

## Lesson Plan 3: Operating Water Supply Schemes


**2 hours**

### Lesson Description



In this lesson, participants explore the factors that influence the successful operation of water supply schemes, activities required for effective operation, plan for common challenges, and examine how to cover costs related to operation and maintenance.

### Learning Outcomes



At the end of this session participants will be able to:

1. Describe factors which affect the operation of water supply schemes
2. List activities required in operating water supply schemes
3. Plan for challenges related to the operation of water supply schemes
4. Analyze different operation and maintenance tasks and how to pay for them

### Materials



- Flip chart paper
- Markers or chalk
- Handout: Factors affecting operation and maintenance of water supply schemes (1 per participant)
- Handout: Operational Challenge tables (1 copy each)
- Handout: Operation and Maintenance Activities (1 per participant)
- Handout: Case Study – Financing Operation and Maintenance (3-4 copies)
- Projector
- PowerPoint: Keeping the water flowing – Financing water supply schemes

### Preparation



- Read and prepare the lesson plan
- Review Part 1: Operating water supply schemes
- Review Part 2: Financing water supply schemes
- Print all required handouts
- Prepare PowerPoint and projector

### Introduction

**5 minutes**


1. Ask the participants to recall the previous lesson with the person who was operating their vehicle, tractor, or using some technology.

2. Explain to them that, in the same way there were a variety of things required to operate the vehicle, there are a variety of things involved in successfully operating water supply schemes, and that in this lesson they will explore this topic.
3. Present the learning outcomes or lesson description.

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**Part 1 – Factors which Influence Operation****15 minutes**

1. Tell the participants that before they start looking at operational activities, it is important to explore different factors that affect regular operation of water supply schemes.
2. Use an example such as the following example as a comparison. You may also use to wish another, more appropriate example – cell phones, tractors, pumps or engines, etc.
  - a. Operating a motorcycle
  - b. Factors influencing operation:
    - i. Age and condition of the motorcycle
    - ii. Amount of gasoline
    - iii. How busy the road is
    - iv. Weather conditions
    - v. How many people are riding the motorcycle
    - vi. Skill level with driving
3. Tell participants that because operating a water supply scheme is a far more complex activity than riding a motorcycle, the types of factors that influence operation are broader. However, effective management of a water supply scheme requires paying attention to each of these types of factors.



4. Explain that the four types of factors influencing water supply scheme operation are:
  - a. Technical factors
  - b. Managerial factors
  - c. Financial factors
  - d. Social factors



5. Post or write the four types of factors on flip chart paper or the board. You can also distribute the handout “Factors affecting operation and maintenance of water supply schemes” to participants (See end of lesson plan).
6. Share information with the participants about each of these types of factors. Explain that while often people focus on technical factors, inability to properly plan for and manage the other factors has been the main reason behind the failure of many water supply schemes.
7. Tell the participants that in the next activity, they will analyze different ways of avoiding, or mitigating, challenges related to these operational factors. By thinking about these now, they will be better prepared to manage the O&M of water supply schemes effectively.

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**Part 1 – Planning for Operation****30 minutes**

1. Tell the participants that you are going to do a group activity to explore the ways in which these factors influence operation of water supply schemes. They will think through ways they can prevent these from becoming problems, and how they would respond to them if they did happen.
2. Explain that you will divide participants into 4-6 groups (depending on number of participants.) You will give each group a situation based on one of the four factors.
3. Explain that in their group, they need to respond to 3 questions:
  - a. Why is this situation a problem for sustainable operation?
  - b. How could it be prevented?
  - c. How could you respond effectively if it did happen?
4. Divide participants into 4-6 groups



5. Either distribute one “*Operational Challenge table*” to each group, or give them one challenge and have them create their own table on a piece of flip chart paper (See end of lesson plan).
6. Check if there are any questions, and then give the groups 5-10 minutes to discuss their situation and the three questions.
7. Ask each group to present their challenge, why it is a problem, how it can be avoided, and how they would respond if it occurred.
8. Discuss each as a large group, adding any other important information. Continue until all groups have presented.

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**Part 2 – Operation and Maintenance Activities and Costs****35 minutes**

1. Explain that in the next activity, participants will look at a case study that has been created to represent different O&M activities of water supply schemes, costs associated with the activities, as well as revenue collection to cover those costs.

2. Tell the participants you are going to provide them with a table of the different types of operation and maintenance activities required for gravity-fed distribution systems. First, as a large group you will discuss the different activities and compare it to their current situation.



3. Distribute the “*Operation and Maintenance Activities*” handout to each participant. As a large group, discuss the different activities in the left column, and highlight the technical as well as “software” components it describes.
4. Tell the participants that a big challenge in operating water supply schemes over time is usually proper financial management and managing costs and revenue sustainability.
5. Explain that these costs are divided into two main categories – capital costs (initial costs and construction) and recurring costs (costs related to operation and maintenance). Planning for recurring costs is a key part of managing the O&M of water supply schemes.


6. Explain that a sample case study has been created to help them analyze their table of activities and estimate what the cost would be to operate and maintain the system. Explain that the values in the case study are not real. True costs will vary significantly by location. The focus is not on the numbers, it is practicing the analysis.
-  7. Divide participants into 3-4 groups and give each group a copy of the “Case Study - Financing Operation and Maintenance” handout. Give each group 5-10 minutes to work through their table, calculating the costs based on the values from the case study.
8. Review the total costs calculated by each group, as well as the total revenue and annual balance. The final values should be:
  - a. Annual costs: Rs 180,277.5
  - b. Annual revenue: Determined by group (Costs + Extra: Minimum = Rs 100.15 per month)
  - c. Annual balance: Determined by group (Revenue – Costs = Balance)
9. Discuss with participants the importance of managing cost and revenue in order to have a surplus balance. *It allows them to create an O&M fund, plan for future repairs or upgrades, and periods where the cash flow may go negative.*
10. Ask the participants if they have any questions. Clarify any difficulty or confusion they may have before continuing.

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## Part 2 – Covering Costs

**20 minutes**



1. Ask participants: “How can water supply schemes obtain revenue in order to continue operating over time?” – *Typically, tariffs or user fees.*
2. Ask participants: “How do you decide what to charge users in a water supply scheme?” Note their responses and discuss as a large group. *Answers may include: How much people can pay, based on local incomes, enough to cover operation and maintenance costs, community consultation, metered charges, pay scale, etc.*
3. Explain that there are 7 principles to keep in mind as they begin to think about sustainable cost recovery for the operation and maintenance of the water supply scheme.
4. Tell participants you are going to show a PowerPoint that will cover key areas of financing the sustainable operation and maintenance of water supply schemes. This presentation focuses more on tips and recommendations than heavy detail. User committees will need to develop their own measures for finances.
-  5. **Show the “PowerPoint: Keeping the water flowing” (Slides 1-2).** Discuss the 7 principles as a large group. Explain that these 7 points are all inter-dependent and affect one another.
6. Highlight that they have just completed a model exercise on the first bullet point: identifying the costs for operation and maintenance of a water supply scheme. Real financial calculations and budgets will be more detailed, but should include hardware, software, and managerial costs.
7. Highlight the second bullet point – maximize willingness to pay.
8. Ask the participants: “What are things will affect if the community is willing to pay for the continued operation of the water supply scheme over time?”
9. Discuss their ideas as a large group for 5 minutes. Record their ideas on flip chart paper.

10. **Present Slide 3** – Factors affecting willingness to pay. Tell participants these are linked to the four types of factors they discussed earlier – Technical, Managerial, Social, and Financial factors.
11. Discuss any remaining points and summarize the points raised by the group. Emphasize that willingness to pay is a good measure for the sustainability of the project over time.
12. Explain that by thinking about and addressing these different factors as they did in Part 1 of this lesson, they will directly enhance the community's willingness to pay.
13. **Present slide 4:** Setting appropriate tariffs. Discuss as a large group.
14. Ask the participants: "Why is equity an important consideration when setting tariffs?" *Equity is important to ensure that all people (men/women, disabled, young/elderly, rich/poor) in the community all have access to safe water.* Discuss their ideas as a large group.
15. Explain that a typical user fee for water supply should not be more than 3-5% of people's incomes. They may introduce artificially lower tariffs early on to increase adoption, and increase to cover true expenses over time.
16. Ask participants: "What are the negative implications if a tariff is too expensive?" *People will not be able to pay, or not willing to pay. The system will lack revenue and eventually fail to be sustainable.*
17. Explain that tariffs need to strike a balance between being too cheap and not recovering costs, and being too expensive and being unaffordable for the community.
18. **Present slide 5.** Discuss the four basic aspects of a financial management system with the large group and find out how comfortable and experienced they are in financial management. They may be very experienced or not experienced at all.
19. Explain that establishing processes for each of these four parts of a financial system will ensure funds are used and allocated appropriately, transparently, and sustainably. If well managed it will contribute to overall user willingness to pay.
20. **Present slide 6.** Ask participants: "Why is establishing alternative sources of funding important for sustainable operation over time?" – *It creates other sources of income in case user fees are insufficient, or in the event that there are expensive repairs or replacements to pay for.*
21. Ask the participants to find a partner.
22. In pairs, ask them to discuss: "What other financial sources could the water supply use besides user fees/tariffs?" *Possible responses include: Creating a voluntary fund people can donate to, establishing water kiosks or additional user charges, investment from the private sector, government subsidies, bank loans, micro-credit schemes, donations, municipal taxation, etc.*
23. Ask for several pairs of to volunteer ideas. Discuss as a large group and summarize their ideas.

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**Review****5 minutes**

1. In their pairs, ask participants to discuss:
  - What are the four factors which influence operation
  - Something new they learned about operating water supply schemes

## Factors affecting operation and maintenance of water supply schemes

### Technical

- Quality of the equipment
- Requirement for water treatment
- Use of chemicals
- Complexity of technologies and O&M activities
- Availability and cost of spare parts
- Water demand and number of users

### Managerial

- Ability to plan for operation and maintenance
- Ongoing and regular monitoring
- Availability of technical assistance
- Ability to communicate with community
- Human resources and staffing
- Leadership

### Financial

- Ongoing cost of running the system
- Budget for operation and maintenance activities
- Tariff structure
- Transparency

### Social

- Community ownership
- Gender-balanced development
- Understanding of benefits
- Habit to use the system
- Demand for service and improvements
- Ability and willingness to pay
- Maintenance culture within community

Adapted from: BRIKKÈ, F. (2000): Operation and Maintenance of rural water supply and sanitation systems. A training package for managers and planners. Malta: IRC International Water and Sanitation Centre and World Health Organisation. URL [\[http://www.bvsde.paho.org/bvsacg/i/fulltext/rural/rural.pdf\]](http://www.bvsde.paho.org/bvsacg/i/fulltext/rural/rural.pdf)

### Operational Challenge Table

<p><b>Financial Factor</b></p> <p>Community members say they cannot afford the tariffs, so they refuse to pay for service.</p>	
<p>Why is this a problem for operation?</p>	
<p>How could this problem be avoided?</p>	
<p>What could be done to respond to this problem?</p>	

### Operational Challenge Table

<b>Social Factor</b>	
The community believes that the organization that built the water supply scheme should be responsible for it, so they neglect to carry out tasks and monitor it.	
Why is this a problem for operation?	
How could this problem be avoided?	
What could be done to respond to this problem?	



### Operational Challenge Table

<p><b>Social Factor</b></p> <p>Women were not considered in the decision-making during planning and construction of the water supply scheme. It is not convenient for them to use, so they fetch water from other sources.</p>	
<p>Why is this a problem for operation?</p>	
<p>How could this problem be avoided?</p>	
<p>What could be done to respond to this problem?</p>	

### Operational Challenge Table

<b>Technical Factor</b>	
The parts for the system are expensive and cannot be purchased nearby.	
Why is this a problem for operation?	
How could this problem be avoided?	
What could be done to respond to this problem?	

### Operational Challenge Table

<b>Managerial Factor</b>	
No one in the community or user committee knows how to test for water quality or repair broken parts.	
Why is this a problem for operation?	
How could this problem be avoided?	
What could be done to respond to this problem?	

### Operational Challenge Table

<b>Social Factor</b>	
People do not know the link between safe drinking water and health, so they are not interested in using the system.	
Why is this a problem for operation?	
How could this problem be avoided?	
What could be done to respond to this problem?	

### Operation and Maintenance Activities

O&M Task	Frequency	Materials / Resources Needed		Activity Cost
		Materials	Quantity	
Ensure protection of water source				
Check catchment for leaks and repair if necessary				
Check all pipes and valves for leaks and repair if necessary				
Monitor tap-stand and ensure proper use				
Check tap-stands for leaks and repair if necessary				
Flush all pipes periodically				
Check reservoir tanks and repair if necessary				
Conduct water quality testing for contamination				
If contaminated, correct the problem and disinfect the system				

Measure water output periodically and check for leaks				
Record operation and maintenance activities in a record book				
Manage a stock of spare parts, tools, and supplies				
Provide ongoing training for operators and technicians				
Pay salaries				
Collect water fees and manage revenue				
Respond to user complaints				
Organize and conduct regular meetings				
Develop or deliver community education on WASH (water, sanitation, and hygiene)				

**Total Annual Costs:**

**Total Annual Revenue:**

**Annual Balance:**

## Case Study: Financing Operation and Maintenance

A village needs to find out how much it costs to operate and maintain their water supply system so they can manage their finances sustainably. The information below will help you calculate their annual costs.

The village has 150 people.

Number	Material / Human Resources	Cost
6	Meters of pipe each year	Rs 63.00 per meter of pipe
3	Elbow joints	Rs 27.00 per joint
2	Couplers	Rs 52.00 per coupler
3	Pipe clips	Rs 34.00 per pipe clip
4	Valves	Rs 112.00 per valve
1	PVC adhesive solution	Rs 305.00
1	Cement for repairs	Rs 5,000
1	Water quality testing kit	Rs 15,000
2	Community training	Rs 15,000 per training
150	Chlorine – 20L per person per day x 365 Days	Rs 0.0085/L
1	Skilled laborer / technician x 1 day per month	Rs 1500 per day
1	Support staff salary x 12 months	Rs 8,000 per month
1	Miscellaneous costs x 12 months	Rs 500 per month

**Costs:** What are their total annual operation and maintenance costs?

**Revenue:** How much should they charge each person to cover the costs + reserve fund?