,932	5,128	119,658	25,641	98,291
Cost estimate 1990s (US$), Infl. Corr.	138,736	168,462	57,596	50,220	66,296	24,104
Last Repair Aid: US$/hh	329	1,458	47	342	493	819
DIDP US$/hh	566	2,407	411	359	1,143	301
Last Repair Aid: US$/ha	1,068	2,479	147	2,346	855	2,457
DIDP US$/ha	1,734	3,369	1,646	1,674	2,210	1,269

Note: 2010-2021 US$ figures are inflation-corrected

3 Inflation correction websites indicated that a 1995 $1 was worth $2 in 2021. The Kurgha budget (2021) was not known yet, but based on the observed needs and the figures for other schemes, it can be assumed that it will be at least NPR 10,000,000, which is about $85,000. For Lampata, the figure is based on the received annual aid over 5 years. Exchange rate was NPR 50 to US$1 in 1990-1995, and NPR 118 to US$1 in 2020.

Relations with various outsiders. The table below shows that the communities find relations with government offices that may provide financial aid more important and useful than those with external service providers, who would have to be paid.

▶ Table 16 – Relations with Useful Outsiders

Of which useful outsiders do you have names and telephone numbers?	Scheme
Masons, skilled labourers	0
Petty Contractor	0
Municipality technician	2
District Irrigation Office	4
Trader of construction materials	0

The DIO-scheme relation. The ILO schemes are prioritised by DIO, because they were built by DIO, because users are resourceful and capable of attracting aid (as shown in 1990-1995) and remained in contact, and because DIO was familiar with the style and type of works.

External aid and community employment. Government agency O&M aid above NPR 1,000,000 (~US$ 8,000) will have to be done by contractors through tendering procedures. It is up to the contractor whom to employ and often they bring in labourers from outside, because they are cheaper and easier to manage. WUAs normally are consulted but have no say about the moneys and works. Amounts of money spent they can request afterwards. Aid below US$8,000, normally the type of aid provided by municipalities, can be managed by WUAs under certain conditions.

The other six. The situation for the other six is only partly similar. DIO repaired the two DIDP mountain schemes, and Bharmajhiya is also taken care of by the department because it is part of a co-managed scheme (department and users together). The budget for Bharmajhiya are said to be unknown to users as the works are fully managed by the Kamala Irrigation Management Office.

The aid for the other three schemes is absent or marginal. This absence of aid might be because the works are only about ten years old, but it is also possible that the schemes are not on the radar of the DIO because they were not implemented through the irrigation department. If true, this is the same phenomenon seen for rural infrastructure throughout Nepal. E.g. a Worldbank Study on water supply scheme O&M in 2012 found that schemes constructed with help from International NGOs and Worldbank directly have a higher construction quality and functionality directly after implementation than works by the government departments, but after a number of years those differences start to vanish and when the beneficiaries turn to the government for help they obtain less assistance than government-assisted schemes, for which the departments and local governments feel more ownership and whose users often maintain relations actively. Users of the six DIDP schemes will easily walk in to the DIO office when they are in the district head quarters and also have the DIO telephone number.

▶ Table 17 – External Aid for the Other Six Schemes

Scheme Name	Thini	Tiri	Dora	Bharmajhiya	Juri Maai	Goshwara
External Aid	DIO, RM	DIO	DIO	DIO	None	None
Budget (NPR)	14,000,000	1,200,000	300,000	X	0	0
Budget (US$)	>120,000	>10,000	>2,000	X	0	0

5.10 Gender equity and social inclusion

The limited study time did not allow for the in-depth queries and field investigations by the consultant himself that would be needed to meaningfully cover gender and inclusion issues that might have affected O&M. Two observations:

- Interviewees state that all users benefit equally and that unequal benefits have not affected O&M. The studied communities are generally homogenous (except for Chhiswang which is 50% ethnic minority and 50% Brahman), land distribution is normally quite even, and landlessness is normally scarce. None of the communities said there were villagers without land in the scheme. Dalits, often landless or marginal land holders were very rare in the villages. The study limitations did not allow to study this aspect in more detail.
- Communities that see a relatively bigger role for women in O&M generally score better on scheme condition and functionality, and WUA functioning. It would require further study to see whether women involvement leads to better scheme functioning or that both women involvement and scheme functioning are both the result of a better organised and more active community or WUA.

The other six. The possibilities of phone interviews were thought to be too limited to cover these subjects.

5.11 Community Feedback on the Way Forward

Improvements ranked: annual inspection/advice visits; finance training; construction training and working with outsiders.

Albeit shortly, the interviewers discussed different options for improvement. The unanimity of answers suggests that a deeper or lengthier discussion would have resulted in the same conclusion. Communities prefer the way the project has been implemented and would not have wanted more responsibility themselves for design, construction, and the WUA format. Exposure to sophisticated ways of design, construction and community organisation and training were found to be important project benefits, while at the same time the communities felt that they would have not have been able to successfully manage the once-in-a-lifetime opportunities of getting a good canal and of exposure to new ways of doing things.

▶ **Table 18 – Wouldn't it have been better if ....**

Should DIDP have left design and construction to the community and only provide budget and TA?	Scheme
Yes, then it would be more easy and cheap to maintain	0
Yes, then we would have learned to do better O&M	0
No, we can always go back to village style after the works deteriorate	3
No, we would not have managed the funds and responsibility well	5
Should DIDP have left the form of the WUA to the community and only provide budget and TA?	**Scheme**
Yes, then we could have had a WUA form that fitted our community	0
Yes, then we could have maintained the WUA better	0
No, we wanted to try the new form and learn	3
No, we would not have managed well	6

It is not surprising that, when discussing possible improvement of the ILO approach, the suggestions to give the community more responsibilities scored lower than suggestions for more training and monitoring. Although the posed question for the phone interviews was slightly different, the outcome is very similar. Community trainings and agency linkage are found more important than self-reliance.

▶ **Table 19 – Rating of possible improvements (for all twelve schemes)**

How do you rate the following improvements to make the scheme's O&M better?	Visited Six	Phoned Six
	Rating	Mention
Annual post-construction inspection and O&M advice visit by DIO	4.50	6
Train WUA on Maintenance Fund and financial management	4.17	6
Train to work effectively with skilled masons, gabion weavers, contractors	4.17	4
Train more users in masonry, RCC and construction skills	4.00	6
Let villagers decide how they organise themselves, and provide the needed training	3.17	2
Let villagers build in their own style, and provide budget and technical support as per the need	2.50	0

In both sets of communities, an open question for suggestions to ILO produced mostly requests for more works, more money, and in one case a mechanised excavator. Villagers rightly assume that it will never hurt to advertise their needs, which, if not addressed by ILO, might still find their way in reports that are read by DoI and other stakeholders.

5.12 A Few Noteworthy Trends in Irrigation Programming

When improving the approach to ensure more successful scheme O&M, one also has to consider trends in irrigation programming in Nepal and elsewhere. It is outside the scope of such a short exercise to cover such trends exhaustively, but a few come to mind. Some of these have also been included in the discussion with communities in the previous chapter. It is not known whether anyone thoroughly studied whether these new trends and changes actually lead to improved O&M:

- **GESI.** Attention has increased over the years for social mobilisation, gender equity and social inclusion. E.g., some programmes do a thorough inventory of each user household, the stakes they have in irrigation and the obstacles they (especially poor people) face in availing of the new opportunities, so that the programme can tailor the approach to their needs and better address possible obstacles, conflict issues or diverging interests.
- **Procurement.** In some non-line agency community infrastructure programmes, communities now also do the material procurement themselves, which increases the capability to deal and cooperate with commercial suppliers and service providers.
- **Municipalities.** With the establishment of municipalities, which are 3-6 times bigger than the old Village Development Committees, local government has much bigger budgets and also often technicians, so, opportunities for technical and financial assistance have become more accessible for the village.
- **Few large or many small interventions.** Most programmes, like the three ILO-ones focus on schemes with big technical problems. A discussion each programme has to conduct is whether to support 10-20 schemes intensively through a professional agency like DIO and in a way that makes them more dependent on external aid or to support a larger number of schemes in lower intensity and less costly ways through municipalities, that address e.g. seepage and slope stability less effectively, but that reach many more communities.
- **Private sector construction services.** The strength of the private sector in the districts is slowly improving, and especially the new development of agricultural value chains does not only benefit farmers with new incomes but also with stronger linkages to the private sector for supplies and sales. Such new linkages could also be beneficial to better linkage to construction services supply chains, which in themselves could also be improved by a project. Because infrastructure government agencies and aid agencies are service- and investment-oriented, strengthening of the construction services supply chains and their linkages to communities is still rare.

▶ 6. Summary and Conclusions

ILO's Employment-Intensive Investment Programme, a global programme, plans to improve its guidance for infrastructure O&M, and commissioned a short (2 week) assessment on irrigation O&M in Nepal, where ILO has supported irrigation through three different programmes in the past. The Nepal irrigation O&M assessment covered in total 12 ILO-supported schemes, six through scheme visits and six through telephone interviews.

Due to the extremely short time available for the assessment, it should be categorised as a quick-and-dirty assessment, that had to necessarily limit its scope and depth. Rather than trying to delve in to the more complex and time-consuming issues of operation, equitable benefit distribution, gender and social inclusion, and the environmental impacts of irrigation canals on natural drainage and slope stability, the focus has been on simple indicators of scheme condition and functionality and an attempt to extract lessons for implementation projects on how to increase the chances that a community can maintain their scheme better.

The three ILO programmes (DIDP, EmPLED, JfP). Dhaulagiri Irrigation Development Programme (DIDP) as a community irrigation support programme in Nepal was typical for its time and it consistently applied a setup and approach that were built on the prevalent ideas and lessons from previous irrigation programmes. Although it specifically emphasised employment generation, it's approach was not very different from other programmes in this respect as labour-intensive approaches were not only the aid sector's most preferred, but also the most logical approach for populous communities, in locations that were hard to reach for government, contractors, roads and machinery, and that themselves approached and managed everything in labour-intensive ways.

Although for the other two programmes, Employment Creation and Peace Building based on Local Economic Development (EmPLED) and Jobs for Peace(JfP), irrigation was one of many interventions towards employment, peace and e.g. agricultural development, the resulting infrastructure and work with community institutions were not much different from DIDP's. The links to commercial agriculture and skill development were stronger, and the links with the government agencies for irrigation were often weaker, except for one branch of the government co-managed Kamala Irrigation System.

Programme	Years since project support	No. of schemes	Study Visit 2021	Telephone interview
DIDP	25+ years	65	6	2
EmPLED	10+ years	3	-	3
JfP	10 years	2	-	1

Even though short, the assessment still shows the wide variety in which communities manage and maintain their schemes, while also producing findings that seem to apply to practically every scheme and fit with observations from other O&M studies, allowing lessons to be formulated that ILO can use in formulating guidance for irrigation and small infrastructure O&M in its Employment-Intensive Investment Programme and other infrastructure programmes.

The interventions. All except one scheme (Chisti) concerned rehabilitation of existing schemes, which ranged from 10 to 125ha (and 10-250 user households) in DIDP and were up to 250ha in EmPLED and JfP's lowland schemes. All schemes were community-managed, except the EmPLED-supported branch of the jointly-managed (government and community) Kamala IP. Project works were mostly done by the community itself or by petty contractors using local labour, which were supervised and supported by project engineers and supervisors.

For all the target communities, irrigated agriculture was the most important source of livelihoods. In hill schemes the projects assisted with control of seepage areas and instable or rocky slopes, flood protection for intake areas, and stream crossings, while in the lowlands besides weirs and intakes, interventions also focus often on flood and siltation control for the whole canal and command area. Most target communities had never experienced such long-lasting, costly and intensive aid experience and effects on income patterns, social structure, leadership and relations with the government last till this day.

Findings.

Scheme condition. All schemes, except one, were actively operated and maintained by the communities with substantial contributions, mostly labour, from each user household. Of the twelve assessed schemes, none were said to be in perfect condition, 5 needed minor repairs (by the community), and 7 needed major repairs (4) or rehabilitation(3) for which the community would need external assistance. All five "minor repair" schemes and one rehabilitation scheme had been assisted by the government with major repairs or rehabilitation within the last 5 years. This includes Bharmajhiya which is part of the large-scale government-managed Kamala irrigation system. Regardless of whether the original project let the communities manage the construction or even procurement, for recent government-assisted major repairs these are done by the government and it's contractors.

▶ **Table 20 – The six visited Dhaulagiri IDP Schemes, Acreage and Users**

Scheme Name	Kurgha	Chisti	Amalachaur	Kushmisera	Lampata	Chhiswang
District	Parbat	Baglung	Baglung	Baglung	Parbat	Myagdi
User HHs, 1995	234	63	119	121	58	85
CA 1995 (ha)	80	50	35	21	30	19
Scheme Condition (repair needs)	Major repair	Minor Repair	Rehabilitation	Minor Repair	Minor Repair	Minor Repair
Functionality, summer	0%	>90%	<20%	>90%	<20%	>90%
Functionality, winter	0%	>90%	<30%	>90%	100%	>90%

The table for the six telephonic interview schemes superficially confirms the general idea, although some of the details seem contradictory and raise questions, that a telephone interview could not solve.

▶ **Table 21 – The six other schemes, Basic information from telephonic interviews**

Scheme Name	Thini	Tiri	Dora	Bharmajhiya	Juri Maai	Goshwara
District	**Mustang**	**Mustang**	**Parsa**	**Dhanusha**	**Dhanusha**	**Ramechhap**
User HHs	225	18	130	200	50	100
CA, max (ha)	125	18	150	152	100	13
Scheme Condition	Rehabilitation	Rehabilitation	Major repair	Minor repair	Major repair	Major repair
Functionality, summer	50-90%	50-90%	<50%	>90%	50-90%	>90%
Functionality, winter	25-50%	25-50%	<50%	<25%	>90%	>90%

Functionality. All except one scheme are functioning: five fully (100% winter and summer), and six partly (between 15% and 90%). In five cases low scheme functionality (see table), large parts, if not all lands, could still be irrigated by use of other additional water sources. On basis of the schemes with more reliable information, the six visited schemes, functionality was on average lowest in schemes needing major repairs or rehabilitation.

WUAs. Most WUAs were said to be still functioning, 50% still in the style promoted by the ILO-supported programme with regular meetings and administration, and others in less formal ways. One (maybe two) had not met within the last year. It was difficult to establish a correlation between WUA performance and scheme condition or functionality because of the recent repairs and rehabilitation done with external aid. WUA operations were also difficult to check in short interviews where only leaders were present and paperwork could not be checked. Based on observations, there seems to be slight correlation between active WUAs, women's involvement, user satisfaction, ability to attract external aid and scheme functionality.

WUA capabilities. Most communities can manage enough technical skills and resources for work with local materials but cannot manage enough skills and resources for repair of more difficult structures, especially works with RCC, large pipes and gabion walls. Wherever the community itself managed to repair structures, none of the works was restored to their original design and quality. Damaged gabion walls are replaced by dry stone walls, large pipes by small pipes or a dug canal, RCC intake works and regulators by dry stone structures, sometimes with a cement masonry orifice.

When assessing the 12 schemes, the most commonly found timeline for scheme condition is as follows:

- The condition and O&M of project-assisted schemes remains manageable for a community for 5-10 years. After this, the need for major repairs and external assistance increases. Many communities actually manage to obtain government aid for such repairs, although it appears more difficult to obtain for schemes that have not been built by the government.

- On average, project-assisted schemes (only DIDP-scheme works are this old) need rehabilitation through external assistance after about 20-25 years. Most schemes that were built through the irrigation government agencies have managed such major assistance.

Choice of technology. The major added value of external aid was the use of a set of technologies (with use of e.g. gabions, RCC, cement, pipes) that can withstand the local challenges better than the local technologies. They can be applied in remote locations, but it appears that except for cement masonry, they can only be repaired well with external technical and financial assistance. A programme that would use and promote technologies that can be better maintained by communities would probably end up with technologies that are too similar to local technologies and could lose its added value. It is unlikely that other non-local technologies would have led to longer infrastructure lifetimes and more adequate repairs by the community.

Socio-economic trends affecting irrigation O&M. The assessment could ask only few questions about increasing O&M problems due to labour shortage caused (and feminization of agriculture) by youth outmigration (more often male) and due to increasing alternative livelihoods options, issues that are being observed across Nepal and have already been discussed in Torsten Berg's studies and papers. The Maoist insurgency accelerated these trends when youth fled the village and must also have disrupted O&M, by disrupting community work and handling of resources for repair. The mountains and lowlands schemes reported such issues, and e.g. also often hire outsiders for unskilled labour, but the hill scheme users seemed to play down such problems. As any assessment of this subject would need more in-depth coverage and discussion, it is not surprising that the findings of this short assessment are a bit inconclusive.

The conditions for construction and repair has further changed considerably since the last 20 years, as rural roads (and construction materials) penetrated the villages (where visiting schemes previously involved hours of walking), influx of money from remittances by migrant labour, the emergency cash cropping for the towns and Indian markets and increased connectivity and access to information through satellite TV and mobile phones.

Why do communities not invest more in O&M? The villagers and outsiders should see community efforts as substantial in themselves, but it is not enough for major repairs. Even though the income loss from a lost irrigated crop can be substantial, the willingness-to-pay for repairs to prevent such losses is only a fraction of the cost of those losses. Analysing and addressing this issue is crucial to improving O&M. The following list of issues contributing to this discrepancy is not exhaustive, just a start to the discussion:

- **Confidence and skills.** The farmers have too little confidence in themselves to manage the technical and management skills to design and implement repair works that were originally done by DIO-experts. Farmers assess the risks too high for a WUA handling large amounts of money for repairs that might ultimately fall short.
- **Cash and risks.** The farmers cannot manage to produce large amounts of cash, if needed at short notice. In theory, each household could manage loans, but the involved risks would be very high and especially poor households could be severely affected if the repairs fail or the WUA mismanages the funds.
- **WUA condition.** The WUA might be more able to manage large repairs in the period after scheme completion, but by the time the scheme starts to show old age problems, many WUAs have transitioned to a less formal, less active, less rigorous, less cohesive form. Often, the institutions start to show old age problems before the scheme infrastructure.
- **Availability of external aid.** The motivation to be self-reliant fact is continuously undermined by the fact that the government, especially irrigation authorities and municipalities, every year assist a number of schemes and that ILO-support often has led to good relations with those offices. The fact that so many schemes have been repaired more than once through (contractors hired by) the government, proves the communities are right. So, WUAs have the telephone numbers of the district government offices but not of nearby skilled labourers, contractors, material suppliers.

Suggestions for approach improvements. The communities (in chapter 4.12) suggest that not much needs to change with the approach. The basics of that approach are also still the basis of the present-day approach of the government and aid projects, although they have in the last 20-30 years introduced more measures for e.g. social mobilisation, gender equity and social inclusion. Communities, when asked about possible programmatic improvements, scored the suggestions to give the community more responsibilities (design, procurement, finance) lower than suggestions for more training, and more post-construction monitoring by the government.

Trends in rural infrastructure programming. New opportunities for improving participation, self-reliance and employment are emerging due to three trends: 1. the establishment of better staffed and resourced rural municipalities since the restructuring into a federal Nepal in 2017, 2. The emergence of new agricultural value chains and a stronger private sector, and 3. youth outmigration leading to negative population growth and an influx of remittances.

▶ 7. Lessons and Suggestions

The following list of "lessons" or suggestions related to project-assisted community-managed irrigation system O&M is extracted from the findings of this small assessment and from third-party studies on rural infrastructure. The suggestions can be used to develop guidance on O&M in community infrastructure programmes, notably irrigation in Nepal's hills. Some of these lessons and suggestions may apply also to community irrigation schemes that have not been supported by DIDP-like and irrigation line agency projects, to lowlands irrigation schemes, to other community infrastructure, and even to schemes in other countries, but extra assessments and deliberation will always be required.

1. **Assessments before programme concept design.** Assess first what communities, local construction services and irrigation related agencies will be capable of in terms of design, construction management, construction skills, supervision personnel and budget, before deciding on technologies and approach.

   a. If you implement irrigation support to communities with infrastructure works that might be too difficult or expensive for the community to repair by itself, do it with a local agency that can provide the technical expertise and required budgets for repairs when required, and that feels ownership for the relations with said communities. In Nepal this would be normally the Province's district-level irrigation line agency.

   b. In case the programme is implemented with or by less resourced agencies (like rural municipalities or NGOs), it is better to reduce the level of technology and investment or to invest in resource mobilisation and workable relations between communities and commercial construction services.

2. **Optimal implementation and O&M scenarios for programmes with a different focus and approach.** Properly assess what place the irrigation interventions have in the ILO-supported programme, and what the programme is capable of in terms of irrigation engineering, capacity building, supervision, before making choices on technology, approach and component setup:

   a. An irrigation programme done with irrigation line agencies, like DIDP, will adjust to what the agency can provide as repair-related support ten or twenty years down the line. The line agency should commit to periodical monitoring visits and financing of repairs after 10 years.

   b. A multi-sector programme that also does some irrigation interventions should ideally either work through the local irrigation line agency (like the interventions in the Kamala irrigation system). Agencies should commit to periodical monitoring visits and financing of complex repairs after 10 years, if needed. Such an approach would need very precise formulation so as to avoid that repairs are done just because communities know an agency has money to spend or just because an agency has a budget and is looking for schemes to repair.

   c. If a programme does not work with irrigation line agencies (like Jobs for Peace), a thorough assessment of O&M scenarios, prospects and risks should be done. It might lead to reduced sophistication of engineering technology, increased capacity building of commercial local construction services and municipalities. Municipalities should commit to periodical monitoring visits and occasional financing of repairs after 10 years.

3. **Capacity building.** Design O&M related capacity building for communities, agencies and construction services on basis of the most likely scheme condition trajectory, with possible major repairs after 10 years and rehabilitation after 20 years.

a. Leave as much as possible of the project implementation in the hands of the community, because capacity building is best done through learning by doing. Conditions:

i. Agree with the community what they are comfortable with
ii. Adjust the WUA formats, structures, mechanisms to what they will be able to sustain successfully
iii. Ensure intensive guidance and coaching by site supervisors
iv. Include adequate training and coaching of resource mobilisation, Maintenance Fund and financial management
v. Train and coach on material procurement
vi. Train more users in masonry, RCC, gabions and other construction skills
vii. Train to work effectively with skilled masons, gabion weavers, contractors
viii. Exchange visits to similar communities with successful O&M

b. Leave as much as possible of the works that the community feels uncapable of to local construction service providers (skilled labours, micro-entrepreneurs and contractors) so that a working relation is established for near future work

i. Construction service providers should be managed and partly paid by the community
ii. The supply chain for construction services will need strengthening by supply chain analysis, linkage events between service providers and potential customers (like the communities with project assisted infrastructure), business development, skill development and coaching of both service providers and customers

c. Assess the ideal form of Maintenance Fund management. Some communities will like to have a separate fund for scheme O&M managed by the WUA. But in east Nepal some communities trusted women's savings and credit groups with the money, so it could be used productively in years without costly repairs and gradually increase. In the Far West the Finland-supported Rural Village Water Resource Management Programme (RVWRMP) WUAs (irrigation and water supply) entrust cooperatives with the money and some cooperatives consider also storing construction materials and employing a technician that can serve all the infrastructure schemes of the area, tens of schemes rather than one or two project-supported ones.

4. Safeguards. Take steps to map, and if needed, address any potential social and environmental safeguards issues that may affect O&M

a. Inventory of all the villagers, including tenants and non-users, listing land, water access, labour availability, main income sources

b. Establish water rights of nearby water systems

c. Assess trends in labour availability, outmigration, alternative income sources

d. Assess trends in village irrigation leadership, traditions, potential conflicts,

e. Assess the position of disadvantaged groups in relation to irrigation, and address any issues like exclusion or neglect of their interests that might affect their interest and contribution in O&M

f. Identify and assess the issues of any project-affected person, whose actions might later undermine O&M. This might be e.g. people whose water or land rights, property, road access, drinking water quality might be affected by the canal or canal construction works.

g. Assess the position of women in relation to irrigation, and address any issues like exclusion or neglect of their interests that might affect their interest and contribution in O&M

h. Assess and properly address environmental issues and risks like slope stability and vulnerability to floods, including those caused by the canal and canal operation itself.

5. **Include Studies in implementation programmes.** Include construction technology studies in programme setups, so that technology approach and design decisions are based on proper assessments of how previously used technologies have performed.

6. **Post-construction phase.** Include a post-construction phase of at least two years in the programme, during which the communities are visited by project - or agency staff who can assess O&M and if necessary advise the community on how to improve their WUA management, resource mobilisation, and linkage to construction services. Ideally this would be done by the local agency, monitored by ILO. An alternative arrangement would be to leave a lumpsum post-construction budget with the local agency, enough for two years continued monitoring and support, on which the agency periodically reports to ILO.

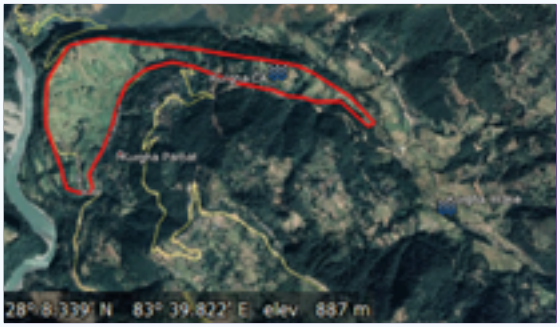
▶ Annexes

Annex 1 – Scheme Contact Details

Scheme Name	Contact	Position	Municipality-Ward	District	Tel. No.
Khurga	Megharaj Upadhyaya	WUA	Phalebas-10	Parbat	986762371
Amalachaur	Gobinda Paudel	WUA	Baglung-12	Baglung	9851240000
Chisti	Puran Sarbhuja	WUA	Jaimini-8	Baglung	9857655355
Kusmisera	Mati Pd Sharma	WUA	Jaimini-1	Baglung	9847658204
Lampata	Hari Narayan Subedi	WUA	Kushma-5	Parbat	9847643503
Chhiswang	Nar B Purja Magar	WUA	Mangala-2	Myagdi	9847627462
Thini	Bhupendra Sherchan	WUA member	Ghopojhong	Mustang	9847637737
Tiri gaun	Sanokanchha Gurung	WUA member	Baragaun Muktichhetra	Mustang	9847670429
Bahuwari Pidari	Babu Lal Yadav	WUA member	Bahusdarmai	Parsa	9845267454
Bharmajhiya	Dev Kumar Gohibar	Former WUA	Ganesh Man Charnath	Dhanusha	9814820696
Juri	Raj Kumar Sah	WUA member	Ganesh Man Charnath	Dhanusha	9815878578
Goshwara, Darga	Hari Bahadur Magar	Former WUA	Doramba	Ramechhap	9818850254

Annex 2 – Scheme locations and intake coordinates

Kurgha



Amalachaur

Chisti

Kusmisera

Lampata

Chhiswang

Annex 3 – Pictures of six scheme visits

Kurgha, Parbat

Amalachaur, Baglung

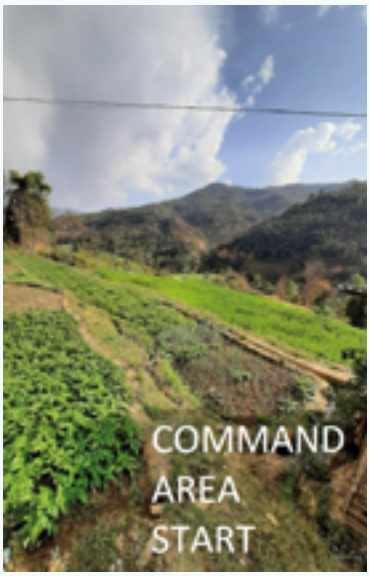
Chisti, Baglung



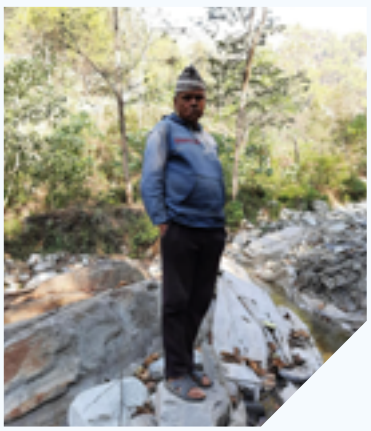





Kusmisera, Baglung



Lampata, Parbat



Chhiswang, Myagdi

Operation and maintenance of irrigation systems: maximizing local resources and community participation Philippines

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Consultant

March 2021

▶ 1. Introduction

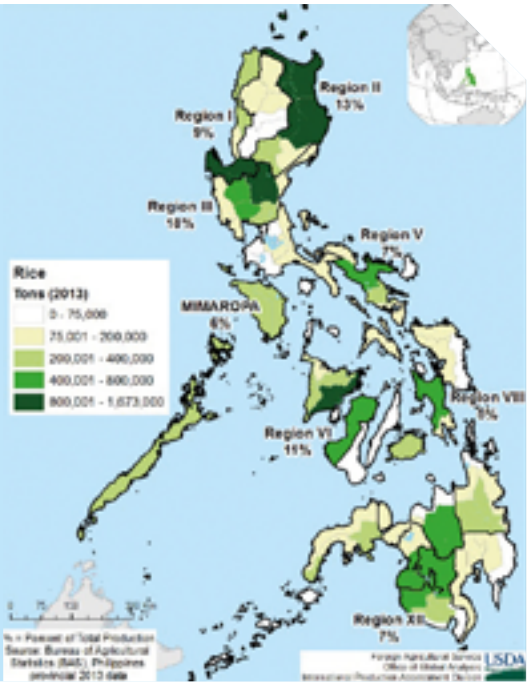
The Philippines is an agricultural country and irrigation is an important component of the agricultural production system. Irrigation increases the capacity of land to produce crops even under unfavorable weather conditions. The country is estimated to have about 10.3 million hectares (mnh) of agricultural lands, of which about 3.1 mnh are considered irrigable. These are areas with up to 3% slope and devoted to rice and corn.[1]

In a recent study by the World Bank, it is stated that the country has an estimated 6.1 mnh irrigable cropland. The report adds that this includes areas that are relatively more difficult to irrigate and with up to 8% slope.

Rice accounts for around 20% of the Gross Value Added (GVA) of Philippine agriculture. Rice employs 2.5 million households, of which 2.1 million are farmers, 110,000 are workers for post-farm activities and 320,000 are for ancillary activities.[2]

A study of the Department of Agriculture (DA) Philippine Rice Research Institute (PhilRice) showed that access to irrigation water, use of high-quality seeds and modern technologies, and farm mechanization are the major contributors of farm productivity. Irrigated farms produce more, at an average of 4.43 metric tons (MT) of palay per hectare (ha), 1.3 MT higher than rainfed areas, at 3.13 MT/ha, according to the Philippine Statistics Authority (PSA).[3]

▶ Figure 1. Philippines: Rice Production
Rice-producing provinces of the country. The dark green areas are the highest producing provinces. For this report, the study areas are Bohol (red circle, post-earthquake) and Cagayan de Oro (blue circle, post-typhoon) that fall under the 200k-400k tons and 75k-200k ton production capacity respectively.



With the 2020 population over 109 million, local palay production is not sufficient to meet the demand. The Philippines has to import rice on a regular basis. High production costs and competition from subsidized foreign rice producers place the Filipino farmer at a losing end.

1 https://www.fareasternagriculture.com/crops/agriculture/is-the-philippine-irrigation-system-running-dry

2 Global Cost and Price Competitiveness of Philippine Rice, L. Gonzales, 2013.

3 Reyes, DA-AFID, 2020

Increased population, especially in the rural areas, means smaller farm landholdings. Although its annual population growth rate for 2020 slightly decreased from that of 2019[4], the country's population is still substantial.

Most farmers lack adequate and appropriate infrastructure, like processing and storage facilities, and has limited access to credit. During harvest season when prices are low, farmers have to sell their surplus produce as they cannot wait for a good price because they do not have a place to dry or store their rice. As a result, they cannot dictate prices to buyers.[5]

Another problem is the lack of effective irrigation systems due to high costs of development of new irrigation facilities, and management and maintenance problems in existing systems.[6]

To make matters worse, the Philippines is vulnerable to natural disasters. The country is hit by an average of 20 typhoons each year, or a strong earthquake once in a while. For farmers, one typhoon can wipe out the entire crop. The feeling of uncertainty pervades among the mostly impoverished farmers.

High poverty rates in the agriculture sector can also be attributed to underemployment. Nearly 70 percent of underemployed Filipinos work in agriculture, forestry or fishery. While farmers and agricultural workers search for employment, government resorted to imports.

Costs of production, agricultural productivity, population, climate change, technology and lack of support infrastructure contribute in creating conditions that are not favorable for the Filipino farmer.

Realizing the predicament of the farmer, past administrations embarked on high-profile programs to improve agricultural productivity and address poverty among farming communities all over the country. Some of these programs include:

- Comprehensive Agrarian Reform Program (CARP)
- Agrarian Reform Communities (ARCs)
- National Irrigation Administration (NIA)

These programs were developed with the end of improving the conditions in the agriculture sector. Despite government's population management and agricultural productivity enhancement programs, the Filipino farmers' condition remain dire.

A national scientist and economics professor Raul Fabella (2014) identified 3 major reasons why farmers remain poor. These are:

1. **Low land retention ceiling**. Under the Comprehensive Agrarian Reform Program (CARP), the ceiling is five hectares for family-cultivated farms, and three hectares each for their children up to four kids, for a total of 17 hectares. Over time, the land is subdivided among the children and grandchildren such that for today's farmers, the average farm size is less than 1.5 hectares.
2. **Farmers are not organized.** Farmers are reluctant to join farm cooperatives because of past actions of some of its leaders. Some believe that farmers' associations and cooperatives are formed primarily to get government dole-outs, and that the government agency that is supposed to guide the farmers' cooperatives are more concerned with regulation rather than empowering the organization with agribusiness acumen.

4 Philippine Population, Worldometer

5 Sebastian et al.,BRIDGING THE RICE YIELD GAP IN THE PHILIPPINES

6 Ibid

3. **Role of Local Government Units (LGUs).** The LGUs are mandated to provide agricultural assistance to farmers in their areas. This, apparently, is very much dependent on the competence of the extension workers recruited, who unfortunately may not fit for the job. In addition, the Local Chief Executive may not see agriculture as a priority as it is not as attractive as the high-profile infrastructure.

Despite the issues confronting the farmers, experts maintain that to sustain agricultural production, farmers must utilize proven rice production technology, better farm inputs, dependable machineries and most especially, must have access to a reliable supply of irrigation water. This entails that irrigation facilities must be kept fully functional and reliable, and the farming communities must develop a culture of maintenance to recognize and/or anticipate problems before they become big and costly.

Documenting the interventions designed for farmers to develop a collective mindset regarding regular and preventive maintenance of agriculture production infrastructure is the overall objective of this paper.

▶ 2. Structure of the Report

The **Introduction** provides a glimpse of the state of the Philippine agriculture sector and its inability to meet local demand for rice. **Chapter 3** presents three important initiatives that government implemented to boost agricultural productivity and address the plight of the Filipino farmer, most of whom remain poor. **Chapter 4** is about a study conducted in communities of agrarian reform beneficiaries with Communal Irrigation Systems provided by government. **Chapter 5** describes the ILO local resource-based (LRB) approach and its experience when it was applied in agricultural areas affected by natural calamities. **Chapter 6** presents case studies illustrating the application of the LRB approach in post-calamity situations. **Chapter 7** is about the lessons learnt from the experience, and **Chapter 8** summarizes the paper and presents potentials for further promoting and applying the LRB approach to help the farmer and improve agricultural productivity.

▶ 3. A Glance at Philippine Agriculture

Realizing the predicament of the Filipino farmer, government embarked on high-profile programs to improve agricultural productivity and address poverty among farming communities all over the country. Some of these programs include the following:

3.1 Comprehensive Agrarian Reform Program (CARP)

Government ventured into agrarian reform and implemented the Comprehensive Agrarian Reform Program (CARP). The program traces a long history of attempts at land reform in the Philippines, all aimed towards the redistribution of private and public agricultural lands to landless farmers, and make them land owners on the belief that it will help improve agricultural production and productivity, create employment to more agricultural workers, and put an end to land-related conflicts.[7] CARP was supposed

7 Wikipedia

to be completed in 1998, but the complexity of its implementation compelled Congress to allocate additional funds and extended the program until 2008.

In 2003, or 15 years into the program, studies funded by the United Nations Development Programme (UNDP), ADB, FAO, European Union (EU) and the Philippine Government, indicated that poverty incidence among program beneficiaries declined from 47.6 to 45.2 percent, while increasing among their non-participating counterparts from 55.1 to 56.4 percent.[8] This was considered a success story of the CARP.

Government declared that as of June 30, 2014, some 6.9 million hectares of land have been acquired and redistributed, equivalent to 88% of the total land subject to CARP.[9]

3.2 Agrarian Reform Communities

Through the Department of Agrarian Reform (DAR), government adopted the Agrarian Reform Community (ARC) development strategy in 1993 as an integrated approach for communities consisting mostly of Agrarian Reform Beneficiaries (ARBs). It was considered as government's key intervention to accelerate community development and sustain national growth.

The ARC strategy aimed at improving productivity of the land, as well as the farmers'. The ARCs became convergence areas where agencies and organizations, both local and foreign, provide resources, assistance and interventions.

In 1995, Republic Act No. 7905 was passed to strengthen the implementation of CARP. The Law calls for establishing at least one ARC per legislative district in 5 years or until 2000. An ARC is a village or a cluster of villages consisting mostly of agrarian reform beneficiaries and their organizations or cooperatives.

In 1995, the Japan Bank for International Cooperation (JBIC) funded the *Agrarian Reform Infrastructure Support Project Phase 1* (ARISP-1) in the most disadvantaged ARCs both in terms of income and living standards. The ARCs' condition was attributed to lack of agriculture support services, absent or inadequate rural infrastructure development, and needed policy reforms in the relevant sectors. Although the beneficiaries have received titles to their lands, their ARCs lacked support infrastructures and basic services like farm-to-market roads, potable water, communal irrigations, post-harvest facilities, and auxiliary support services.[10] The government's strategy for ARC development was to complement the land distribution activity with participatory bottom-up planning processes that encouraged beneficiaries to identify their priority needs and implement measures to meet these needs.

In September 2002, the Institute of Agrarian and Rurban Development Studies of the University of the Philippines Los Baños, in partnership with Dr Nozawa of the University of Asia in Japan, conducted an evaluation of the JBIC-funded ARISP-I.

The evaluation covered three ARCs under ARISP-I and three ARCs not covered by the project.

The findings showed that the ARISP-I generally resulted in increased crop yield which "produced favorable changes in the level of non-farm and farm income combined". The evaluation noted greater improvements in cropping intensity for rice, rice productivity, average farmgate price, and household income in ARCs covered by ARISP-I compared with non-ARISP ARCs.[11]

The evaluation noted that cropping intensity in ARISP ARCs was higher at two to three rice harvests per year compared with only one in non-ARISP ARCs. In terms of rice productivity, the average harvest per hectare was about 4 tonnes in ARISP-covered ARCs compared with only a little more than 2 tonnes in

8 Guardian, 2003

9 The Official Gazette, 2014

10 ADB, 2012

11 Guardian, E.A., Impact of access to land on food security and poverty: the case of Philippine agrarian reform

non-ARISP ARCs. The report stated that improvements in productivity and income "were attributed to the communal irrigation facilities that have been provided, which have resulted in sufficient water supply, and to the adoption of high-yielding varieties and increased fertilizer inputs."

The JBIC-sponsored survey of three ARISP-assisted ARCs mentions a big increase in the income of the ARB households of about Php120,000 per year. Considering that the national average annual income of rural households is Php40,000 – 60,000, the increase is significant and substantial. However, a big portion of the increase was attributed to remittances from family members working abroad, and not solely the effects of CARP.

However, the improvements mentioned were true only in representative ARCs, and not in all ARCs. A 2002 evaluation by DAR using its ARC level of development assessment (ALDA) ratings indicated that a greater number of ARCs still produce below the national mean, and an equally significant number of ARB households have incomes below the poverty threshold.[12]

By December 2017, a total of 2,216 ARCs in 1,288 municipalities, 9,724 villages with 1.52 million agrarian reform beneficiaries were confirmed established by the DAR National ARC Task Force. A total of 116 ARC clusters have been likewise confirmed.[13] Local and foreign funding from Official Development Assistance (ODA) were utilized to develop the ARCs and ARC Clusters.

Another main accomplishment of the CARP was the virtual elimination of share tenancy, which was reduced from 67 percent before 1972 to 3 percent in 1995. Conversely, owner-cultivation increased from 2 to 23 percent during the same period.[14]

The success of ARC development is anchored on the performance of ARB organizations, mainly cooperatives. The 2002 assessment based on DAR's ALDA ratings indicate that only 19 percent of ARB organizations have fulltime management and staff.

A more comprehensive assessment and quantification of the impact is needed, especially at the household level.

Despite the questions raised regarding the findings of studies on ARCs, it can be acknowledged that some improvements happened. It is just a matter of focusing on what works and sustaining these and/or replicating in other areas.

3.3 Irrigation Development and the National Irrigation Administration (NIA)

National government use resources, both labour and fiscal, on the ARCs in support of the CARP. One of the agencies mandated to provide this support is the National Irrigation Administration. NIA is tasked to investigate, study, and develop all available water resources in the country that can be used for irrigation. NIA oversees the development of national irrigation systems (NIS), communal irrigation systems (CIS) and private irrigation systems (PIS). [15]

The NIS are large and medium irrigation schemes that are operated and maintained by NIA. The beneficiaries pay irrigation service fees for the water they receive from the system.

CIS are small-scale schemes that are constructed with the participation of farmer-beneficiaries who are organized to form the irrigators' association (IA). The IA is responsible for the system's operation and

12 Ibid

13 https://ap.fftc.org.tw/article/1315

14 Bravo and Pantoja, Beyond 2000: An Assessment of the Economy and Policy Recommendations-Social Sector Dealing with Agrarian Reform, 1998

15 NIA Website

sustained use. The CIS is turned over to the organization upon project completion under a pre-arranged cost-recovery agreement with the NIA.

The PIS are irrigation systems that are constructed, operated and maintained by private individuals or groups without any technical assistance from NIA or other government agencies.

The following Table from the NIA website compares the development and management of NIS and the CIS.

▶ Table 1. Comparison between National and Communal Irrigation Systems, Source: NIA

For comparaison	National Irrigation System	Communal Irrigation System
Area (ha)	> 1,000	> 1,000
Implementation/construction	NIA	NIA wirh farmers' participation
Operation and maintenance	NIA and Irrigators Associations	Irrigators Associations
Water charges	Farmers pay irrigation service fee per hectare/season/crop	Farmers pay amortization
Purpose of water charges	Purpose of water charges	Capital cost recovery

NIA has three irrigation development schemes. These are river diversion, storage or reservoir and pump irrigation. The river diversion scheme draws water from the flow of rivers or streams. Storage or reservoir facilities involve construction of dams to hold water and released as needed. Reservoir projects are typically multi-purpose and may include power generation, flood control, fishery and recreation. In pump projects, water is lifted from the source, like from aquifers or from rivers and streams, and stored or distributed through a network of canals. Pump systems are also used in some storage or diversion schemes to lift water to higher elevations or pump groundwater to supplement available supply from the river.

NIA's mandate is to irrigate most, if not all farmlands. However, efforts seem not enough in providing water, particularly in remote communities. In a study by Jayson Cainglet, lead facilitator of the regional work in the Asia Pacific of the Agribusiness Action Initiatives, it is stated that NIA's irrigation development has not reached 50 per cent of its target.

The 2014 data from the Philippine Statistics Authority indicate that the total irrigated land in the country is 1.7 million hectares, or a little over the 50% target set by NIA. The 2014 average yield per hectare of 4.22 tons is considered above marginal. But judging from agriculture's performance from 2010-2011 wherein productivity growth was not sustained, the lack of adequate irrigation systems in the countryside can be a contributing factor. [16]

Table 2 indicates the total irrigated area, type of irrigation system used and average palay yield from 1990-2014.

16 AgriMag, Feb. 2018

▶ Table 2. Total Irrigated Area, Type of Irrigation System in the Philippines and Yield of Rice, 1990-2014. Source: Philippine Statistics Authority, 2016 (CountryStat)

Year	Total Irrigated area	Communal Irrigation System	Private Irrigation System	National Irrigation System	Yield (t/ha)
1990	1,566,008	750,671	152,128	663,209	3.29
1991	1,508,254	760,332	152,128	667,794	3.32
1992	1,522,392	731,969	152,128	645,789	3.34
1993	1,540,041	741,394	152,128	646,519	3.34
1994	1,268,428	442,006	174,610	651,812	3.38
1995	1,307,010	474,289	180,909	651,812	3.26
1996	1,322,860	488,532	182,516	651,812	3.31
1997	1,335,517	491,356	181,447	662,714	2.93
1998	1,338,815	486,066	174,200	678,549	2.70
1999	1,338,815	486,066	174,200	678,549	2.95
2000	1,361,454	501,442	174,200	685,812	3.08
2001	1,373,825	510,615	174,200	689,010	3.19
2002	1,387,236	523,923	174,200	689,113	3.54
2003	1,396,082	532,150	174,200	689,732	3.77
2004	1,401,744	537,305	174,200	690,239	3.92
2005	1,413,236	543,262	174,200	695,774	4.02
2006	1,427,924	548,978	174,200	704,746	4.10
2007	1,434,597	554,020	174,200	706,377	4.21
2008	1,519,942	554,020	174,200	748,593	4.14
2009	1,539,937	557,631	217,329	764,977	3.84
2010	1,542,668	558,333	217,329	767,006	3.99
2011	1,570,926	496,442	193,814	712,790	3.93
2012	1,626,510	534,403	200,018	722,583	3.12
2013	1,678,595	576,419	194,620	740,214	4.12
2014	1,708,063	595,653	194,841	750,169	4.22

A very significant and relevant information regarding the state of the country's rice production is the 2019 report of the United States Department of Agriculture-Foreign Agriculture Services (USDA-FAS), which states that the Philippines has emerged as the top global importer of rice, beating China. The USDA-FAS projected that the country's rice imports will reach 3 million metric tons (MT) by year-end, the highest in the world and the highest for the country, while China is expected to import 2.5 million MT.[17]

Succeeding discussions shall focus on Communal Irrigations Systems (CIS) as a number of ARCs were provided with CIS for their agricultural production. A fully functional CIS is key in sustaining the livelihood of the agrarian reform beneficiaries.

17 Parocha, Philippine News Agency, 2019

▶ 4. Current Situation in Communal Irrigation Systems of the Philippines

In 2019, the Philippine Institute of Developmental Studies (PIDS) conducted an assessment of some 90 CIS in 11 provinces, mostly in Luzon. Although the study did not include the three areas considered in this report, the findings are relevant and significant in understanding rural agriculture conditions even in post-calamity situations.

The study utilized key informant interviews and focus group discussions among various irrigation management offices.

The PIDS study listed issues in the management and operation of CIS in the country. The study noted the low yields among CIS areas, and these can be attributed to:

- Uncertainty of water supply
- Some CIS areas have slopes greater than 3%
- Environmental problems like forest denudation, logging, kaingin, land use conversion and quarrying affect water supply
- Aging infrastructure needs rehabilitation, repair and maintenance
- Inequitable water flow distribution needs better water management
- Lack of drainage canals cause floods during the rainy season
- Improper or inadequate operation and maintenance

The study adds that development of large irrigation systems in the Philippines has slowed down. Experience and lessons from National Irrigation Systems indicate that to open new areas for irrigation, more manageable small-scale facilities like communal irrigation systems (CIS)[18] may have to be resorted to. This type of irrigation utilize either gravity flow and/or pumps to bring water from the source to the cropland area.

With the continuing low yields and recurring expenses from small farm operations, the President of the Philippines signed into law in 2018 the Free Irrigation System Act (FISA), exempting all farmers with landholdings of 8 hectares or less from paying irrigation service fees. Php 2 billion was provided to the budget of the NIA, but this does not include subsidies for operation and maintenance of the CIS.

The impact of FISA will have to be determined yet.

18 David, 2003.

▶ 5. The ILO Local Resource-based Approach for the Operation and Maintenance of CIS

The ILO Local resource-based approach is about the use of, to the extent possible, everything local for the construction, operation and maintenance of community infrastructure assets. With the LRB approach, local capacities and use of local materials are utilized without necessarily sacrificing quality of the works delivered. With LRB, the use of available resources is emphasized. These include local labor, local materials, local knowledge, local skills and culture, local enterprises, local institutions and organizations, and locally produced tools and equipment.

ILO has established that the participation of the community or residents during construction of a public facility creates a sense of ownership of the project, resulting in its proper use and maintenance and prolonged useful life. The same can be expected among the members of the irrigators association once they are given the role and responsibility in ensuring the sustained use of the irrigation system though proper use, and application of preventive and periodic maintenance procedures.

ILO has generated a body of knowledge, technology, information and experience from its application of the local resource-based approach in several countries, under varying conditions, in different forms of governments and in cross-cultural settings. In the Philippines, the ILO can collaborate with the appropriate government agency, like the National Irrigation Administration (NIA), the Department of Agrarian Reform (DAR) and/or the Department of Agriculture (DA) to help develop a culture of maintenance among the agrarian reform beneficiary communities. The collaboration will aim to reinforce the irrigators associations' and farmers' cooperatives' capacity on maintenance not only of the irrigation facility but on the agriculture support infrastructure as well. The ILO has vast experience in the construction, operation and maintenance of farm-to-market roads, footpaths, footbridges, domestic water supply sources, and community public buildings like schools, health centers, markets, to name some.

The enhanced capacity on operation and maintenance of the irrigation system will not only result in a fully functional facility but will likewise strengthen the local labour pool through transfer of practical skills on O&M. It is envisaged that farmers will develop the capacity to identify indicators of potential maintenance issues and promptly take action before conditions deteriorate and result in losses as well as costly repairs.

The resource inflows, like the wages paid for services provided by local groups and the payments to local suppliers for the purchase of local materials, will remain in local circulation and help revitalize the local economy as the money will tend to remain in the area.

The LRB was applied in several areas right after these were hit by a calamity. The selected areas are agrarian reform communities with communal irrigation systems (CIS) that were damaged by the calamity. The communities were severely affected and the members of the farmer-irrigators associations were mobilized and trained as workers for the restoration, repair and/or rehabilitation of the affected CIS and their support infrastructure under ILO's Decent Work Programme.

The following case studies illustrate the application of the ILO LRB approach in NIA-initiated communal irrigation systems.

▶ 6. Case Studies

Case studies of communal irrigation facilities in 2 selected areas hit by a 7.2 magnitude earthquake in the island of Bohol in 2013 and a strong typhoon that caused a destructive flash flood that killed thousands in Cagayan de Oro and Iligan in Northern Mindanao in 2011 are presented here. ILO Manila formed project teams in the 3 CSI areas.

6.1 Busao Communal Irrigation System, Bohol

▶ Figure 2. Map of Busao Irrigation System. Source: NIA Bohol Provincial Office

About 70% of the population of Barangay Busao, Maribojoc Municipality in Bohol works in agriculture and are organized as the Busao-Agahay-Toril-Sto. Rosario Irrigators' Multi-purpose Cooperative (BATSI-MPC), one of Bohol's main rice-producing organizations with its 135 active members. The Busao Irrigation System was constructed in the early '70s and farmers implement 2-3 cropping seasons a year. It is a reliable source of water until the 7.2 magnitude earthquake of October 2013 destroyed most of its concrete-lined canals (red broken line). Damage to the system was extensive and landslide areas were immense. Agricultural activities completely stopped.

▶ Fig. 3. Damaged siphon stopped delivering irrigation water to the farmlands.

▶ Fig. 4. The earthquake broke the system's concrete pipes in several places, spilling precious irrigation water where it was not needed.

Before the earthquake, water from the nearby Inambacan Falls was more than enough for the twenty-six (26) hectares of Busao farmland. The system was expanded to service the croplands of four adjacent barangays for a total of forty-two (42) hectares. The crop production in the area increased significantly, averaging 5,000 cavans (250 metric tons) of palay in one cropping season. It was a significant contribution to the food security of the province.

▶ Fig. 5. Workers replace the destroyed wooden footbridge with concrete and steel cable suspension bridge.

The barangays are linked by a concrete and wooden footbridge that spans a river tributary. The bridge is reached via a footpath that is also used by tricycles and farm animals. The earthquake weakened the old footbridge and a relatively strong typhoon that hit Bohol a few months later totally demolished it. BATSI requested that the rehabilitation of the footbridge be included in the ILO intervention.

During the earthquake, farmlands with ripening palay were destroyed by landslides and what were left were swept away by rampaging waters released from temporarily blocked waterways. The farmers did not go into land preparation as water from irrigation did not reach their areas. So, from an average of 120 50-kg cavans (6 metric tons) per hectare, the farmers produced almost nothing.

The irrigation system, footbridge and access road were vital in restoring pre-earthquake conditions in the area. BATSI-MPC went to the National Irrigation Administration, the provincial government and other groups to seek assistance but no positive response was received. The association approached the municipal government of Maribojoc but were told that irrigation system rehabilitation was not high in its list of priorities.

BATSI went to the Department of Labor and Employment (DOLE) and was referred to the ILO whose project team was then doing emergency employment cash-for-work activities in adjacent barangays. The ILO team conducted an inventory of the skills among members of BATSI to determine its capacity and the type of assistance to seek from the City Engineering Office for the rehabilitation of the CIS and its support infrastructure. The activities decided upon included: unearthing the main canal that was covered by landslide; restoring the siphon; constructing reinforced concrete covers; and, repairs on the rest of the distribution lines. The ILO team designed and supervised the construction of a new footbridge, rehabilitated the access road and restored the CIS with guidance from NIA and the LGU. All the 109 Men and women members of

▶ Figs. 6 & 7. Workers from the irrigators association unearth the main canal that was covered by landslide (above), while the others work on the concrete siphon (left) that serviced farms on the other side of the stream.

▶ Fig. 8 & 9. Reinforced concrete covers (above) are cast on-site to protect the newly-unearthed main canal (lef) from future landslides.

the association trained on local resource-based approach and worked with the ILO for 30 days. The total cost for labor and materials amounted to US$27,645.13. Throughout the engagement, the ILO team advocated for observance of safety in the workplace, trained the workers on occupational safety and health, and stationed a licensed nurse on site. The ILO likewise shared its core message of social protection, social dialogue, workers' rights and just compensation.

The ILO team facilitated the workers' enrolment for health insurance (PhilHealth), social security (SSS) and one-year accident insurance coverage. They were also provided with personal protective gear and hand tools. The rehabilitation of the CIS and its support infrastructure was done within the agreed period, generating income for the 61 male and 58 female members and their families and restored agricultural production capacity. When the restoration was finished, water from the irrigation facility finally reached the BATSI-MPC farmlands. In a recent talks with leaders of the association, it was mentioned that the rehabilitated system was again damaged by another typhoon that hit their area. Fortunately, government extended assistance and rehabilitated the facility using their "experienced" members as workers. The leaders declared that the system is now in working condition.

▶ Fig. 10. Irrigation water finally reaches Busao croplands.

6.2 Cabawan Communal Irrigation System (CIS), Bohol

Barangay Cabawan in the municipality of Maribojoc was one of the villages severely damaged by the 7.2 magnitude earthquake that hit Bohol on October 15, 2013. Several dwellings, private and public establishments and infrastructure were destroyed, including Cabawan's CIS, a key agricultural support facility that was constructed with the technical and financial assistance from the National Irrigation Administration (NIA). The earthquake took away the residents' reliable livelihood source, who were then forced to rely on whatever humanitarian aid that can reach them.

The national and local governments, together with international and local aid agencies, came to help the survivors get back on their feet and return to their normal lives. Most of the farmers lost the areas they till because of landslides, and those that were spared were abandoned because irrigation water ceased to reach them. Farmers then decided to look for job opportunities elsewhere as it became extremely difficult to plant again.

▶ Fig. 11. Hill collapsed on the Cabawan irrigation system's water impounding facility

The Cabawan Farmers Organization, composed of 100 individuals, approached the ILO project team to seek assistance. The ILO team walked through the whole length of the damaged irrigation system and determined that the water impounding area at source located more than a kilometer upstream was buried by a huge landslide from a hill that collapsed on it. The water impoundment walls were gone and a new concrete structure has to be built. In addition, the main canal was breached in several places and has to be repaired. In some sections, the concrete-lined canal has to be provided with reinforced concrete covers to protect it from future landslides.

▶ Fig. 12. The earthquake damaged the irrigation system's main canal in several places

Prior to the calamity, the Cabawan CIS irrigated 25 hectares of farmland and produced around 120 cavans per hectare. The earthquake deprived the community of their only means of livelihood and drove most of the male members of the irrigators association to work as laborers in the repair and reconstruction of houses damaged by the tremor as there ensued a shortage of workers to address the widespread damage. When asked how will the farmers make the landslide-covered farms productive again, the Provincial Agriculturist mentioned that they can either clear the debris, or resort to cash crops as these have higher value and enjoy a high market demand.

The Barangay Chairman of Cabawan stated that the local government, as its role in addressing the crisis, enacted a Barangay Resolution appealing to potential sources of assistance, like the municipal and provincial governments and private entities, but the earthquake affected a big part of the island province that these appeals for help were not answered.

After meeting with the Barangay Chairman and the members of the ARC and agreed on the collaborative work, the ILO project team distributed hand tools, PPEs and materials and coordinated with the City Engineering Office and NIA to oversee the CIS rehabilitation. Workers focused on clearing and cleaning the sections of

▶ **Fig. 13. Collapsing ground underneath main canal.**

the main canal that were covered by landslides. The biggest challenge was how to clear the huge volume of earth that buried the water impounding area. The City Government mentioned that its backhoe can be made available to ease the burden of manually taking out the tons of debris. However, the equipment did not come and ILO's engagement ended. The needed repair at water source did not materialize. A total of 99 workers, 50 male and 49 female toiled for 20 days clearing and cleaning the main canal. The water impounding area was not rehabilitated as the huge volume of landslide, estimated at around 14 truckloads, remained untouched. The limited amount of water served about 5 hectares of farmland only.

In a recent talk with Cabawan's elected officials, they admitted that only 5 hectares of its 25 hectare irrigated farmland are served by what remains of the irrigation water from their severely damaged irrigation facility. The members have ventured into other livelihood opportunities like working in the city in construction, or as temporary workers in Panglao Island's tourism industry. The association is still awaiting the commitment of the province for the rehabilitation of their facility, and its leaders are still optimistic in reaching out to the NIA provincial office and the Municipal government of Maribojoc, thinking that 2022 is an election year.

▶ **Fig. 14. Members of the Cabawan Irrigators Association receive their handtools and PPEs from the ILO.**

6.3 Mambuaya CIS, Cagayan de Oro

▶ **Fig. 15. Map of Mambuaya Irrigation System, Source: Mambuaya Irrigators Association**

Barangay Mambuaya has 47 hectares of irrigated rice field. The area was hit by Typhoons Sendong (*Washi*, Dec. 2011) and Pablo (*Bopha*, Dec. 2012) and destroyed the communal irrigation system's intake box (red circle). In addition, a huge volume of silt was left in the main and lateral canals (red broken line) that were quickly claimed by vegetation. The farmers did not plant and the harvest of 120 cavans of palay per hectare was not realized. The ARC lost Php 5,640,000 (US$131,200) income.

The main canal has a total length of 2,500 meters while the lateral is 1,500 meters. NIA assessed the damage and stated that both the main and lateral canals are covered with about 1,700 cubic meters of silt. They added that workers can clear 2 cubic

▶ **Figs. 16 & 17. Members of the Mambuaya Irrigators Association clear the lateral canals of vegetation and silt.**

▶ Figs. 18 & 19. The main canal was also cleared of silt and vegetation and soon irrigation water flowed to the farmlands (right).

meters a day and 50 workers can do the task in 17 days, generating about 850 work-days.

The ILO project accepted the request of the Mambuaya Irrigators Association and met with its leaders and members. Skills were assessed to aid the design and implementation of the intervention. Hand tools, personal protective equipment (PPEs) and coverage for health, social security and accident insurance was facilitated. The 50 workers, consisting of 23 males and 27 females, were briefed on safety in the workplace and a local nurse was hired to monitor and address on-site health issues.

Members with leadership qualities were designated as team leaders for the manual laborers, while some of the skilled were supervised by NIA in reconstructing the river diversion intake box and retaining walls.

The project resulted in a new river diversion infrastructure, stronger retaining walls, and cleared and cleaned main and lateral canals. Soon, irrigation water flowed again in the CIS' distribution system towards the members' planting areas. Agricultural activities of the irrigations' association resumed.

▶ Figs. 20 & 21. Skilled members of the Mambuaya irrigators' association, under supervision by the National Irrigation Administration, reconstruct the retaining wall and intake box of the river diversion facility.

▶ 7. Lessons Learned

The ILO local resource-based projects implemented in calamity-hit areas, as illustrated in the three case studies, were timely interventions that addressed crucial and immediate needs of survivors. The interventions not only restored damaged facilities but also provided an effective channel to share new information, transfer practical skills and build self-confidence among affected individuals during critical times. In the projects, the organizations that represented the affected farmers and their families were recipients of the collective responsibility that was hoped to nurture a culture of maintenance that eventually should result in a longer useful life of the communal infrastructure.

The ILO local resource-based approach and the application of labor-based methods proved to be socially-acceptable and attractive interventions that addressed immediate needs. The sudden loss of livelihood among farmers due to loss of irrigation water created multi-layered and interconnected problems that were simultaneously addressed by the ILO LRB approach. The case studies demonstrate that the approach brought back, through the direct involvement of users, the usefulness of the irrigation systems. The approach also provided immediate income to those who lost a primary source of livelihood, increased opportunities for participants to seek alternative sources of income with the practical skills acquired, and revitalized the local economy with the cash inflows, from wages and purchases of locally available materials, that remained in local circulation.

The natural calamities forced the affected members to venture into unfamiliar and uncertain territories. Driven by desperation, some members opted to be relocated far from their loved ones who also had to endure the hardships and uncertainty. The ILO interventions allowed affected families to remain together and work for a common objective, as well as cooperate with other members of the community in exploring and making use of everything useful and available in the area, as preached under the LRB approach.

The warm reception and active participation given by the target beneficiaries to the ILO interventions during those post-calamity situations, and considering that the main agricultural livelihood activity using the restored communal irrigation system still exist several years after the emergency interventions, it can be surmised that the impact of the ILO approach contributed to beneficial results for the community.

Today, it can be claimed that the approach fits well in post-calamity situations as it highlights the use of whatever is within the capacity of the survivors - local labour, local resources, knowledge, skills, and network. In addition, the participants' dire conditions, their familiarity of the area, and the benefits they will receive if they commit their participation, contributed to the attainment of the project objectives.

The LRB approach provided timely and crucial interventions that assured cooperation and participation among individuals, communities, local leaders and organizations as the benefits that will accrue to them were visible right at the start of the negotiations. It can likewise be claimed that transparency in dealing with local communities is crucial in gaining their trust and confidence, as well as their willingness and cooperation to attain project objectives.

▶ 8. Conclusion

Farmers, especially those with small landholdings, are the most disadvantaged members of the Philippine society. Agriculture is a capital-intensive undertaking and those without the capital fall prey to opportunistic individuals who lend them money at usurious rates. The poor farmer, realizing that the mounting debt is an inescapable trap, ends up selling his land and his only means of livelihood.

Government recognized this dilemma and embarked on several programs to address the plight of the farmer. However, globalization and international agreements entered the picture and succeeding developments prove to be more disadvantageous to the local farmer. For instance, government agreed to rice import liberalization to meet local demand for rice. Unfortunately, the imported rice comes cheaper than the locally produced commodity thus making it difficult for the farmer to compete. In addition, market forces cause the conversion of agricultural lands to residential, commercial and other uses to cater to the need for new land for of an expanding urban area. More farmers abandon their production areas. With increasing local demand for rice and dwindling local production, the Philippines will continue to be the biggest importer among rice-eating nations.

Against this backdrop, the ILO LRB approach can be pushed and packaged to help the Philippine agriculture sector. Considering that agriculture is still the biggest source of employment for rural workers, this move is significant and responsive to local needs.

The LRB approach, together with labor-based methods, remain relevant as they address sustainability, cost efficiency and cost effectiveness in the rural economy. The rural workers remain part of the country's natural capital and must be protected and conserved and must be helped to steer away from the path to rural poverty.

Of the three areas identified in the study, two are concerned with policy reforms and one is about the farmer's personal perception of the surroundings he is in. The local resource-based approach encouraged the active participation of 134 men and 124 women in the study areas in ensuring that their respective irrigation facilities function again. The LRB approach established that the transfer and application of practical skills for both men and women can be done in the agriculture sector and reinforce the stand of the Philippine farmer.

Studies have shown that individually, the farmers do not stand a chance in the environment they are currently in. But as an organization, they can transform into a dynamic and strong force that can be reckoned with. The farmers should be organized and be made aware of their potentials. Government recognized this, awarded them the land they till, created the Agrarian Reform Communities (ARCs) and provided these communities with the means such as agricultural production inputs and materials, technology and infrastructure, and a strong presence in this sector.

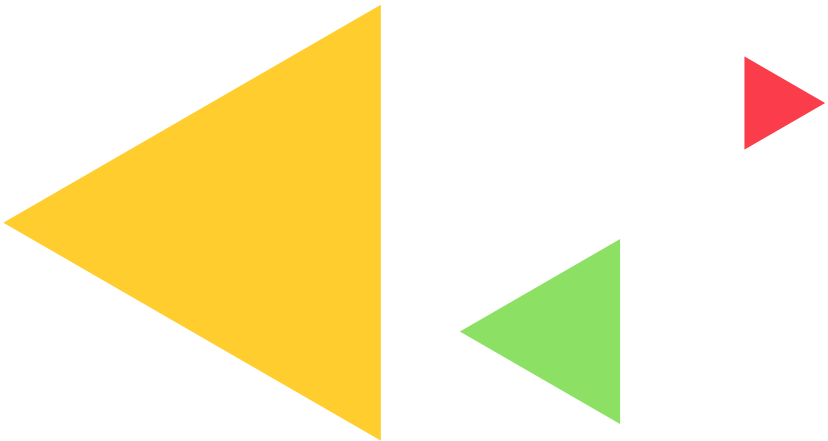
The ILO implemented several local resource-based projects under the Employment Intensive Investment Programme (EIIP). In most of these projects, it was emphasized that the beneficiaries must be organized and registered with the appropriate government agency, like the Department of Labor and Employment (DOLE), to assume a legal personality so they can enter into a contract with the ILO. The requirement prepared them for their role as community contractors to prove that they can deliver on agreed tasks within the allotted period and following prescribed standards. In Cagayan de Oro and Iligan cities in

Northern Mindanao and in Dolores, Eastern Samar, the community contractors organized by the ILO were later engaged by the local government units to construct additional classrooms, a drainage system and the perimeter walls of a government high school. Through ILO EIIP projects, the LGUs recognized the capacity of the local contractors and tapped them to do additional work under the community contracting scheme under a policy enacted to engage community-based organized and registered groups using public funds.

With the farmers' irrigators associations in place, the community mobilizing and organizing processes have been done and attention can focus on the operation and management of the organization's activities. The challenge for the ILO is to find effective entry points to present the LRB approach as an attractive option that will enhance agricultural productivity through the members' improved capacity in ensuring that the irrigation facility, among the other agricultural support infrastructure, will remain reliable and useful.

The ILO EIIP has developed a wealth of knowledge, lessons and experiences in dealing with marginalized communities to create jobs, transfer skills, strengthen the local labour pool and build confidence for them to search for other livelihood and income opportunities. The farmers' Agrarian Reform Communities may be a new frontier in promoting and advocating the ILO's local resource-based approach and help address underemployment in the agriculture sector.

An in-depth study may be needed to pave the way for this endeavor.



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