Economics of private and village operated water supply systems for domestic water

study undertaken for the

Livelihoods & Food Security Trust Fund, LIFT

at the United Nations Office for Project Services (UNOPS)

Micro-Credit Ratings International Limited, M-CRIL

542 Megapolis, Sohna Road, Sector 48, Gurgaon 122018 INDIA

Funded by

Livelihoods and Food Security Trust Fund

March 2018

Table of Contents

Acknowledgements and Disclaimers

Acknowledgements

We thank the European Union and government of Australia, Denmark, France, Ireland, Italy, Luxembourg, the Netherlands, New Zealand, Sweden, Switzerland, the United Kingdom, the United States of America for their kind contributions to improving the livelihoods and food security of rural people in Myanmar. We would also like to thank the Mitsubishi Corporation, as a private sector donor.

Disclaimers

This document is supported with financial assistance from Australia, Denmark, the European Union, France, Ireland, Italy, Luxembourg, the Netherlands, New Zealand, Sweden, Switzerland, the United Kingdom, the United States of America, and the Mitsubishi Corporation. The views expressed herein are not to be taken to reflect the official opinion of any of the LIFT donors.

Preface

Scope and Objectives of this study

1 Introduction

UNOPS is the Fund Manager (FM) for the Livelihoods and Food Security Trust Fund (LIFT) in Myanmar. LIFT is a multi-donor fund committed to addressing food insecurity and income poverty and thereby achieving Millennium Development Goal 1. LIFT's overarching aim is to contribute to the national goal of sustainably reducing the number of people living in poverty and hunger in Myanmar, initially with the eradication of extreme poverty and hunger in Myanmar. LIFT works on various thematic areas and operates through a variety of implementation partners in 4 different agro-ecological zones of the country: the Dry Zone, the Uplands Zone (Kachin State, Chin State and Shan State), the Delta/Coastal zone, and in Rakhine State.

LIFT's impact strategy proposes "to allow smallholders with commercial potential to 'step up' the agricultural ladder; subsistence farmers to 'hang in' for food security and for landless labourers to 'step out' of agriculture, and into more productive sectors of the economy. In addition to eradicating poverty and enhancing socio-economic well-being, LIFT also has a strong learning agenda and intends to catalyse pro-poor development through continuous dialogue with policymakers and other industry stakeholders.

So far, LIFT has reached over 3 million people, roughly 6% of Myanmar's population, and is active in just under half of the country's townships. The Fund is expected to continue operations until the end of 2018.

2 Purpose and objective of the study

The **purpose** of this study is to investigate the cost-effectiveness of community managed village water supply systems. The results of this study will inform the WASH component as well as the social protection component in selecting suitable water sources and ways to let the community manage the resources only if sufficient revenue is generated so that communities have the resources to maintain and repair the water supply systems.

The **objective** is to get the information of revenue/profit (in terms of money) of private and village operated water supply systems to provide business information to potential investors (community/VDC) and rural financial service providers to implement the self-help community manage water supply system.

<u>Geographic coverage</u>

A total of 15 villages from 3 townships (Pakokku and Yesagyo in Magway Region and Myingyan in Mandalay Region) were covered by this study.

Scope of the study

The research scope of this assignment included the following

- Identification of the inventory of existing village water supply systems which sell water to individual HH and select five water supply systems from each of the 3 townships (a total 15 villages in the DZ project area – 5 from each township)
- Collecting the information on the cost of existing systems (project and community investments), operational cost, maintenance cost and income from water sold (seasonal data)
- Collecting additional information on rules, regulations, management approach and other information to assess the effectiveness, efficiency and quality of the systems
- Calculating yearly costs and incomes for the various systems based on collected information and also calculating the payback period for investment and simulation of cost-benefit of the water supply system
- Analysing various water management approaches and making good practice recommendations
- Calculating community savings from water purchases (before and after)
- Citing examples and calculating additional income from saving time from water collection

Expected result

- Obtaining business information of village level / private water supply systems
- Development Partners use this information for WASH (water supply component) project design
- Villagers, CSO, CBO, VDC have reliable information to implement self-help water supply system
- Villagers, CSO, CBO, VDC have enough information to decide for investment in village water supply system with either own funding or loan from reliable sources.
- Financial service providers have enough business information of village water supply system for decision on loan approval

The overall report of the research will include an additional section focusing specifically on

- Villagers, CSO, CBO, VDC and local government departments having sufficient and reliable information to implement self-help water supply systems and possibly using credit to develop the systems
- Financial service providers have enough business information of village water supply systems for decisions on loan approval

3 Approach and methodology for the study

The overall study comprised the following activities

This study was conducted in 15 suitable villages in 3 project townships, Myingyan, Yesagyo and Pakokku. These villages were selected by the M-CRIL team in consultation with township DRD, development partners (DPs) and LIFT's IPs.

Considering the objectives and focus of the study there was little overlap among the 15 villages selected and the villages covered in the study to undertake the Cost-Benefit analysis of gap irrigation as most of the villages covered in the latter study were not found to have interesting domestic water supply systems.

In accordance with the ToR, M-CRIL adopted the following steps, approach and methodology for this study.

A) Development of appropriate checklists of questions

The M-CRIL team developed appropriate checklists of questions (for both individual interviews and FGDs) for various stakeholders - **contained in Annex 2**. M-CRIL used mixed methods, qualitative and quantitative for data collection.

B) Desk study of the available information and documents

M-CRIL tried to undertake a desk study of the relevant information and documents related to drinking water supply systems in Myanmar. However, very limited information related to the study could be obtained.

C) Field work (15 villages in 3 townships)

- Visits to 5 villages each in the 3 study townships to carry out field work. The M-CRIL study team conducted individual interviews with various stakeholders such as water suppliers and their management committees in the case of village/community water supply systems, DRD, DPs and IPs. In addition, the M-CRIL team carried out FGDs with water users and villagers.
- The M-CRIL team collected all the business data/information on village level water systems.

4 Limitations of the study

The study team made all possible efforts to identify suitable villages for the study based on the suggestions from implementing partners in particular UN-Habitat, DRDs and the UNOPS team. However, the M-CRIL study team faced difficulties in identifying different types of water supply systems in the townships; except 1 small private water supplier in Pakokku township, no other private water supplier was found in any of the study villages. Therefore, this study primarily covers community/village water supply systems in each of the study villages to ensure that 5 water systems in each of the townships are covered by the study. The study team made an effort to ensure the reliability of the information gathered in relation to the investment cost of various water supply systems.

The study team would like to thank LIFT, in particular Mr Harald Kreuscher, Programme Officer, and U Sein Myint from LIFT for providing the opportunity to M-CRIL to undertake this interesting study. The study team greatly appreciates the support provided by U Sein Myint who accompanied the M-CRIL team to the villages in Yesagyo and from Myingyan and also in resolving various issues in the selection of villages for the study.

Additionally, the study team would like to thank all the project staff of all the IPs, the water suppliers, members of various water management committees and water users and community from the respective villages and other stakeholders including UN-Habitat and DRDs visited for their valuable time in participating in discussions.

Ashok Kumar, Executive Director, Livelihoods & Value Chains, M-CRIL
+ Team Leader for this study
U Aung Ngwe, National Consultant

Chapter 1

Inventory of the existing village water supply systems

This Chapter discusses the inventory of the domestic water supply systems in the villages from various townships covered by the study.

1.1 Inventory of domestic water supply systems

In most of the villages covered in the study, there is more than one source for household (HH) water supply. In the past, there were other water sources including dug wells, hand pumps, river, ponds which the community used for drinking and other HH purposes. With the establishment of community water systems in the study villages through various projects such as the USAID funded Shae Thot project implemented by UN-Habitat, Solidarites International (SI) project and UNICEF and LIFT project, many of the earlier water sources are not operational and are not used by the community. However, some sources are still operational and used though not for drinking but rather for other household purposes. In a few study villages, DRD and the Farm Machinery Department have supported the establishment of tube wells and water tanks but without installation of pipelines to the individual HHs. **Table 1** summarises the inventory of water sources in the study villages in the 15 villages covered in the 3 townships. **Figure 1** depicts the distribution of water supply systems by source of support. As is apparent for the table, the major water sources selling drinking water to HHs in the study villages are community-owned and managed water supply systems funded through various projects – UN-Habitat supported water systems stand at the top by providing water to a total of 839 HHs whereas UNICIF supported systems provide water just to 10 HHs. Except for one small private water supplier serving only 6 HHs in Pakokku township, no private suppliers were found in any of the study villages.

Table 1
Inventory of water sources in the study villages

Township: Pakkoku

Village: Myo Khin Thar

- This village has a community water system supported by UN-Habitat since 2013. Major equipment including a tube well, water tank, engine, dynamo, and a motor were provided initially during 2013 and water was supplied by laying pipelines to 50 HHs out of a total of 210 HHs in the village. Subsequently, in 2016 UN-Habitat funded pipeline connections to the remaining 160 HHs covering all the HHs in the village
- In addition to the community water supply system, there are 9 hand dug wells which are not operational anymore as well as 50 hand pumps individually installed and owned for domestic water
- A total of 3 rain water harvesting tanks were provided by UNDP in 2008 in the village for the use by the village monastery and a primary school, these tanks are not for use by individual HHs. The harvesting tank in the primary school has a filter attached and water is used for drinking.

- There are no private water suppliers in the village.
- Community members made a contribution to the digging of channels for installation of pipelines based on training for the purpose.

Village: Tha Yet Pin Su

- In addition to a UN-Habitat supported community water supply system which is supplying water since March 2017, there are 25 hand pumps[1] individually owned. Out of 96 HHs in the village, 90 are connected to the UN-Habitat water supply system.
- Before the UN-Habitat water system, HHs were using the hand pumps for drinking water.

Village: Ma Gyee Koe Pin

- The monastery in the village has a water supply system and has been supplying drinking water since 2009 to 172 HHs out of 190 in the village. Till July 2010, water was supplied to HHs free of charge. Water meters were installed in individual HHs in August 2010. The monk provided water meters to 150 HHs but 22 HHs purchased their own water meter as the monk ran out of funds.
- While most of the water systems equipment and infrastructure including an engine, a tube well, a small water tank were financed by the monastery/monk, UN-Habitat supported with about MMK 1.6 million for the construction of another water tank of 10,000 gallon capacity.
- In the village there is a private water supplier who sells water only to 6 newly constructed houses which are located in the upland area of the village and the monastery water system is unable to supply to these HHs. He has been selling water since August 2016.
- This village also has an engine operated deep tube well and water tank provided by the Farm Machinery Department in the past. HHs were fetching water from this water tank as this did not have a pipeline. It was reported that this system is still functional but not used. However, in case of need water from this tank is transferred to the monastery tank using a pipeline.
- In addition, 11 HHs have their own tube wells for their own purposes and do not sell water.
- There is a village water management committee with 15 members; the monk is its Chairman.

Village: Ma Gyi Kan

- In addition to a UN-Habitat supported community water supply system which has commenced water supply recently, this village has a Government tube well without pipeline to individual HHs and a pond. HHs were fetching water from this Govt tube well for drinking purposes. The Government tube well was established about 30 years ago and was operational only for 4 months during the summer.

[1] These pump water from about 80-100 feet depth; investment about MMK2 lakh; hand operated commonly found in eastern India as well as Myanmar.

- It was learnt by the M-CRIL team that except for 4 months when the Government tube well was supplying water, HHs were earlier using pond water for all purposes including for drinking for the rest of the period.
- The UN-Habitat system supplies water to all the 89 HHs in the village.

Village: Ah Shay Nga Kyaw

- A big well was constructed by community members about 65 years ago. Water from this well is pumped water to an overhead tank and is then supplied to 85 individual households (HHs) in the village using the pipes connected to their houses. In the past HHs were lifting water from the well manually.
- UN-Habitat supported this system with a pump and the construction of an overhead tank and pipeline to individual HHs in November 2017
- There are no other water supply systems in the village including private water suppliers.

Yesagyo

Village: Kyauk Hlay Khar

- Solidarites International (SI) supported a community water supply system which was established in May 2014 and has been supplying drinking water since July 2014 to all the 193 HHs in the village.
- In addition, 3 households have their own tube wells; these households rent out accommodation facilities to university students (sometimes 100 students in each household). However, these HHs also use the SI connection for drinking purposes.
- Before the SI system, HHs were meeting their domestic needs (including for drinking) from 4 big dug wells, but these are not operational anymore.

Village: Htan Ngai Taw

- There are two major water supply systems – the first one supported by a USAID funded Shae Thot project and operational since May 2015; the second one is supported by UN-Habitat and DRD and have been operational since October 2017.
- Out of a total of about 200 HHs in the village, 141 are connected to the Shae Thot water system and the rest of the HHs to the second system.
- Before these water supply systems, there were about 15-20 dug wells (one of them for drinking water) but these dug wells remained dry during the summer and the HHs had to fetch water from other villages. These dug wells are still operational as a sand dam has been constructed in the stream in the vicinity (raising the ground water level) and the people use the water for domestic purposes other than drinking.

Village: Peik Thin Kat

- In addition to a community tube well water supply system supported and established by SI which has been supplying water since July 2015, there is also a monastery owned tube well supplying water to the HHs. There are 7 small tube wells owned by individual HHs supplying water for domestic purposes other than drinking and a few big dug wells as old as 50-60 years and still operational.
- All the 103 HHs in the village have connections either of SI or the monastery water system or both.

- The SI water system has not been operational for the last 3 months. The SI water system is generally operational for 6 months in a year and during the summer it does not lift and supply water adequately and consistently according to the villagers. During this period, the HHs depend on the monastery water system. However, the monastery system also stopped functioning recently due to engine breakdown. As a result, most of the HHs currently fetch drinking water from the dug well.
- In the past, the major sources of domestic water were dug wells, river and ponds.

Village: Kokako Su

- In addition to a community water supply system supported and established in 2014 by SI, supplying water since July 2014, there are about 20 dug wells and 2 community water ponds for household water use. The tube well and the water tank of the SI water system were established about 1.5 km away from the village. It was reported that the tube well was installed first by the community contribution and SI provided 70% of the total investment in the tube well in addition to support for an overhead tank, ground tank, main pipeline, engine, dynamo and pump.
- All the 185 HHs in the village are connected to the SI water system.
- In the past, the major sources of domestic water were big dug wells from where the HHs fetched water.

Village: Kyee Kan

- There are two major water supply systems – the first one, supported by SI, has been supplying water since June 2016; the other of the village monastery has been supplying water since January 2016.
- Out of a total of 280 HHs in the village, 212 HHs are connected to the SI water system and the rest to the monastery water system.
- There were 8 big dug wells that were used in the past and they are no more operational and in use.

Myingyan

Village: Gway Gyi

- UN-Habitat supported a community water supply system which started water supply in July 2017. Additionally, another tube well exists for which a ground water tank was supported by UNICEF in 1978. This village has about 30 smaller tube wells owned by individual HHs and 1 big hand dug well.
- Out of 297 HHs in the village, 120 are connected to the UN-Habitat water supply system with a pipeline. Other HHs get water from the individuals' tube wells for a charge; and about 10 HHs each from the UNICEF tank and the dug well.
- There is a water management committee with 7 members to manage and supervise both the UN-Habitat and Monastery water systems. The UNICEF tube well is being managed and supervised by the Village Welfare Committee.

Village: Tei Gyi

- UN-Habitat supported a community water supply system which started in July 2016. There is another tube well of the village monastery. Additionally, there are 27 smaller tube wells owned by individuals and 1 pond (which is not used anymore).
- Out of 207 HHs in the village, 167 are connected to the UN-Habitat water supply system with a pipeline. Other HHs get water from individuals' tube wells free of charge; and about 10 HHs get water from the monastery tube well free of charge.
- Earlier, when there were no water supply systems, HHs used water from the pond and monastery tube well for drinking purposes.

Village: Chin Myit Kyin

- UN-Habitat supported a community water supply system which started in May 2017. There are two other tube wells – one by the Township Development Committee/DRD and the other of the village monastery. Additionally, there are 17 smaller tube wells owned by individuals (water used for other household and cattle purposes), 3 dug wells and 1 pond (which is not used any more).
- Out of a total of 85 HHs in the village, 72 are connected to the UN-Habitat water supply system with a pipeline and just 2-3 HHs obtain water from the Township Development Committee tube well. The rest obtain water from those HHs that have a water connection from the UN-Habitat water supply system. Individuals with own tube wells also have connection to the UN-Habitat water supply system.

Village: Kyee Pin

- UN-Habitat supported a community water supply system which started in April 2017. Additionally, there are 5 smaller tube wells individually owned (for other HHs to use).
- All 31 HHs in the village are connected to the UN-Habitat community water supply system including the monastery and a private school.

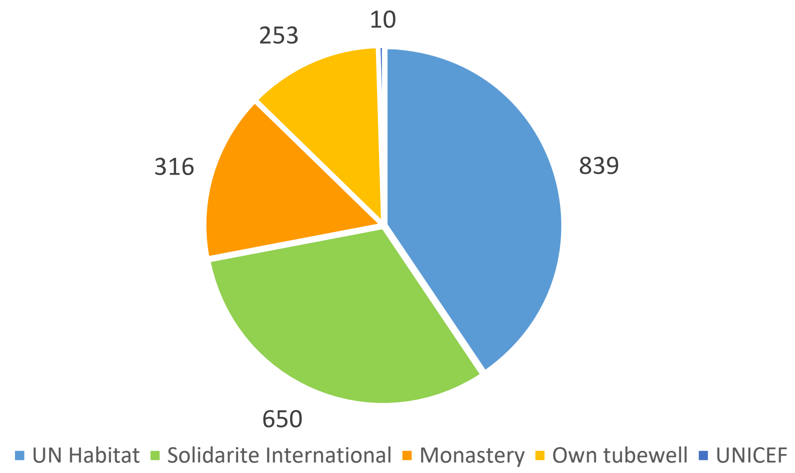
Village: Kyauk Kan

- The village has 4 dug wells, 2 ponds, 1 water harvesting tank and 30 smaller tube wells individually owned.
- Shae Thot project supported the construction of a dug well, overhead sheds in 4 dug wells and the water harvesting tank in 2012. Out of these 3 dug wells, two are used for drinking water and one for other domestic purposes.
- There is a water committee with 10 members to manage and supervise all the dug wells.
- Thus, this village is still using dug well water for drinking (considered as quality water by the villagers).

Plus

+ Water harvest tanks or ponds – 9 (5 villages)
+ dug wells – 73
+ hand pumps – 75 (2 villages)

Figure 1 Households covered by source of support for water supply



Overall status of water sources in the townships by officials from DRD

According to DRD Pakokku, out of 252 villages in the township, about 190 villages have been provided some kind of water source and water supply systems with 110 villages covered by UN-Habitat and about 80 by DRD. Similarly, according to DRD, Myingyan out of 187 villages in the township, about 166 villages have been provided with some types of water sources and supply systems. DRD in Yesagyo township could not be contacted because of his unavailability. Various water sources and systems in the townships include tube wells, dug wells and village ponds. In Pakokku township there is a total of 9,390 different types of water sources; this information was not made available for Myingyan township.

Chapter 2

Investments and community contribution in water systems

As discussed earlier, there are several water sources in the study villages used for meeting household water requirements. Except for a few villages, where tube well water is not available so far even for drinking purposes, the villages covered by this study have one community managed water supply system (in a few villages other systems as well). In line with the study requirements, only those water systems have been considered for detailed study which sell water to individual HHs. For the only private water supplier serving only a few HHs, the M-CRIL study team studied the operations and economics of this private water supplier. This chapter discusses investments and their composition, operational life of various infrastructures and equipment, contribution made by the community and other important aspects associated with water supply systems which sell water for household use (both drinking and other purposes).

CSOs, CBOs, VDCs and other development partners can use the following findings while designing and implementing water supply systems in villages.

2.1 Investments in installing the existing water systems

Most of the community managed water supply systems were established with financial support from aid projects as discussed above[2]. The financial support provided through these projects for installing these water systems is in the range of MMK7 to 22 million. The amount of financial support depends upon the capacity of water supply systems and the types of infrastructures established as part of the overall system. The one private water supplier has made an investment of about MMK 2.7 million. Details of expenses & investments in the community water systems by the projects in the study villages are presented in **Annex 1**.

The investments in infrastructures including tube well & boring and water tanks primarily depend upon the depth and size of tube wells and the capacity/size of water tanks respectively. However, the study team observed wide variations in expenses/costs and investments for similar equipment. This was primarily because of the variations in the capacity, quality and the manufacturer of a particular equipment used in a water supply system and the extent of the donor funds available for the purpose.

2.2 Distribution of investments for various purposes & items in water supply systems

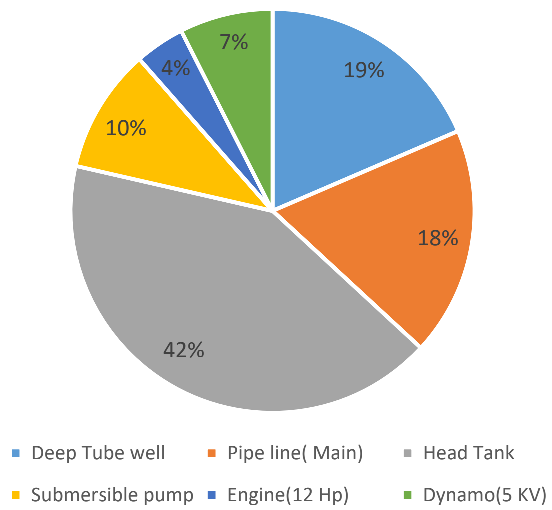
Investments in the tube well and boring, water tank/s and the water supply pipeline generally constitute the major part of about 80-85% of total investments in the community water supply systems. The rest about 15-20% of the total investment is used for the diesel engine and/or motor and the water pump and other smaller equipment.[3] Almost the same

[2] All the investments in the individual water systems were funded through the projects without any loans from banks/financial institutions

[3] This excludes the expenses for digging channels and laying water supply pipelines; these have been undertaken by community as their contribution to the project in most of the cases

composition of the total investment for various items/purposes was observed in the private water supplier covered in the study. **Figure 2** below depicts the distribution of total investments of about MMK10 million recently made in one of the study villages.[4] This water supply system has made investment in all the necessary infrastructures and equipment and supplies water to about 90 HHs in the village.

Figure 2 Distribution of investment for various purposes



2.3 Operational life of water supply infrastructures and various equipment

The amount of investment and the quality of equipment and infrastructures determine their operational life. However, the effective operational life of such equipment also depends on the extent of their use and periodic proper maintenance. **Table 2** below provides a summary of the operational life of equipment and infrastructures used in water systems.

Table 2
Operational life of various equipment and infrastructures of water supply systems

Equipment/infrastructure	Range of operational life (years)	Remarks
Tube well and boring Water pipeline (Main + subsidiary)	20-30 15-20	 Main pipeline preferably should be of very high quality
Overhead water tank Ground water tank	25-30	Both the types of water tanks have almost similar operational life. Overhead tanks are preferred to ensure higher pressure of water supply to HHs
Submersible pump	3-6	It is better to install good quality pumps which have about 5 years operational life

[4] The community has contributed towards digging of channel for pipeline and installation of the pipelin

Equipment/infrastructure	Range of operational life (years)	Remarks
Motor	8-10	Not all the water systems have motor, which is based on the quality of electric supply in the village
Diesel engine	5-10	
Dynamo	5-10	

Note: the operational life of equipment varies widely based on equipment quality and periodic maintenance

Tube well, water tank/s and water pipelines which require the major part of the total investment of 80-85% of water supply systems as discussed above have much longer operational life of 15-30 years as compared to the operational life of other equipment/machineries which need to be replaced after a couple of years depending upon the requirements. The submersible pump needs to be replaced every 3-6 years depending upon the quality of pump followed by engine and dynamo which need to be replaced every 7-8 years, in general.

2.4 Community contribution in establishing community water supply systems

In addition to the financial support from the projects, in all the community established water supply systems, the community has made a significant contribution in various forms. In most cases, the community has dug the channel for water laying pipelines and the installation of most of the pipeline with the support of project engineers.[5] Additionally, in most of the cases the individual HHs purchased their own water meter. In a few cases, the community has also purchased equipment such as dynamoes, voltage stabilizers/ transformers, pumps and other necessary smaller tools. In one case, the community invested 30% of tube well cost. The contribution made by the community in establishing water supply systems in the study villages is presented in **Annex 1**.

[5] The M-CRIL study team made efforts to quantify such contributions by the community but it was not possible to do so.

Chapter 3

Operational aspects of water supply systems

This chapter discusses various operational aspects related to water supply by the community water systems. These aspects include the operational age of the water systems, access to water by HHs and the adequacy of water supply, pattern of water use by HHs and per unit water charges amongst others.

3.1 Operational age of existing water supply systems

Various water supply systems in the study villages were established and started selling water at different points in time and several of these have not even completed one year of operations. Out of 15 water supply systems covered including the private supplier in Pakokku, 7 (5 from Yesagyo and 2 from Pakokku) have been selling water for more than one and half years; 8 have been selling water for less than a year and 2 have started selling water very recently just 15 days to 1.5 months. In one[6] of the villages covered in Myingyan, HHs do not have pipeline connections yet and water is not sold to the HHs since they fetch water from dug wells.

3.2 Access to water by HHs and the adequacy of water supply

In general, most of the HHs receive water all the time in adequate quantity except a few HHs that are located at high elevations/topographies making 24-hour water supply to them difficult. The supply of water all the time to HHs has been made possible by storing it in ground and overhead tank/s. Only in a few cases, water is supplied for a few hours daily and in one case 3 times per week.[7] **Table 3** summarises the extent of access to water by HHs and the adequacy of water supply.

Table 3

Extent of access to water by HHs and adequacy of water supply

Township/villages	Extent of access to water by HHs & adequacy of water supply
Pakokku	
Myo Khin Thar	Water supply all the time in adequate quantity except to 10 HHs located on higher land
Tha Yet pin Su	Water supply all the time in adequate quantity
Ma Gyee Koe Pin -monastery system	
-private water supplier	

[6] This was the most useful possible village from a water supply perspective after covering the other 4 villages in the township

[7] HHs with such water supply frequencies store water in smaller water tanks for further use during the rest of the period

Township/villages	Extent of access to water by HHs & adequacy of water supply
Ma Gyi Kan	Water supply 2 times per day, 2-3 hours each time – adequate quantity in general
Ah Shay Nga Kyaw	Water supply 3 times per week (2 hours per time) – adequate for drinking in general
Yesagyo	
Kyauk Hlay Khar	Water supply all the time in adequate quantity
Htan Ngai Taw	Water supply all the time in adequate quantity
Peik Thin Kat	Water supply all the time during 8 months in adequate quantity and 3-4 hours during the rest of the year, not adequate
Kokako Su	Most HHs get water all the time in adequate quantity except 6 HHs who are at located on higher land
Kyee Kan	Water supply all the time in adequate quantity
Myingyan	
Gway Gyi	Water supply all the time in adequate quantity
Tei Gyi	
Chin Myit Kyin	
Kyee Pin	
Kyauk Kan	No household supply

3.3 Fees/charges across villages and monthly consumption of water by HHs

Water fees to HHs are charged on a per unit basis for water consumption. Per unit water charges and monthly consumption of water by individual HHs varies across villages in the various townships and the quantity of water per unit also varies across villages, **Table 4**. According to UN-Habitat, 220 gallons (UK unit or imperial gallons) of water make one unit of water. It is specified as the measurement to be adopted as it is **equivalent to one cubic metre**. However, all the water management committees reported varying numbers of gallons per unit of water consumed (**Table 4**) and the corresponding water charges per unit of water. The variation in gallons per unit of water across villages is due to variation in bucket size used in villages for measuring the volume of water. This necessitates the adoption of a standard quantity of water per unit consumed across villages.

The use of water by individual HHs depends sometimes upon the supply sources. In most villages, water from the community water supply systems is used for all purposes including drinking and other domestic purposes but in a few villages water from these sources is used only for drinking purposes.

Monthly water charges paid by HHs is in the range of about MMK500-3,600[8] with median at about MMK1,300.

[8] MMK3,600 paid by HHs covered by the private supplier

Table 4
Summary of per unit water fee and average monthly water consumption in various townships

Township/villages	Per unit fee (MMK)	Monthly water consumption per HH (units)	Monthly water charges per HH (MMK)	Gallons[9] per unit
Pakokku				
Myo Khin Thar	100	4.93	493	180
Tha Yet pin Su	150	3.22	483	200
Ma Gyee Koe Pin	35	54.18	1,896	25
-private water supplier	35	104.00	3,628	25
Ma Gyi Kan	750	3.28	2,461	180
Ah Shay Nga Kyaw	400	2.00	800	N.A.
Yesagyo				
Kyauk Hlay Khar	200	8.16	1,633	250
Htan Ngai Taw	300	4.00	1,201	250
Peik Thin Kat	400	2.78	1,112	180
Kokako Su	500	4.08	2,038	250
Kyee Kan	200	2.45	489	200
Myingyan				
Gway Gyi	300	3.43	1,028	100
Tei Gyi	300	4.94	1,481	240
Chin Myit Kyin	400	4.26	1,703	200
Kyee Pin	200	6.38	1,277	250

3.4 Pattern of water consumption by HHs in different seasons

The seasonal pattern of water consumption by HHs could only be obtained for those systems which are well established and have been supplying water for more than a year. In those villages where water supply is adequate round the year, water consumption by HHs is almost double (in a few cases even more than double) in the summer season than the water use by HHs during the rainy and winter seasons. Usually, HHs use almost the same quantity of water during the latter two seasons. In some villages where water supply systems cannot provide adequate water during the summer, the consumption of water by HHs was found to be much less than during the rainy and winter seasons when water supply is adequate.

Additionally, the total quantity of water consumption by individual households depends on the different purposes for which water is used. Some HHs use water not only for drinking but others also for other domestic purposes including kitchen gardens, vegetable and fruit

[9] As reported by the individual water management committees in the study villages

cultivation and livestock/cattle rearing. Water consumption by these HHs was found to be much more than by those HHs that use water just for drinking and other domestic purposes.

3.5 Frequency of collecting water fees/charges from HH users

The community water supply systems collect water fees from HH users on various frequencies including fortnightly, monthly and bi-monthly basis. **Table 5** below presents the summary of the frequency of water fee collection. As is apparent from the table the most common method of water fee collection is monthly followed by fortnightly (mostly used in Myingyan); and bi-monthly exclusively used in Pakokku township.

Table 5

Frequency of water fee collection in various township

Townships	Frequency of water fee collection
Pakokku	Out of 5 community water supply systems covered, 3 collect monthly and 2 on a bi-monthly basis The private water supplier from the Ma Gyee Koe Pin, Pakokku village collect monthly fees
Yesagyo	Out of 5 community water supply systems covered, 4 collect the water fee monthly and 1 on a fortnightly basis.
Myingyan	Out of 4 community water supply systems covered, 3 collect the water fee fortnightly basis and 1 on a monthly basis

3.6 Timeliness of water fee payment by HHs

As reported by the water management committee (discussed in detail later) managing the community water supply systems in the respective villages, most of the water users pay water charges on time. Only a few of the members (just 2-5% of the total water users) delay the payment but not for more than 2-5 days. Only in a few cases, some vulnerable HHs (HHs with only 1-2 old members or very poor) unable to make the payment for genuine reasons are waived of the water charges – such cases are decided at the water management committee level. In no villages, did the water management committee mention any significant issues related to the payment of water charges by HHs. In most of the villages, no penalty has been reported to be charged for the minor delay in payment of water fee by HHs.

Chapter 4

Management of community water supply systems

CSOs, CBOs, VDCs and other development partners planning to design and implement water supply systems in villages can consider similar institutional arrangement with required modifications if required at the village level to manage the water supply system. The institutional arrangement established seems to be working smoothly in general.

4.1 Institutional arrangement for managing the community water supply systems

In all the study villages with community water supply systems, there is a water management committee for monitoring, supervising and overall management of the water supply. All the members in the water management committee are from the respective village/community. The number of members in the water management committee vary from 5 to 15 members with mostly 9-12 members. There are usually 2-4 women members in each committee. These water committees have the following officer bearers

- a Chairman/Secretary,
- a vice chairman (only in a few cases)
- Cash holder (1-2)
- Accountant/s,
- Auditor/s,

+ other members (3-5)

In some water committees there is a Patron who is the village head in some cases.

Such water management committees were formed at the start of the installation of the water supply system in order to ensure their participation during establishment and installation. The water management committees formed were also engaged in purchasing equipment including pipelines and monitoring the expenses incurred. Members of the management committees rotate from time to time whenever required; the need for such rotation is decided collectively by the committee.

4.2 Functions and responsibilities of the water management committee

In addition to the overall support provided during the installation of the water supply system in the village, the functions and responsibilities of the water management committee includes

- **Maintenance of the water supply system**

The committee monitors and supervises on a regular basis maintenance of the equipment, infrastructure and water supply pipelines (both main and individual connections) and also the water meters of individual HH users.

- **Operation of water supply system/s**

This includes operating the engine to pump water from the tube well and/or operating the motor if it is power driven. Usually, the water management committee engages an operator with a full time salary in the range of MMK 50,000-150,000 per month; only in one case does a member of the water management committee perform this role voluntarily. The person engaged in operating the engine also maintain the overall water supply system. Only in a few cases is the engine operator employed on a part-time basis (currently) but even these aim for the full-time engagement of the operator going ahead.

- **Monitoring of water supply to HH users**

The committee monitors the supply of water to HH users and in case of any issue in the individual pipelines tries to resolve the issue as early as possible.

- **Reading water consumption units of HHs and collection of water charges from HHs**

In most places, the water committees have hired 2-6 water fee collectors (either full time or part time) for taking the readings of units of water consumed by individual HHs and the collection of water fees from users. In most cases, these water collectors are part time and are paid a salary ranging from MMK 6,000-20,000 per month.

- **Conflict resolution**

The water management committee resolves any conflict/issues related to users and the water supply. In most of the cases, issue arising are resolved amicably.

- **Management of finance and accounts related to the water supply system/s**

Accountant/s and auditors of the water management committee keep and maintain the records of water fee collection and other incomes and all the expenses related to the water supply systems.

- **Monitoring and ensuring that water is used only for the agreed purposes**

In some of the villages water is supplied only for drinking purposes during certain months due to the inadequate water supply. It was reported in one village, that there is a penalty of MMK10,000 for using water for purposes other than those specified and after two such incidences are found with any user, the connection is disconnected. However, no disconnections for this reason were reported.

Most of the water management committees have written rules in the local language for running the water supply system. The M-CRIL team obtained a copy of these rules and regulations of a water supply system; these are summarised in **Table 6** below.

Table 6

Rules and regulations of a water supply system

1	The users and villagers have to take care of the pipelines and valves located near their homes and neighboring houses.
2	Users are not allowed to open and close water gates and valves themselves but to report any needs to the management committee urgently.
3	If the committee finds the opening and closing of gates and valves without permission, the committee will charge a fine of MMK3,000.
4	For repairing the pipeline and other maintenance work, the committee will inform users in advance for stopping the water supply during a specified period.
5	The water collector will collect the water fee on the 2nd day of the next month. In case of delay of payment for up to 8 days, the user will pay the fee at the house of the fee collectors. If the delay is for more than 8 days, the water supply will be stopped. After the users pay their due charges along with fines for late payment, the connection will be resumed.
6	If the water meter is not working properly and some pipelines are loose and there is water leakage, the users will inform the water committee and the committee will repair it urgently. The user will pay the material cost and service charges, if required.
7	If a water pipeline, water valve and water gate of a user are broken, the user will pay for these charges and the committee will repair these.
8	When the committee finds that the water meter is not functioning because of inappropriate handling by the user, the user will be charged a fine of MMK5,000 and pay this fine to the committee. If not, the water supply will be disconnected.
9	The committee will prepare an account statement and inform the community/users on a 3 month basis. Any surplus money generated will be used for the sustainable operation of the water supply system.
10	The committees will accept the advice and suggestions of users in a positive manner.

4.3 Management approach of the water management committee

As discussed above, there is a management committee in place to manage the community water supply systems established through a project. The members of the committee are selected based on a consensus from the users/villagers following a democratic process. The meetings of the water management committee take place at various intervals – in most cases these meetings take place monthly or bi-monthly. Only in a few cases, do these meetings take place on a fortnightly or a quarterly basis. Water users can approach the management committee easily. Other important aspects related to the overall management and approach of the water management committee are discussed below.

- **Effectiveness, efficiency and equality of the systems**

During the discussion with the water users in FGDs, the users mentioned that in case of any issues the committee acts responsibly and tries to resolve the issues as soon as possible. Additionally, all the users connected to the respective water systems (which depends upon the extent of laying of the water pipeline through the respective projects) get access to water equally except a few users where the existing water supply systems themselves are not able to release water all the time due to the higher elevation of their houses. There are cases where additional water pipelines and other infrastructures was installed in various phases by projects to ensure the equality of access to water by all the HHs in the village.

In all the cases, the various aspects related to overall operations and management of the water supply systems are managed effectively by the respective water management committees and with the required support from water users who make timely payment of water charges responsibly.

In most of the cases, transparency in account keeping was observed but the quality of accounts varied across the committees. It appears that the quality of training and capacity building support provided through the project to the water management committees varies. In those cases where the water supply systems have been in existence for a few years the water management committee appears to be more effective in managing various aspects of water supply. It is apparent that it takes experience and learning for those who are relatively new to build their capacities to become effective.

In some cases, it was reported that all the members of the water management committees are active and devote their time adequately to the water supply system but, in some cases, it was reported that a few members do not devote their time adequately.

Management approach of the private water supplier

The private water supplier in Ma Gyee Koe Pin village of Pakokku township is reported to manage personally all the operations related to the water supply including water fee collection from the 6 HHs he sells water to. His daughter manages the accounts. He has not hired any person for operations and management of the water supply system.

Chapter 5

Annual incomes and payback period of the water supply systems

5.1 Calculations of annual incomes and expenses of water supply systems

Various systems have been operational for selling water to HHs in the sample villages for different periods of time – in some cases for less than 12 months' duration. In those cases where the water systems have not completed 12 months of operation, the M-CRIL team has estimated annual expenses and incomes based on the trend of income and expenses during the period for which data was available. All the water fee incomes collected have been accounted for by the management committees of the water supply systems but in a few cases the information was not consolidated adequately. The expenses include fuel expenses for the engine, electricity if power operated, maintenance, salaries of the engine operator and water fee collectors and others. At several places some expenses have been clubbed with other accounting heads. In cases where data was for relatively short durations, the study team has estimated expenses based on discussions with the water management committee. Data for yearly income and expenses of the community water supply systems are summarised in **Table 7**. The villages with more mature and better managed water supply systems are shaded in the table.

Table 7

Annual incomes and expenses for the community water supply systems

Township/villages	Total income	Total expenses[10]	Net surplus	# of months for which data was available
Pakokku	Values in MMK			
Myo Khin Thar	1,241,520	432,324	809,196	10 months
Tha Yet pin Su	556,950	366,570	190,380	8 months
Ma Gyee Koe Pin	3,913,700	1,600,600	2,313,100	12 mth data provided
private supplier	261,189	162,857	98,331	14 months
Ma Gyi Kan	2,628,000	2,100,000	528,000	one month only
Ah Shay Nga Kyaw	816,000	432,000	384,000	one month only
Yesagyo				
Kyauk Hlay Khar	3,781,610	897,663	2,883,947	41 months
Htan Ngai Taw	2,032,007	770,357	1,261,650	28 months
Peik Thin Kat	1,374,850	520,000	854,850	24 months
Kokako Su	4,524,600	2,961,057	1,563,543	42 months
Kyee Kan	1,244,463	115,579	1,128,884	19 months
Myingyan				
Gway Gyi	1,480,470	1,860,000	-379,530	4 months
Tei Gyi	2,967,100	3,060,000	-92,900	6 months
Chin Myit Kyin	1,471,800	1,318,050	153,750	8 months
Kyee Pin	474,900	265,500	209,400	8 months

[10] Since all the investments in the respective water systems was funded through the projects, there is no interest expense in any case

Major highlights of annual incomes, expenses & surpluses

- Except for two water supply systems, all others show varying amounts of net surplus.
- Considering the annual incomes and expenses of water supply systems, in particular from Yesagyo and a few from Pakokku, which are well established/matured and have been selling water for more than one and a half years a more realistic pattern emerges compared to those which are relatively new. The latter are yet to establish fully their parameters such as the appropriate amount of water fee/charges per unit relative to the pattern of expenses over a reasonable timeframe.
- More mature water supply systems have been generating a reasonable amount of net surplus in the range of MMK 1-3 million after meeting all the operational expenses. Annual surpluses for various water supply systems vary based on the water fee charges per unit water consumption, cost effectiveness of operations and the total number of HHs being served by the water supply systems.
- It is apparent that all the mature water supply systems are operationally viable and sustainable in terms of supplying water and generating reasonable surpluses after meeting all the operational expenses.
- The private water supplier who sell water to 6 HHs in the village makes an annual net surplus of around MMK 1 lakh. This supplier also uses water from the water system for his own purposes and has not hired anyone for the purpose.

5.2 Payback period for investment in water supply systems

Payback period for various water systems has been calculated based on the total investments made in installing the respective water systems and the amount of annual net surplus generated by them. The calculations of payback period are presented in **Table 8**.

Table 8

Calculations of payback period[11] for various water systems

Townships/villages	Total investment (MMK)	Annual surplus (MMK)	Payback period, yrs
Pakokku			
Myo Khin Thar	13,320,300	809,196	16
Tha Yet pin Su	14,321,000	190,380	75
Ma Gyee Koe Pin	8,020,000	2,313,100	3.5
private water supplier	2,750,000	98,331	28
Ma Gyi Kan	10,037,000	528,000	19
Ah Shay Nga Kyaw	7,042,000	384,000	18
Yesagyo			
Kyauk Hlay Khar	7,918,260	2,883,947	3
Htan Ngai Taw	9,041,200	1,261,650	7
Peik Thin Kat	7,228,920	854,850	8.5
Kokako Su	22,000,000	1,563,543	14
Kyee Kan	10,900,000	1,128,884	10

[11] The payback period will increase if the water supply systems take bank loans to finance the water systems

Townships/villages	Total investment (MMK)	Annual surplus (MMK)	Payback period, yrs
Myingyan			
Gway Gyi	1,19,23,000	(-) 379,530	
Tei Gyi	1,84,60,000	(-) 92,900	
Chin Myit Kyin	1,34,26,000	1,53,750	87
Kyee Pin	1,14,91,000	2,09,400	55

Note: The private water supplier also uses the system for his own water needs.

Major highlights from the payback period calculations

- Considering the established water systems selling water for one and half years and more, the payback period for various water systems works out in the range of about 3 years to 14 years with the average of about 8 years; some with a payback period of about 3 years and some with about 7-9 years.
- These payback periods for the established community water systems seem to be reasonable considering that the supply of safe drinking water to the community is a social and community good; profit generation is not the major objective in establishing these water supply systems.
- For other newly established water systems, it would be more realistic to calculate annual surplus and payback period after they have completed at least one (and preferably two) years of operations. This will enable them to generate the required experience to make adjustments in their operations including working out appropriate water charges and considering the pattern of expenses.

Chapter 6

Analysis of benefits to water users and the community

All the users in all the villages receiving water shared significant benefits from access to water supply. The study team has attempted to monetise the savings and incomes accruing to HHs from saved time and by pursuing livelihoods activities because of access to HH water. The key benefits to the HHs are discussed below.

6.1 Savings in time and effort

Access to water at the household level through water pipelines has provided comfort to the users and resulted in the saving of a significant amount of time and effort for individual users. When these water supply systems did not exist, HHs were spending a considerable amount of productive time in fetching water from dug wells and other sources. Additionally, they were using water in a very limited manner as they needed to fetch manually all the water they used. The amount of time HHs spent in fetching water depended on the distance and location of the water source/s and the quantity of water needed for individual HHs based on family size. The time spent by HHs in fetching water varied across villages – in some villages one person from some HHs was engaged most of his/her time during the day to fetch water; some HHs spent from 2 hours to 6 hours per day in fetching water to meet their requirements.

6.2 Use of saved time for productive purposes for additional income generation

The time saved from fetching water as a result of the establishment of these water systems is now being used by the members of some HHs for productive purposes and income generating activities. Many users reported that they are now able to spend more time on agriculture or other productive activities. Depending upon the time saved and livelihoods activities pursued, HHs reported generating additional daily incomes of MMK2,000-5,000 translating to monthly incomes in the range of MMK50,000 to 150,000.[12]

In one of the villages where the LIFT project is being implemented, around half the households are now engaged in vegetable cultivation enabling additional earnings/or savings of MMK1,000-1,500 per day. Additionally, there are a couple of other villages where 10-15 of the HHs have started vegetable and fruit cultivation after access to water supply. Similarly, about 100 HHs in one of the villages in Yesagyo are now engaged in incense stick making and earning MMK 25-30,000 per month; other HHs earn about MMK45,000 per month from textile weaving.

6.3 Access to safe drinking water and for other purposes in adequate quantity

Water users in all the villages agreed that water quality from the community water supply systems is good and safe. Additionally, the supply of water is adequate in general and to meet their water requirements except in a few cases of power failure or breakdown of machinery.

[12] Such incomes are estimates based on the number of hours saved from fetching water and use of that time for income activities (mostly farm activities) of various types.

6.4 Other additional livelihood activities started by HHs

A few HHs from some of the study villages attributed access to water as the main factor enabling them to start other income generating activities. Some HHs reported starting pig rearing with the water supply and one of them reported generating additional income of MMK 100,000 every two months. Similarly, another HH reported to having started goat rearing because of water supply and generating as much as MMK 600,000 per 3-4 months.

6.5 Reduction in the incidence of water borne diseases

When the community water supply systems were non-existent, HHs were using water from dug wells and other sources for drinking purposes and there were common incidences of water borne diseases such as diarrhoea and also kidney diseases in a few cases. About 10-15 community members and even more (these numbers increased significantly during the rainy season in most of the villages) usually suffered from diarrhoea when they used water from dug wells and/or other sources. The treatment for diarrhoea costs around MMK 30,000 to MMK 100,000 depending upon the severity of cases. In a few cases the expenses increased to MMK 150,000. With the use of safe drinking water from the water supply systems the incidence of water borne-diseases is reported to have reduced significantly.

6.6 Control on fire incidences in villages without much difficulty

Community members in some villages reported that during the summer months they had a very tough time controlling household fire accidents due to the lack of adequate water for the purpose. However, now with access to and storage of water they have a better chance of controlling fire incidences and preventing potential fire havoc in entire villages.

6.7 Cost-benefit analysis

Without detailed survey information, cost-benefit analysis can only be undertaken as a simulation using assumptions based on the feedback provided in this chapter from interviews conducted with key informants and water using households in the 15 villages covered by this study. The resulting assumptions are presented in **Table 9** (on the following page). Of particular, interest are the assumptions made about the decline in morbidity rates overall (30% down to 10%) and for adults (25% down to 7.5%) on account of the availability of clean drinking water. Also of interest is the proportion of households able to increase their incomes from new activities undertaken due to the availability of water (15%). ***This is a matter for discussion with project managers of LIFT and could be subjected to a sensitivity analysis***. The period of the IRR calculation has been taken as 10 years to roughly match the average payback period of about 8 years of the 6 mature, well managed projects; a period that also matches the average expected life of a typical investment in equipment purchased for a water supply project. The feasibility analysis takes into account the longer life of the tube well boring and platforms.

For a water system supplying water to 150 HHs[13], the internal rate of return based purely on the cashflow to the water supply systems is at 29% (well above the interest on savings of around 8% currently paid by banks in Myanmar). The availability of clean drinking water results in reduction in morbidity (from water borne diseases) enabling both a reduction in treatment cost of the diseases and reduction in loss of income due to the inability to work on account of illness. This is a benefit to the community. Not surprisingly incorporating the estimated benefit resulting from this reduction in morbidity increases the IRR substantially to 90% per annum. Incorporating the effects of additional income earning opportunities resulting from the supply of water takes the IRR about 180%

Table 9

Cost-benefit Analysis of Water Supply Systems in the Dry Zone

a. Benefits from cash flows directly attributable to the water supply projects – based on averages of information from the 6 mature and well managed water supply systems covered by this study (referred to above) – Ma Gyee Koe Pin in Pakkoku and all 5 in Yesagyo township	
Average investment, MMK	13,500,300
Average annual net surplus, MMK	4,262,000
Payback period, years	10
Households connected	168
Persons per household*	5.6
Adults per household*	3.8
Working adults per household*	2.8
b. Benefits from reduction in morbidity – cost of water borne disease treatment	
Morbidity (water borne) before water supply, persons	30%
number of persons	252
Direct cost (of treatment) per morbidity, MMK	40,000
Total cost incurred due to morbidity, MMK	10,080,000
Morbidity (water borne) after water supply, persons	10%
Morbidity cost after water supply, MMK	3,360,000
Net savings in annual cost of morbidity treatment	**6,720,000**
c. Benefits from reduction in morbidity - wages lost due to loss of working time	
Proportion of adults affected before water supply	25%
after water supply	7.5%
Adult days lost per morbidity	4
Wages per person day, MMK	5,000
Total annual wages lost - before water supply	2,100,000
after water supply	855,000
Net savings in annual loss of wages	**1,245,000**

[13] A water system established without a bank loan

d. Benefits from household incomes enabled by the availability of water supply	
Proportion of households able to increase earnings from the use of water for pig rearing, vegetable cultivation, other activities	15%
	MMK
Average monthly return per HH, new income sources	45,000
Net annual return from additional income	**12,150,000**

* Data based on household surveys conducted by M-CRIL in the Dry Zone (though not in the project townships) in 2014 and 2017

Calculation of internal rate of return, IRR (for 150 HHs)	**Year 0**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Cashflows	-13,500,000	4,262,000	4,262,000	4,262,000	4,262,000	4,262,000	4,262,000	4,262,000	4,262,000	4,262,000	4,262,000
Net saving in cost of treatment of morbidity		6,720,000	6,720,000	6,720,000	6,720,000	6,720,000	6,720,000	6,720,000	6,720,000	6,720,000	6,720,000
Net annual reduction in loss of wages		1,245,000	1,245,000	1,245,000	1,245,000	1,245,000	1,245,000	1,245,000	1,245,000	1,245,000	1,245,000
Net benefit	-13,500,000	12,227,000	12,227,000	12,227,000	12,227,000	12,227,000	12,227,000	12,227,000	12,227,000	12,227,000	12,227,000
Net annual return from additional income		12,150,000	12,150,000	12,150,000	12,150,000	12,150,000	12,150,000	12,150,000	12,150,000	12,150,000	12,150,000
	-13,500,000	24,377,000	24,377,000	24,377,000	24,377,000	24,377,000	24,377,000	24,377,000	24,377,000	24,377,000	24,377,000

	Rates of return
IRR - based on cash flow	29%
IRR - based on imputed savings from reduction of morbidity	90%
IRR - cashflow + imputed savings + additional income resulting from availability of water	181%

Chapter 7

Key difficulties/challenges

While in most cases no major challenges were reported by the community water management committees, some difficulties reported by them are summarised below. CSOs, CBOs, VDCs and other development partners should consider these difficulties while designing and implementing water supply systems in villages.

- During the installation of the water supply system in one of the villages in Pakokku, there were difficulties and disagreement on the site selection of the water source and location for establishing the water supply system. This was resolved through discussions with the community facilitated by the project support agency. In 2 villages, after boring at significant depth at the selected site for the tube well, water was not found so another site was selected for boring to install the tube well; water was found fortunately at the new sites.

- In one of the villages in Pakokku, during the initial operational period the water fee was determined based on the number of members and cattle in a HH. But in several instances, HHs consumed a lot of water during festivals, and for migrant labourers who stayed with the households for agricultural activities. This resulted in inadequate incomes as compared to consumption of water by the HHs. Finally, water meters in individual HHs were installed to address this problem.

- In a good number of cases, the project through which the water supply systems were established had not provided adequate training for the effective operations and management of the system. In most of the cases, water management committees have learned by doing.

- At times, due to power failure or unseen engine breakdown, water supply to HHs is hampered.

- For the newly established water systems, the water management committees find it difficult to solve even minor operational and technical problems and they need to call mechanics for the purpose.

- In a few cases, some HHs were reluctant to shift the boundary wall and fencing of their houses for digging of channel for laying water pipelines. However, this was resolved with persuasion by the community and the project staff.

- In one of the villages in Yesagyo, the water supply system funded by SI is not operational for some period during summer and the villagers still face difficulty in managing water. They obtain water from other nearby villages.

- A few users find it difficult to access water all the time due to their houses being at a higher elevation than other households in the village.

Challenges perceived by officials from township DRDs

- DRD officials from the townships reported that the water management committees formed earlier to manage water sources and supply systems in their respective villages are not active in general. Only 2-3 members are forced to take the entire responsibility of managing the water supply system; some committees are also quite weak in financial management.

- DRD officials reported that it is difficult to collect a water fee from the users when the community uses government water systems. One of the major reasons cited for non-payment of fee was that government provided these systems free of cost; the community always asks for more funds to manage the such a water system. DRD supported systems in the case of tube wells and tanks do not have water pipelines to individual HHs.

- According to DRD officials there were many instances where water was not found after boring to the depth of 300-400 feet resulting in huge investment losses.

Chapter 8

Suggested guidelines for stakeholders and practice recommendations

As discussed above, community water supply systems have emerged as the major water supplier in all the study villages. Based on this, the study team has outlined general guidelines and the key practice recommendations emerging from the study findings. These guidelines can be helpful in particular for villagers, CSO, CBO, VDC, development partners, local government departments and other stakeholders planning to design and implement self-help water supply systems in villages. Nevertheless, it is expected that individual stakeholders including the village community, CSO, VDV and financial service providers will undertake their own research based on a specific context and their own objectives/requirements. Additionally, the major part of the suggested guidelines can also be potentially helpful for a private investor interested in establishing a water supply system as well as for the consideration of banks in financing such water supply systems.

8.1 Guidelines for establishing community water supply system

- **Identification of suitable location/site for establishing tube well and water tanks for water supply systems**

  It is essential to identify a suitable location/site purely based on elements of technical feasibility and the availability of ground water for establishing a tube well. Similarly, the location of water tanks should be purely based on technical feasibility and other practical aspects. No preference should be given to identify a site that favours one or another group of households.

- **Determining the suitability of establishing either an overhead water tank or a ground water tank or both**

  Depending upon the topography of the village, the number of HHs to be covered by the water system and the farthest distance of HHs from the water system and tanks and other technical and financial aspects, the suitability of establishing either an overhead tank or a ground water tank should be determined. In some cases, the water supply systems can establish both the types of water tanks if that is found to be technically and operationally feasible. In general, the overhead tanks are preferred to the ground water tank which ensures higher pressure of water supply thus regular water supply to all HHs connected to the water system. The services of an engineer **with domain expertise** should be sought for this purpose.

- **Village survey for laying main pipeline and distribution pipeline**

  In general, the main pipeline should be of very high quality as this will be laid on the main roads which may be exposed to heavy vehicle load. The services of an appropriately skilled and experienced civil engineer should be sought for this purpose.

- **Community contribution to activities/equipment associated with the water supply system**

  Various forms of contribution by HHs and the community are essential for establishing such water supply systems. As discussed above in this report, in most cases the community and HHs have contributed their labour in the digging of channels for laying water pipelines and their installation with appropriate training for the purpose. Additionally, in most cases, individual HHs have paid for their own water meters and in some cases for the distribution pipelines for individual connections.

  Such contributions to be made by the community and the HHs in a water supply system should be agreed in advance based on detailed discussions with the community. It is apparent that contributions from the community in various forms have led to the significant interest of community members in the management of the water supply systems from the start. It has also reduced the overall investment to be made by a project or through a loan in establishing a community water supply system. This is in contrast to the approach where everything was funded free of cost by the government.

- **Working out the capacity/size of tube well, water tank/s and other equipment**

  The capacity of various types of infrastructure and equipment should be determined based on the total number of HHs to be covered by the water system, average HH size, and monthly water consumption by HHs considering the variation in water consumption by HHs in different seasons. As this study shows, water consumption in the summer season is significantly more and also depends upon the purposes for which individual HHs use water. While some HHs can use water from the system primarily for drinking and other household purposes, other HHs use it other purposes as well, including gardening, vegetable and fruit cultivation and livestock rearing. Therefore, careful estimation of water consumption by HHs should be made to provide the necessary inputs for determining the capacity of the water supply system.

  The capacity of parts of the infrastructure such as tube well and water tanks, in particular, which require major investments in a water system and have a longer operational life, should be determined not just based on the current requirements of the water system but also the need for future expansion. The total length of the main and distribution pipelines should be worked out carefully as wide variations in pipeline investment were observed during this study depending on the site of the tube well and water tank and the distance of these from houses in the village. Since these require a high degree of technical expertise, it is best if this is done by the engineer with domain expertise hired to provide technical support in the design and construction of the water system.

- **Working out the investments required and ways to finance**

  After the agreement with the community and HHs about the contribution to be made by them and working out the capacity of tube well and water tanks and other equipment, the additional investments required in the infrastructure and equipment should be worked out. As discussed above, the investments may vary based on the size and capacity of a water supply system. The services of an engineer should be sought for this purpose in addition to discussions with the suppliers of various equipment.

If the community decides to make its own investment in a water supply system then loans will not be required. However, if loans are needed for some part of the water system, the CSO, CBO, VDC will need to a develop a suitable project feasibility report and a proposal with the help of an expert in order to approach a bank/s or government agency for the purpose.

- **Hiring technical persons/engineers for establishing the overall water supply system**

  As emphasised several times above, qualified technical persons/engineers with prior experience in establishing water supply systems should be hired to provide guidance on each step in the establishment of the water supply system.

- **Determining the institutional management structure for managing the water supply system**

  Chapter 4 discusses the community water management committees established to manage water supply systems and the roles and responsibilities of such committees in managing community water supply systems effectively. In most of the cases, the first management committee was formed before the installation of the water system to take care of and to supervise the installation of the water system from the start. A similar management committee can be established to supervise the installation and to manage the water system thereafter. The management committee should develop all the important rules and regulations necessary to manage and operate a water supply system effectively. Specific recommendations related to the need for capacity building of the management committee are made in the practice recommendations in **Section 8.2**.

- **Hiring persons to run the water supply system and to collect water fees from HHs**

  As discussed in **Chapter 4**, various activities need to be undertaken to run a water supply system. These activities include operating and maintaining the water system on a timely basis and timely collection of water charges/fees from water users. While in some of the villages, management committees perform some of these activities on a voluntary basis during the initial period after the water system becomes operational, perhaps to reduce initial operational expenses, for the long term it is better that the community water supply system hires suitable persons to perform these activities effectively. Salaries/payments to be made to such persons should be determined keeping in mind whether their engagement is part time or a full time basis. As discussed above, while the engine operators are hired on a full time basis in general, the water fee collectors are part time and are paid a salary ranging from MMK 6,000-20,000 per month based on the number of HHs served by the water supply system.

- **Working out operating expenses of the water system**

  While most operating expenses should be calculated on a monthly basis, some expenses are incurred on an annual basis. Monthly operating expenses could include diesel cost and/or electricity charges to run the water system, salaries/payments to made to the water system operator and water fee collector/s and minor maintenance expenses for the water system. Provisions should also be made for meeting annual expenses incurred on major maintenance such as the overhauling of the pump, engine and/or motor as well as the funds required for replacing equipment such as pumps and engines every few years.

  If such systems are financed through bank loans, payment of interest on the bank loans should be included as finance cost and factored into annual expenses.

- **Determining appropriate water charges for water consumption**

  Water charges/fees from water users/HHs are the major source of revenues for the water supply system; determining these correctly is, therefore, the key to long-term sustainability to meet operational expenses as well as the cost of replacement of equipment on a periodic basis. However, as this study reveals, water management committees generally determine the appropriate amount of per unit water charges by trial and error. It would be better to adopt a more deliberate method of working out water charges considering all the expenses, payment of principal and interest if bank loans are obtained and covering overheads, keeping aside a surplus for overhaul or replacement of the motor, the water pump and pipes as well as for potential expansion of the water supply system in future. Charges should be based on the quantity of water consumed by a household.

  The most common frequency of collecting water fees from HHs is monthly followed by fortnightly (mainly in Myingyan); and bi-monthly exclusively in Pakokku township. However, it is desirable to collect water fees from HHs on a monthly basis to ensure smooth cashflow management and cost reduction (over fortnightly collections).

  As the study reveals, more mature water supply systems have been generating a reasonable amount of net surplus in the range of MMK 1-3 million annually after meeting all operating expenses. This primarily depends on water charges per unit of consumption, cost effectiveness of operations and the total number of HHs being served by the water supply system. All mature water supply systems with an average payback period of about 8 years are operationally viable and sustainable in terms of supplying water and generating reasonable surpluses. However, as discussed above all the water systems studied by M-CRIL have been funded by various development projects and have not obtained any bank loans. If such systems are financed through bank loans, the net surplus will reduce accordingly and therefore the water charges should be determined considering the amount of principal and interest necessary to service loans in addition to meeting other expenses to run the water system.

8.2 Practice recommendations

In addition to the above guidelines, the following are the key practice recommendations emerging from this study

- **Capacity building for effective operations and management of water supply systems**

  While the water management committees of the mature water supply systems have reached a stage where they are able to manage operations comfortably, recently established management committees seem to find it difficult to do so. They need capacity building support on most operational and management aspects. This can be done by engaging a technical and management professional at least for a year and a half to visit them at periodic intervals. The development and provision of simple formats for accounting and consolidation of incomes and expenses will be useful in this regard for establishing effective management systems more quickly.

  Considering that women members manage water at the HH level and know more about the demand side of water for various purposes, the representation of women in the water management committee should be increased from the present 2-4 members to at least 50% of the total number of members.

- **Technical audit of water supply systems and audit of water management committee**

  It will be helpful to explore the possibility of introducing a technical audit of water supply systems at periodic intervals. The technical audit of newly established water systems can be undertaken on a two-year basis and of the older systems which have completed 3 years or more of operations can be undertaken on a yearly basis. Such technical audit of the water supply systems can enable the water management committees to take the necessary steps to rectify potential problems in future. Similarly, the audit of water management committees on a yearly basis can improve the functioning of the water management committees by identifying weak areas of management for improvement.

  Based on the findings from such audits, better performing and managed water supply systems in the Dry Zone can be identified. Exposure visits for newly established water systems can be organized to the better managed mature water systems to enable peer interaction and learning.

- **Introducing a standard volume of water as the measure for each unit of water consumed**

  It will be better to encourage the adoption of a standard unit of water consumed instead of having different quantities of water per unit of consumption across villages and townships. This will help in setting a benchmark for water charges in the Dry Zone. Ideally, this could be in cubic metres but ***it would be a mistake to ignore the common understanding of the community – which is in imperial gallons – if it cannot be changed in the near future.***

- **Promotion of private water suppliers in villages where pipeline water supply does not exist**

  Just one private water supplier was found in the study villages. It will be helpful to explore the possibility of promoting and financing private water supply systems in villages where the community still depends on sources other than tube well water to meet their clean drinking water requirements. This is a development activity based on consultation with the community and is ***not a recommendation for further research***.

8.3 Understanding financial feasibility of water systems

The study team has presented above a cost-benefit analysis as a simulation using various assumptions and key study findings from this study. The donors, project managers and users would all be interested in understanding the overall cost-benefit relationship of a water supply system at the community level. In addition, stakeholders including CSOs, CBOs, VDCs, development partners, local government departments and banks would also be interested in understanding the financial feasibility of establishing a water supply system ***with a bank loan***. Considering this, the study team has undertaken the financial analysis of a water supply system and as part of that has developed simple spreadsheet formats which are attached to this report. The summary of the analysis is presented in **Table 10** below. Three scenarios with different numbers of HHs in villages have been considered for working out the financial feasibility of a water supply system

Scenario 1 – supplying water to about 100 HHs in a village
Scenario 2 – supplying water to about 150 HHs in a village
Scenario 3 – supplying water to about 200 HHs in a village

The following are <u>the key parameters and assumptions</u> used for the financial analysis

- All the major infrastructure and equipment required in a water supply system have been considered

- The community and individual HHs will contribute to the digging of channels for water pipelines and install their own water meter

- Significant variations in costs/investments in tube wells with similar depth were observed because of the availability of ground water and the bottom layer of soil. Keeping this in mind the study team has made suitable approximations based on the available data.

- The capacities of these have been estimated based on the discussions with water management committees and study findings. Further, variations have been considered in the capacities for this infrastructure and equipment by factoring marginal increases in cost/investment if water is to be supplied to more HHs. However, the actual capacity/ sizes of various infrastructure and equipment needs to be determined on the spot based on prevailing conditions in a specific context.

- While the study team has tried to consider the current prices to the extent possible to determine investment in constructing water supply systems and related equipment, suitable adjustments to these prices should be made to enable a realistic analysis based on prevailing prices.

- This analysis has considered running the system by diesel engine and accordingly the fuel cost has been considered. In case, the water system uses electricity the power cost will be lower as compared to fuel cost – therefore this will further enhance financial feasibility.

- For a smaller number of HHs in a village, water unit charges are higher compared to the charges applicable to HHs in villages with more HHs. This is the inevitable result of economies of scale.

- The tenure for repaying loans by the water supply systems for 100-150 HHs has been assumed to be 6 years in relation to the overall cashflow whereas for systems supplying water to about 200 HHs, the loan tenure has been assumed to be 5 years.

The summary of the financial analysis and key assumptions for 3 different scenarios presented in **Table 10** below (for detailed calculations and other assumptions, please refer to the excel sheet attached) suggests that with the above assumptions and the investments/expenses estimated the establishment of a community water supply system with a bank loan is financially viable (IRR works out in the range of 7-14%) for all the scenarios. The value of IRR increases as the number of households connected to a water supply increases.

The investors and the village community can consider establishing a water supply system with a bank loan by collecting the following minimum amount of water fee for various Scenarios as below from water users to generate adequate net surplus to operate the water supply system effectively and repay a loan from a bank.

Scenario 1 – supplying water to about 100 HHs: *average minimum monthly water consumption per HH 7 units and water charge MMK650 per unit of water*

Scenario 2 – supplying water to about 150 HHs: *average minimum monthly water consumption per HH 7 units and water charge MMK550 per unit of water*

Scenario 3 – supplying water to about 200 HHs: *average minimum monthly water consumption per HH 8 units and water charge: MMK450 per unit of water*

Table 10

Analysis of financial feasibility of a water supply system for the 3 scenarios

	Scenario 1	Scenario 2	Scenario 3
Number of HHs to be covered by a water supply system	**100**	**150**	**200**
Water fee charged per unit of 220 gallons/one cubic meter, MMK	650	550	450
Average # of water units consumed per HH per month	7	7	8
	Amount, MMK		
Total estimated investment in water system, MMK	9,950,000	13,500,000	15,650,000
Annual water charges - revenues	5,070,000	6,930,000	8,640,000
Annual expenses - operations, depreciation and maintenance	2,125,000	2,668,000	2,125,000
Average annual net surplus	2,945,000	4,262,000	5,292,500
Loan details			
Amount of bank loan (75% of total investment)	7,462,500	10,125,000	11,737,500
Annual rate of interest on bank loan (%)	15%	15%	15%
Duration of loan, years	6	6	5
Equated annual instalment (principal + interest) to bank	1,971,868	2,675,399	3,501,479
Internal rate of return, IRR	**9%**	**11%**	**14%**

Note: Community contribution - digging of all pipeline channels, laying water pipeline and individual water meter

Annex 1

Summary of investments made in water supply systems and the community contribution

Pakkoku

Village 1: Myo Khin Thar

Equipment/infrastructure	Value	Community contribution and other remarks
Deep Tube well (300 feet) Pipeline (Main) Ground tank Submersible pump Engine (28HP) Dynamo (10 KV)	4,100,000 4,770,000 2,070,000 1,210,000 590,300 580,000	Digging of channel for pipelines and the installation of pipeline after receiving training from engineers for the purpose; purchase of a transformer/voltage stabilizer
Total	**13,320,300**	

Village 2: Tha Yet Pin Su

Equipment/infrastructure	Value	Community contribution and other remarks
Tube well Pipeline (Main) Overhead Tank Submersible pump	5,606,000 2,440,000 4,575,000 1,700,000	Digging of channel for pipeline and the installation of pipeline after receiving training from engineers for the purpose; purchase of a transformer/voltage stabilizer
Total	**14,321,000**	

Village 3: Ma Gyee Koe Pin

Monastery owned tube well

Equipment/infrastructure	Value	Community contribution and other remarks
Tube well Water tank Engine Pipeline	1,000,000 2,000,000 520,000 4,500,000	Digging of channel for pipeline and installation of the pipeline
Total	**8,020,000**	

Private supplier owned tube well

Equipment/infrastructure	Value	Community contribution and other remarks
Tube well +pipeline Overhead water tank Pump Pipeline + miscellaneous	1,200,000 1,000,000 350,000 200,000	Not applicable
Total	**2,750,000**	

Village 4: Ma Gyi Kan

Equipment/infrastructure	Value	Community contribution and other remarks
Deep Tube well Pipeline (main) Overhead Tank Submersible pump Engine (12 HP) Dynamo (5KV)	1,861,000 1,840,000 4,186,000 1,000,000 400,000 750,000	Digging of channel for pipeline and installation of the pipeline
Total	**10,037,000**	

Village 5: Ah Shay Nga Kyaw

Equipment/infrastructure	Value	Community contribution and other remarks
Repair of well Pipeline (main) Overhead Tank Submersible pump	172,000 2,590,000 3,240,000 1,040,000	Digging of channel for pipeline & laying of the pipeline; dynamo and engine – total value around MMK 1.8 million. Purchase of individual water meter and pipeline for individual connections
Total	**7,042,000**	

Yesagyo

Village: Kyauk Hlay Khar

Equipment/infrastructure	Value	Community contribution and other remarks
Pipeline (main) Ground Tank Submersible pump Engine (22 HP) Dynamo (10 KV) Building Fencing	3,572,990 1,870,450 340,000 270,000 217,000 1,041,220 606,600	Community financed the tube well, arranged a pipeline for individual connections and also water meters. Part of the main pipeline was also financed by the community. Out of two ground tanks, DRD supported the construction of one & channel digging by the project
Total	**7,918,260**	

Village: Htan Ngai Taw

Equipment/infrastructure	Value	Community contribution and other remarks
Big well Pipeline (Main) Overhead water tank (1500 gallons) Submersible pump	1,723,200 2,996,000 4,186,000 136,000	Digging of channel for a pipeline, tube well installation, pump, pipeline for individual connections and water meters.
Total	**9,041,200**	

Village: Peik Thin Kat

Equipment/infrastructure	Value	Community contribution and other remarks
Pipeline (main) Overhead tank Submersible pump Engine (22 HP) 3" water pump Building Fencing	3,271,570 1,360,330 280,000 450,000 250,000 1,041,220 575,800	Channel digging, pipeline for individual connection and water meter
Total	**7,228,920**	

Village: Kokako Su

Equipment/infrastructure	Value	Community contribution and other remarks
Overhead and ground tanks +main pipeline, 70% of tube well installation cost, engine, channel digging cost, dynamo, pump and motor		30% of tube well installation cost by the community (about MMK0.9 million); pipeline for individual connection and water meter SI supported the water supply system only after a tube well was installed by the community.
Total	22,000,000*	

* Breakup of the investment was not available

Village: Kyee Kan

Equipment/infrastructure	Value	Community contribution and other remarks
Tube well + pump Overhead tank Pipeline (main)	3,100,000 3,250,000 4,550,000	Channel digging for pipeline, pipeline installation, pipeline for individual connection and water meter.
Total	**10,900,000**	

Myingyan

Village: Gway Gyi

Equipment/infrastructure	Value	Community contribution and other remarks
Tube well Pipeline (Main) Ground tank Submersible pump Engine (25 HP) Dynamo (10 KV)	5,600,000 600,000 3,198,000 1,280,000 567,000 678,000	Channel digging for laying pipeline, 50% of main pipeline investment, pipeline to HH connections and water meter, sand and gravel for water tank
Total	**1,1923,000**	

Village: Tei Gyi

Equipment/infrastructure	Value	Community contribution and other remarks
Tube well Pipeline (Main) Overhead water Tank Submersible pump Engine (25 HP) Dynamo (10 KV)	5,865,000 3,816,000 5,824,000 1,750,000 555,000 650,000	Channel digging for laying pipeline, pipeline to HHs and water meters
Total	**18,460,000**	

Village: Chin Myit Kyin

Equipment/infrastructure	Value	Community contribution and other remarks
Tube well Pipeline (Main) Ground tank Submersible pump Engine (22 HP) Dynamo (10 KV)	6,064,000 2,206,000 2,784,000 1,255,000 567,000 550,000	Channel digging for laying pipelines, pipeline to HH connections and water meters, gravel for water tank
Total	**13,426,000**	

Village: Kyee Pin

Equipment/infrastructure	Value	Community contribution and other remarks
Tube well Pipeline (Main) Overhead water Tank (1,200 gallons) Submersible pump Engine (18 HP) Dynamo (7 KV)	3,255,000 1,043,000 5,503,000 1,150,000 420,000 120,000	Channel digging for laying pipeline, pipeline to HH connection and water meter, sand and foundation stone for water tank
Total	**11,491,000**	

Village: Kyauk Kan

Equipment/infrastructure	Value	Community contribution and other remarks
Water harvesting Tank Big dug well Shed of dug wells	1,800,000 1,300,000 1,200,000	No contribution reported; the existing water supply does not have tube wells and pipeline connectivity
Total	**4,300,000**	

Annex 2

Terms of Reference

Amendment of the objective:

In addition and in line with the current TOR, LIFT is requesting M-Cril to obtain information about the economics of private and village operated water supply systems for domestic water and to understand how successful schemes are managed and operated.

These systems are very similar because they both run on deep tube wells, tube wells and other underground water resources that require pumping.

As for the other part of the study already being undertaken, the analysis will provide additional insights such as

- relevant business information to potential investors (community / VDC) and rural financial service providers to finance private or community managed water supply systems.
- Information to existing partners developing domestic water supply systems in selecting suitable water sources and approaches to let the community manage the development, operations and maintenance of the resources.

With the results of this additional research finding, communities will understand chances to run a sustainable water supply system and the need for revenues to develop and operate public or private water supply systems

4. Scope and Methodology:

The methodology will be the same as in the current study.

Geographic scope:
Three of the six townships of the ongoing study. The 15 villages should overlap with the ongoing study as much as possible if they have interesting domestic water supply systems in their villages.

Research scope:
As for the research scope, the additional part will not include WASH or nutrition issues. Based on information from DRD, LIFT's IPs, other development partners worked/working in Dry Zone project townships and comments / feedback from LIFT FMO, the consultant team will prepare/revise final study design and work-plan and will sent to LIFT for approval, focusing on additional tasks such as :

- Inventory existing different village water supply systems which sell the water to individual HH and select the five water supply systems for each townships (total 15 villages in DZ project area)

- Collect the cost of existing system (project and community investments), operation cost, maintenance cost, income from water sold (seasonal data)
- Collect additional information on rules, regulations, management approach and other information to assess the effectiveness, efficiency and equality of the systems
- Calculate the yearly costs and income for the various systems based on collected information and also calculate the payback period for investment and simulation of cost / benefit of water system
- Analyze various water management approaches and make good practice recommendations
- Calculate community savings from water purchases (before and after)
- Give examples and calculate additional income from saving time from water collection

Report:
The report of the research will include an additional section focusing specifically on

- Villagers / CSO / CBO / VDC and local government departments have sufficient and reliable information to implement self-help water supply system and possibly using credits to develop the system
- Financial service providers have enough business information of village water supply system for decision on loan approval

It is expected that the consultant team uses the same team members from the ongoing study to conduct this study. They are already deployed in the field and have all the necessary qualifications and experiences.

5. Revised workplan:

The consultant will provide a revised workplan, which will include following tasks:

Description	Due
1. **Revised study design**	**Two weeks after signing of amendment**
2. Revised field work plan (data and information collection) to be conducted in three project townships (five villages per township) **(max 21 working days by national consultants and field technicians in four weeks duration)** • Meeting with DRD, DPs and IPs (2 days per township) • Collection of business data / information of village level water system (1 day per village)	

3. Analyses to be done on data/information collection from 15 villages) **(max 15 working days by national consultant and field technicians in two weeks duration) plus** **(max 3 working days by international consultant in one week duration)** • Analyses monthly basis (based on water demand) cost/benefit for different water supply system (1 day x 15 villages = 15 days) plus 3 days for combine	
4. Draft study report preparation **(max six working days by international consultant)** Study report together with detail analyses and data/information of individual village collected during the field visits as annexes must be submitted for review and final feedback.	
5. Final training report preparation **(one working day by international consultant)** The length of the final report should not be more than 30 pages but annexes (supportive documents) will not be limited to make sure all necessary documents are included. Annexes should be included collected data/information, calculated data, simulation of monthly water sold data and other related documents.	**On week after receiving feedback from DZ programme team, LIFT**

Annex 3

Checklist of questions

M-CRIL Study of economics of private and village operated water supply systems for domestic water: LIFT Myanmar, January 2018

Note: The study team will try to capture information on various aspects during the third round of visit scheduled for the ongoing study related to the C-B analysis of irrigation during monsoon gap time.

Checklist of questions for FGDs with water users/villagers

Date:

Township: **Village:**

No. of participating respondents:

Introduce briefly the purpose of the discussions and about the study.

Information on inventory of various existing water supply systems in the villages

1. Which are the existing water supply systems in the village?
2. Which are the systems used by most of the villagers? Prioritise those systems and suppliers based on important factors as perceived by the water users.
3. Who are the suppliers – capture the profile and number of water suppliers from each water system.
4. How many years ago these water systems ware established and started providing water for HH use?
5. List the advantages and disadvantages of various water systems and their suppliers?
6. In case of community managed water supply systems, gather detailed information on various aspects related to its operations and management (including establishment costs, annual maintenance cost, operational costs, incomes and other important aspects)
7. Capture information related to the issues wrt to quality of water supplied and other important aspects such as timeliness of supply and quantity of water supplied as against promised.
8. Try to understand the most preferred systems by the users and the reasons associated with this.

Usage pattern and charges paid by water users

9. What were the systems for managing water requirements before in the villages? Try to capture the information on how water requirements were met by individual HH before these water supply systems were not existing.

10. What is the frequency of the water supply by major water supply systems and average quantity of water usage by individual households Try to understand the extent of variation of water supply by different suppliers.

11. What is the average charges you pay for using water and what is the periodicity of the payment (monthly, bi-monthly or other periodicities)? Try to capture the information on user charges for various water supply systems.

12. How have the use of these water systems reduced your difficulties and improved quality of your life. Try to quantify the benefits at the individual HH level in terms of annual savings as a result of the use of water from these systems. Also calculate additional income from saving time from water collection before.

13. What are the major challenges you face in meeting your water requirements? Also capture their views on how these challenges can be addressed and resolved?

+ follow up questions emerging from the discussion on the above

M-CRIL Study of economics of private and village operated water supply systems for domestic water: LIFT Myanmar, January 2018

Checklist of questions for individual interview with water suppliers

This will be carried out at least for one supplier for each water system in villages. Appropriate customization in applying this checklist will be made on the spot based on the type and nature of a water supplier.

Date:

Township: **Village:**

Type of water system:

Name of the farmer:

Introduce briefly the purpose of the detailed discussions.

1. Which are the major water supply systems in the village?

2. How many water suppliers for each water supply system are there in the village?

3. Since when you started selling water?

4. How many HH you are supplying water to and what is this % (wrt to total HHs in the village)?

5. Which water supply system has major market share (try to understand the market share for each water supply system and each category of water suppliers, if so)

6. Please share with us detailed information on the cost of installation of existing water system; This has to captured keeping in mind the nature of suppliers such as private and community owned (entailing project and community investments in case of community owned).

7. In case of community managed water supply systems, gather detailed information on various aspects related to its organisational set up, operation management and other relevant aspects.

8. In case of private water supplier, try to understand how the cost of water system establishment was financed. Try to capture the names of banks/MFI or other sources for financing and terms (loan amount, duration, interest rates) of financing.

9. For each of the water system, capture in detail the operational cost, maintenance cost and income from water sold (seasonal data).

10. For each type of water system, collect information on rules, regulations, management approach and other relevant information

11. What is the operational life of various types of water systems and related equipment (please cover all the major types in use in use)?

Usage pattern and charges paid by water users

14. Try to capture the information how water requirements were met by individual HH before these water supply systems were not existing and operational in the village.

15. What is the frequency of the water supply by major water supply systems and average quantity of water usage by individual households. Try to understand the extent of variation of water supply by different suppliers.

16. What is the average charges you receive from each HH for providing water and what is the periodicity of the charges (monthly, bi-monthly or other periodicities)?

17. What is your annual income from water supply (collect the information for the last 2 years at least). Try to estimate the net surplus on a yearly basis.

18. Do you think that current existing water supply systems are able to meet the overall water demand of the HHs in the villages? To what extent do you think that the water demand of the HHs is being met?

19. How have these water systems reduced difficulties and improved quality of life of HHs. Try to quantify the benefits accruing at the individual HH level from this supplier's perspective (in terms of annual savings as a result of the use of water from these systems).

20. What are the major challenges you face in your operation related to water supply and water supply? Also capture information on how the supplier addresses and resolves those challenges?

+ follow up questions emerging from the discussion on the above

M-CRIL Study of economics of private and village operated water supply systems for domestic water: LIFT Myanmar, January 2018

Checklist of questions for DRD, DPs and IPs as the case may be

Date:

Township:
Name of the agency:
Name of the staff member/s:

Introduce briefly the purpose of the detailed discussions.

1. Please tell us how HHs currently meet their HH water requirements and which the major water systems in the villages?

2. What were earlier arrangements for the HH for meeting water requirements?

3. When the new water systems in villages were established and tell us the background on how these were established?

4. Do you think that the existing water systems and methods are appropriate considering the nature of water demand by HHs and other aspects? If yes or not, why and which would be appropriate systems/methods?

5. Which are the most efficient and reasonable water supply systems which are commonly used by HHs?

6. Do you think that current existing water supply systems are able to meet the overall water demand of the HHs in the villages? To what extent do you think that the water demand of the HHs is being met?

7. Why there is still inadequate supply of water to the HHs, in case the entire demand is not being met through existing water systems?

8. What are your roles and responsibilities? Tell us the specific activities you perform in relation of various water systems.

9. What are your views about the benefits to HHs of using water from existing systems?

10. Please tell us how the establishment cost for various water systems are finance? Major banks and MFIs providing loans for such installation.

11. What challenges do you think still continue at HHs in meeting water needs in general? What are the challenges you perceive at the level of water suppliers?

12. Which villages in the township do you suggest for us for the study? Please suggest 4-5 villages from the township to be covered and the 3 priority villages?

+ follow up questions emerging from the discussion on the above.