

Agricultural Engineering Irrigation and Drainage Technology Year 2/2022-2023

Supervision of Pressurized Irrigation Maintenance (IDTPI601)

Credits: 4

Learning Hours: 40

By

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Purpose statement

- **UNIT 1 - DEVELOP A MAINTENANCE PLAN FOR A SMALL-SCALE IRRIGATION SYSTEM**
- **UNIT 2 - ORGANIZE RESOURCES**
- **UNIT 3 - CARRY OUT MAINTENANCE OF IRRIGATION SYSTEM COMPONENT AND TESTING**
- **UNIT 4 - CONTROL MAINTENANCE ACTIVITIES FOR PRESSURIZED IRRIGATION COMPONENTS**
- **UNIT 5 - PREPARE REPORT FOR PRESSURIZED IRRIGATION SYSTEM MAINTENANCE**

Purpose Statement

- This module describes the skills; knowledge and attitude required to Supervise pressurized irrigation maintenance.
- It is intended for learners pursuing TVET diploma of irrigation and drainage technology.
- At the end of this module the students will be able to develop a maintenance plan for pressurized irrigation system, organize resources, carry out maintenance of irrigation component and testing equipment, control maintenance activities for pressurized irrigation components and complete records and report of irrigation system maintenance.
- Qualified student deemed competent to this competency, may work with others in support of current professional practice in marshland, hillside, small scale irrigation, garden and greenhouses under guidance.

Group Work: 18-07-2023

- Discuss general indicators of Irrigation scheme performance.

(1 hour for research + 10 minutes for presentation)

Introduction

- ❑ Irrigation is a vital input in the agricultural productivity and agricultural growth.
- ❑ Irrigation system saves water, time and money.
- ❑ Right design of the system & how to maintain it.
- ❑ A large % of available water resources worldwide for irrigation purposes. Average **water use efficiency of irrigation projects**: 30-35%.
- ❑ Mistakes occur during installation → water use efficiencies reduced

Introduction

- ❑ Because of all that sun, the tropics don't experience the kind of seasons the rest of Earth does. [The tropical seasons](#) are broken up into just two: [the wet season \(rainy season\)](#) and [the dry season](#). The amount of rain can vary greatly from one area of the tropics to another.
- ❑ [Rwanda has a tropical climate](#) characterized by its hilly landscape stretching from east to west. The country has four primary climatic regions: eastern plains, central plateau, highlands, and regions around Lake Kivu.

Introduction

❑ Water efficiency at field level is by design between 50-60% for surface irrigation, 90% for drip irrigation, and 50% for sprinkler. However an increasing number of studies have shown that drip and sprinkler efficiencies can be as low as gravity.

Introduction

Pressurized Irrigation

- ❑ In pressurized irrigation systems **water is pressurized and precisely applied to the plants under pressure through a system of pipes.**
- ❑ Pressurized irrigation systems, as opposed to the surface irrigation systems, are more effective in application of irrigation water to the crops.

Introduction

Pressurized Irrigation

- They provide improved farm distribution, improved control over timing, reduced wastage of land in laying field distribution network, reduced demand for labour and better use of limited water resources.
- Variations, with 2 major ones: ***drip irrigation systems and sprinkler systems***, with variations too (***field type, crop & kind of water delivery fittings***), but the basic system components remain the same.

Introduction

- ❑ Control station (pressure is applied), mains and sub mains (pipes of differing dimensions), manifolds/feeder pipelines; and laterals or irrigating pipelines equipped with emitters (in **drip irrigation systems**) or other fixtures delivering water to plants or spray booms for forage and grains, and **centre-pivot systems (in sprinkler systems)**.
- ❑ Fertilizer injectors for fertigation (ICID, n.d.).
- ❑ **Trickle/drip irrigation** is a means of applying water efficiently to plants (Bucks, Nakayama, & Gilbert, 1979).

Three purposes of irrigation system maintenance

- ❑ Minimizing conveyance losses,
- ❑ Prevention of failure of control structures,
- ❑ Sustaining the hydraulic conditions required by the design for effective water distribution.

UNIT 1. DEVELOP A MAINTENANCE PLAN FOR A SMALL-SCALE IRRIGATION SYSTEM

- 1.1. Inspect Irrigation scheme
- 1.2. Establish maintenance check list
- 1.3. Elaborated maintenance schedule
- 1.4. Estimate cost of maintenance activities
- 1.5. Identify occupational Health and Safety risks
- 1.6. Establish control plan for OHS risks
- 1.7. Mitigate environmental impacts of maintenance activities
- 1.8. Develop reporting of planned activities

1.1. Irrigation scheme inspection

Irrigation Systems Maintenance Principles:

- ✓ Determine the problem timely
- ✓ Respond immediately to the problem
- ✓ Need based solution to the problem
- ✓ Availability of spare parts
- ✓ Vigilance of system components during operation
- ✓ Estimation of maintenance requirement
- ✓ Development of maintenance plan prior to season (ICID., n.d.).

1.1. Irrigation scheme inspection

General indicators of Irrigation scheme performance

- ❑ Indicators for irrigation performance assessment include water delivery, water use efficiency, maintenance, sustainability of irrigation, environmental aspects, socio-economics and management (Bos, 1997).
- ❑ Concerning the performance of irrigation water management, Kuscu et al (2009) mentioned that physical performance indicators include ***average irrigation ratio and relative water supply***.

3 distinct categories of performance measures

- ✓ ***Process measures***, related to a system's internal operations;
- ✓ ***Output measures***, focusing on a system's final output;
- ✓ ***Impact measures***, pertaining to the effects that the system's outputs induce in its larger environment (Small & Svendsen, 1990).

- ❑ For evaluating performances of large-scale schemes, irrigation water delivery performance and output performance indicators were used (Awulachew & Ayana, 2011).
- ❑ Irrigation performance indicators are crucial in monitoring the **spatial and temporal performances** of the scheme, and looking for causes and providing advice to **improve the overall productivity of the scheme** ([AIAP, 2022](#)).

Some key indicators

Adequacy and beneficial fraction or efficiency

- ✓ **Adequacy**: ratio of seasonal actual evapotranspiration (ETa) to seasonal potential evapotranspiration (ETp). It is therefore a measure of the degree of agreement between the actual water use and crop water requirement.
- ✓ **Beneficial fraction**: ratio of the water that is consumed as transpiration to overall field water consumption (ETa). It therefore shows the efficiency of on farm water and agronomic practices in use of water for crop growth ([AIAP, 2022](#)).

Assessing the Condition of Irrigation components

- ☐ Sensors
- ☐ Connections
- ☐ Drains
- ☐ Water emitters
- ☐ Controllers
- ☐ Operation equipments
- ☐ Piping and fittings
- ☐ Flow control devices
- ☐ Fertigation equipments
- ☐ Filtration system

Water lifting devices

- Rotodynamic pumps
- Positive displacement pumps

Water measurement devices

- Pressure gauge
- Current meter
- Water meters
- Propeller meter

Water source

- Water discharge
- Water quality for irrigation

1.2. Maintenance check list establishment

- ❑ Identify maintenance activities required for each irrigation system component

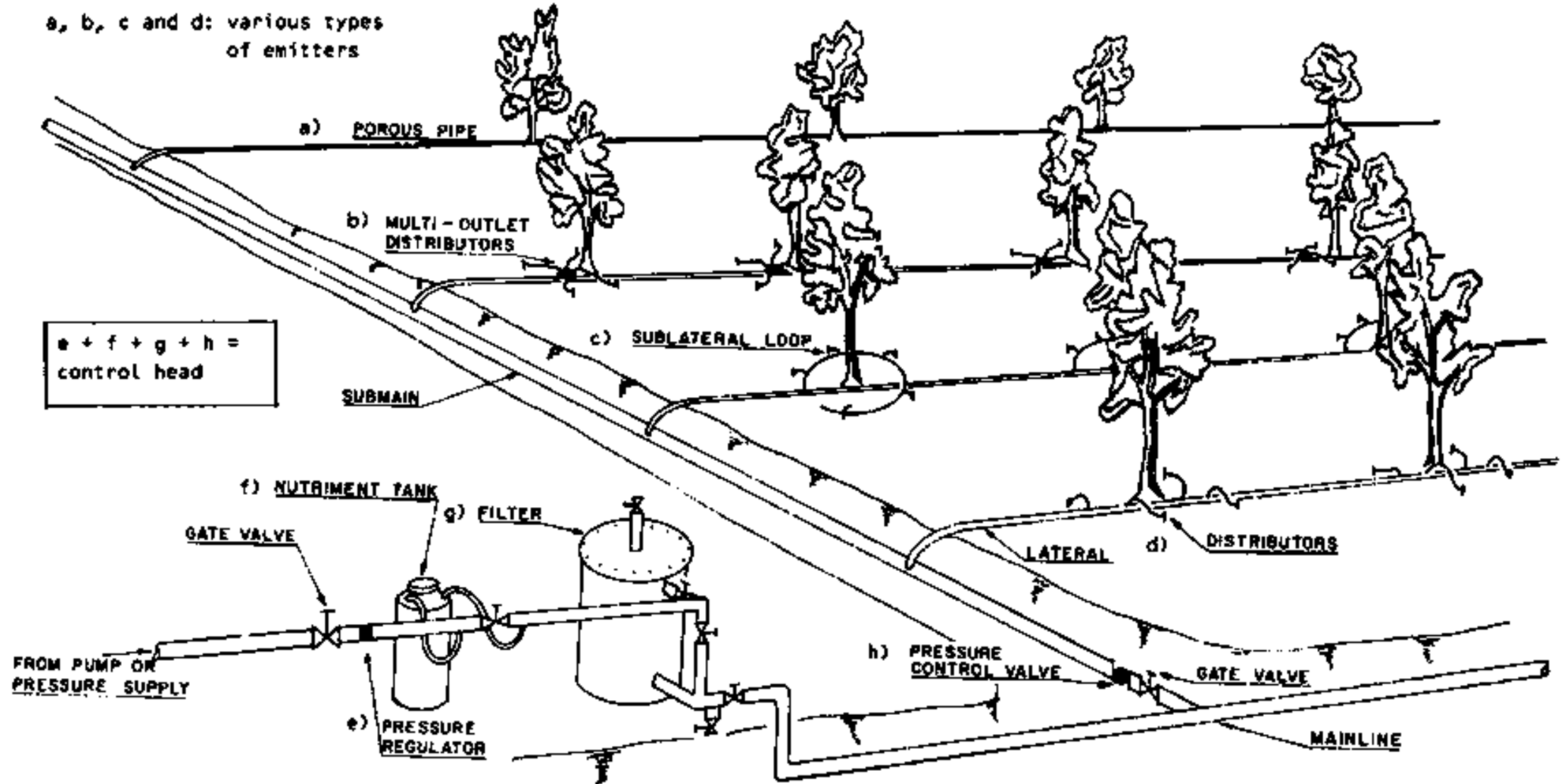
Maintenance check list format

- ☐ Facility name
- ☐ Structure type
- ☐ Current status/Existing condition
- ☐ Description of deterioration
- ☐ Grading of deterioration
- ☐ Possible cause of deterioration
- ☐ Remedy

Types of maintenance

- ☐ Routine maintenance
- ☐ Special maintenance
- ☐ Deferred maintenance: maintenance work that is postponed due to limitations in available resources, such as time, staffing, or funds

Drip irrigation components



Sprinkler irrigation components



Center pivot irrigation components



1.3. Maintenance schedule elaboration

Maintenance types

- ☐ Corrective maintenance
- ☐ Preventive maintenance

Maintenance activities and priorities

- ☐ Greasing
- ☐ Flushing
- ☐ Oiling/lubrification
- ☐ Calibration
- ☐ Painting
- ☐ Recharging batteries

1.3. Maintenance schedule elaboration

Maintenance types

- ❑ Irrigation components have a finite life span.
- ❑ **A good preventive maintenance program can prolong the life of irrigation equipment and keep it running efficiently.**
- ❑ The specific preventive maintenance procedures and intervals vary from course to course depending on the type of irrigation equipment and its age.
- ❑ In general, an irrigation system preventive maintenance program involves the **observation, adjustment and maintenance at regular intervals of sprinklers, valves, controllers and other components.**

1.3. Maintenance schedule elaboration

Maintenance types

□ The following activities typically form the foundation for a preventive maintenance program:

- 1) **Daily maintenance** involves checking for wet and dry areas, monitoring the pump system and checking the central controller to ensure it is properly programmed.
- 2) **Weekly maintenance** often includes observing sprinkler operation to make sure they are properly rotating and that there are no leaks or clogged nozzles.
- 3) Less-frequent but important jobs include **semiannual pump system maintenance and raising and leveling sprinklers**.

1.3. Maintenance schedule elaboration

Maintenance types

❑ Some benefits of preventive maintenance:

- 1) Water conservation.
- 2) Prevent catastrophic failures.
- 3) Reduced energy consumption.
- 4) Maintain irrigation efficiency.
- 5) Prolong the life of an irrigation system and reduces long-term costs.

Preventive maintenance

- ❑ ***Water filtration,***
- ❑ ***Chemical treatment,***
- ❑ ***Pipeline flushing,***
- ❑ ***Field inspection*** (Bucks, Nakayama, & Gilbert, 1979).

Irrigation system components to be maintained

- ☐ Pumps and motors
- ☐ Conveyance system
- ☐ Sprinkler heads
- ☐ Drippers
- ☐ Filters
- ☐ Fertigation equipments
- ☐ Irrigation controllers
- ☐ Center pivot components

1.4. Maintenance activities cost estimation

Key sensitivities elements driving maintenance costs

☐ Operation and maintenance costs.

☐ Capital cost, interest rate

☐ Water cost

☐ Power cost

☐ Labor cost

☐ Materials, tools and equipments costs (Cost of spare parts)

☐ Transport costs

☐ Communication costs

☐ Consumables cost

1.5. Identify occupational Health and Safety risks

Most Common Hazards in a Workplace

Categories of hazards:

- ✓ Biological hazards
- ✓ Chemical hazards
- ✓ Physical hazards
- ✓ Safety hazards
- ✓ Ergonomic hazards
- ✓ Psychosocial hazards

Managing Hazards in the Workplace

- ✓ Appropriate risk assessment
- ✓ Appropriate risk control measures

1.6. Establish control plan for OHS risks

Personal Safety Behavior in the Working place

- ☐ Safety signs
- ☐ First aid kit
- ☐ Fencing and locking
- ☐ Fire (Fire extinguisher & Fire alarm)

Main ways to prevent a hazard

- ☐ Incineration
- ☐ Dumping
- ☐ **PPES** (Personal protective equipment)
- ☐ Administrative controls
- ☐ Engineering control

Safety of materials, tools and machineries

- ❑ Check manufactures' instructions

1.7. Mitigate environmental impacts of maintenance activities

- ❑ Environmental impacts of irrigation maintenance activities
- ❑ Strategies for mitigating Environmental impacts associated with Irrigation maintenance

1.8. Develop reporting of planned activities

Importance of maintenance plan and report

- ☐ Reason of maintenance plan
- ☐ Reason of maintenance report
- ☐ Maintenance data recording techniques

Report format

- Key components of a report
- Special report formats exist

Group Assignment: July 24, 2023

- 1) By means of examples, differentiate operation costs from maintenance costs considered in pressurized irrigation.
- 2) Briefly explain the types of hazards that may occur during maintenance activities of pressurized irrigation.
- 3) By using examples, explain environmental impacts of irrigation maintenance activities.
- 4) Identify an equipment to be maintained in drip/sprinkler irrigation and prepare a draft for maintenance activities report.

(1 day for research & 10 minutes for presentation on 25-07-2023)

2. ORGANIZE RESOURCES

- 2.1. Select materials, tools and equipment and machinery
- 2.2. Recruit competent labors
- 2.3. Notify affected parties.
- 2.4. Mobilize and organize delivery of materials, equipment and machinery
- 2.5. Estimate financial resources for maintenance activities
- 2.6. Organize personnel on site

2.1. Select materials, tools and equipment/machinery

Materials to consider

- ✓ Fittings and accessories
- ✓ Tubings
- ✓ Couplings

Necessary tools

- ✓ Measuring and layout tools
- ✓ Alignment tools
- ✓ Marking tools
- ✓ Cutting tools
- ✓ Fixing and holding tools
- ✓ Hammering tools
- ✓ Agricultural tools

Machinery/equipment

- ✓ Boring equipment
- ✓ Pumping equipments
- ✓ Threading machines and dies
- ✓ Drilling machines
- ✓ Welding machines
- ✓ Agricultural equipment

❑ Quality parameters of irrigation equipment and machineries

2.2. Recruit competent labors

Staffing

- ✓ Job description
- ✓ Selection criteria
- ✓ Recruitment criteria
- ✓ Conduct Exams
- ✓ Training of new staff
- ✓ Orientation and placement
- ✓ Method of remuneration

2.3. Notify affected parties on the works to be undertaken

- ☐ Environmental effects associated with pressurized irrigation maintenance
- ☐ Identify people nearby
- ☐ Notification ways

2.4. Mobilize and Organize delivery of materials, tools and equipment/machinery

- Materials, equipment and machinery specifications
- Logistics and procurement (Transport means, Tax declaration & Import permit)
- Delivery note
- Coding
- Storing
- Resource mobilization (Social inclusion of beneficiaries and partners)

2.5. Estimate financial resources for maintenance activities

- ☐ Irrigation facilities deterioration level
- ☐ Depreciation of machines or equipments
- ☐ Maintenance budget estimation
- ☐ Lifespan of purchased machines or equipments

2.6. Organize Personnel on site

Good planning of the project

- ☐ Work schedule
- ☐ Work with deadlines
- ☐ Define priorities

Use project management softwares

- ☐ Good communication
- ☐ Use digital Kanban boards
- ☐ Measure progress regularly

Staffing the maintenance services

- ☐ Laborers
- ☐ Ganger or headman
- ☐ Overseer
- ☐ Work inspector
- ☐ Machine operator
- ☐ Mechanics
- ☐ Chief maintenance

Task assignment

- Workload analysis
- Allocation of works
- Follow up and evaluation

Group work: 25-07-2023

Q1) By giving examples, differentiate a trained worker from a competent worker.

Q2) Discuss the specifications of at least 10 important materials, equipments and machines used in irrigation.

Q3) Discuss key considerations for good planning of an irrigation project.

3. CARRY OUT MAINTENANCE OF IRRIGATION SYSTEM COMPONENT AND TESTING

- 3.1. Implement preventative maintenance
- 3.2. Conduct equipment troubleshoot
- 3.3. Remove silt, weeds, microorganism in irrigation components
- 3.4. Replace and adjust defective parts update maintenance and calibrations records test the system

3.1. Implement preventive maintenance

What is preventive maintenance?

- Any maintenance activity, such as an inspection, servicing or replacement, that's performed as part of **a scheduled plan, rather than as a response to a breakdown**, can be considered preventive maintenance.

3.1. Implement preventive maintenance

What is the purpose of preventive maintenance?

- By identifying components or parts that are wearing out and repairing or replacing them before they fail, an effective preventive maintenance program can help **limit production downtime and extend the service life of equipment and facilities.**

3.1. Implement preventive maintenance

Preventive maintenance for pressurized irrigation

- ☐ Prevent catastrophic failures of the system
- ☐ Reduce energy consumption
- ☐ Maintain irrigation efficiency

Best management practices

- ☐ Review often the conditions of infrastructures
- ☐ Follow manufacturer's recommendations
- ☐ Keep the records of maintenance

Reasons for poor maintenance

- ☐ Insufficient funds
- ☐ Lack of interest by the farmers
- ☐ Poor organization

3.2. Conduct equipment troubleshoot

- ☐ Most sensitive components requiring troubleshooting
(Troubleshooting of electrical and electronic irrigation devices)
- ☐ Pump troubleshooting
- ☐ Filter troubleshooting
- ☐ Troubleshooting of an irrigation controller
- ☐ Troubleshooting of irrigation softwares
- ☐ Troubleshooting of control panel

3.3. Remove silt, weeds, micro organism in irrigation components

Common defects

- ☐ Clogging of filters
- ☐ Clogging of emitters
- ☐ Blockage of pipe network
- ☐ Algae growth in system leaks

Types of cleaning activities

- ☐ Filter cleaning
- ☐ Flushing the system
- ☐ Acidification

- ❑ **The most serious problem in trickle irrigation is clogging of emitters or applicators.**
- ❑ Emitter clogging can become a major problem with many systems unless **correct preventive measures** are taken.
- ❑ Clogging will adversely affect the **rate of water application and uniformity of water distribution, and increase operating costs**, as it becomes necessary to check, replace, or reclaim bad emitters.
- ❑ **The greatest loss can be the grower's confidence with the trickle irrigation method (Bucks, Nakayama, & Gilbert, 1979).**

Two approaches to solve the clogging problem in trickle irrigation

- ❑ Develop emitter devices which may require less or minimum maintenance (Wilson, 1972; Solomon, 1977).
- ❑ Focus attention on improving the quality of water before it reaches the emitters (Bucks, Nakayama, & Gilbert, 1979, Ford & Tucker, 1974; McElhoe & Hilton, 1974; Ford, 1976; Bucks et al., 1977; Nakayama et al., 1978).

Principal physical, chemical, and biological contributors to clogging of trickle systems (Bucks, Nakayama, & Gilbert, 1979).

A. Physical: suspended solids

1. *Organic*

(a) Aquatic plants (phytoplankton
/algae)

(b) Aquatic animals (zooplankton)

(c) Bacteria

2. *Inorganic*

(a) Sand

(b) Silt

(c) Clay

B. Chemical: precipitation

1. Calcium or magnesium carbonate

2. Calcium sulfate

3. Heavy metal hydroxides, oxides,
carbonates, silicates, and sulfides

4. Fertilizers

(a) Phosphate

(b) Aqueous ammonia

(c) Iron, zinc, copper, manganese

C. Biological: bacteria and algae

1. Filaments

2. Slimes

3. Microbial depositions

(a) Iron

(b) Sulfur

(c) Manganese

3.4. Replace and adjust defective parts

- ☐ Identification of component defect and specification
- ☐ Isolation of component defect
- ☐ Replacement or adjustment of defective part.
- ☐ System testing and recovery to the normal status
- ☐ Disposal of defective parts

3.5. Update maintenance and calibrations records

- ☐ Equipment maintenance log(EML)
- ☐ Importance of equipment maintenance log (EML)
- ☐ EML update
- ☐ Record keeping

3.6. Test The system

Uniformity testing of the system

- ☐ Amount of water applied
- ☐ Factors affecting amount of water applied
- ☐ Water flow

Pump testing

- Net positive suction of a pump
- The Pressure requirement
- Main drain test

3.6. Test The system

Test system efficiency

- ❖ Conveyance efficiency
- ❖ Distribution efficiency
- ❖ Application efficiency

Irrigation system (Project) efficiency, E_p

$$E_p = W_{pl}/W_{OHW} = E_t E_c E_a$$

- Conveyance (transportation) efficiency :

$$E_t = W_{ib}/W_{OHW}$$

W_{OHW} = water released at the headwork

W_{ib} = water received at the inlet of the block of field

- Field channel efficiency, E_c :

$$E_c = W_{if}/W_{ib}$$

W_{if} = water received at the field inlet

- Field application efficiency, E_a :

$$E_a = W_{pl}/W_{if}$$

W_{pl} = water actually made available to crop

Irrigation system (project) efficiency (cont'd)

Water distribution efficiency, E_d

$$E_d = E_t \cdot E_c$$

Farm efficiency

$$E_f = E_c \cdot E_a$$

❑ In irrigation systems the conveyance efficiency provides the best way of assessing whether canal maintenance is required (Bos, 1997).

3.7. Check water distribution test, leakage and pump faults

Common Pump faults

- Sucking failure
- Shaft bending
- Breaking of impeller
- Friction in the bearings
- Overheating
- Abnormal sound

Common causes of pipe leakages

- ☐ High pressure
- ☐ Less outlets
- ☒ Untightened flanges
- ☐ Inappropriate PVC pipes

✓ **Water application efficiencies**

3.7. Check water distribution test, leakage and pump faults

Water application efficiencies

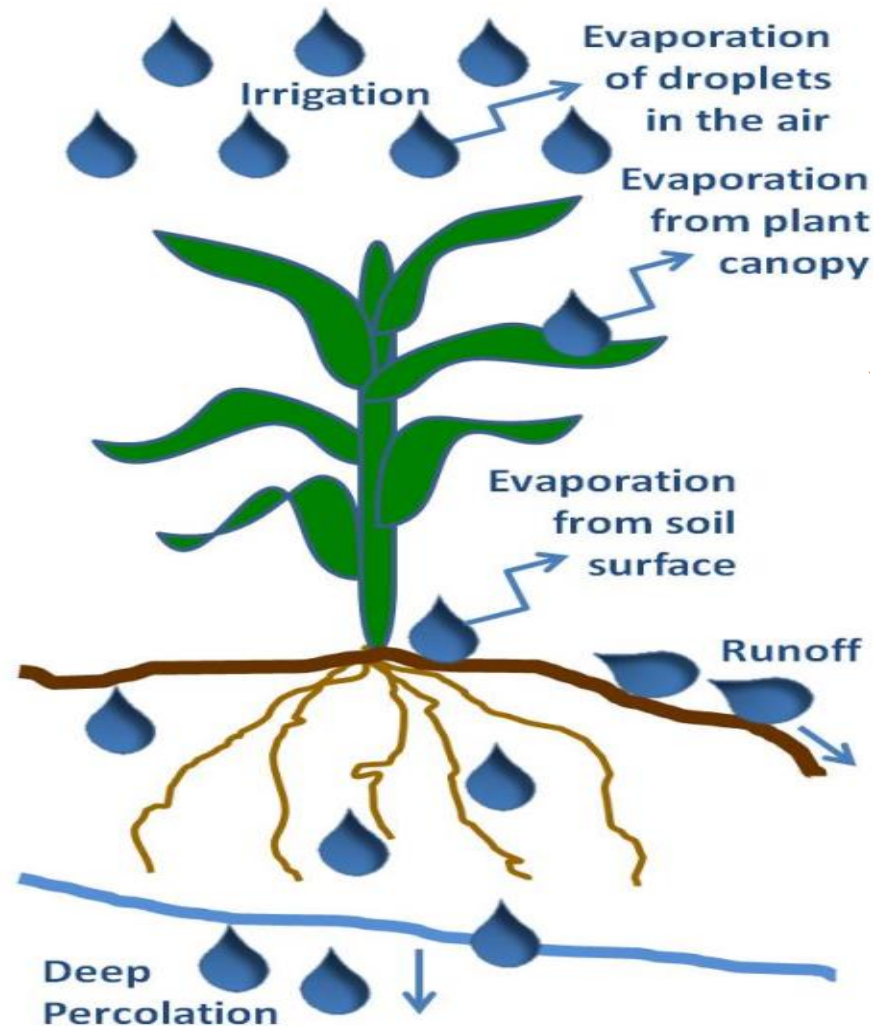
- Water application efficiency is a measurement of how effective the irrigation system is in storing water in the crop root zone.
- It is expressed as the percentage of the total volume of water delivered to the field that is stored in the root zone to meet crop evapotranspiration (ET) needs.

3.7. Check water distribution test, leakage and pump faults

Mechanisms of Water Losses

- Irrigation systems should be evaluated in order to limit the following common losses of water from irrigation applications.
 - 1) Evaporation from the soil and plant surfaces
 - 2) Runoff from the target site
 - 3) Deep percolation below the root zone

3.7. Check water distribution test, leakage and pump faults



Mechanisms of Water Losses

ASSIGNMENT 1: 25-07-2023

Q1) Find and review a video showing how the dry pipe valve trip tests (Partial trip test & Full trip test) are performed.

Q2) Describe how to maintain irrigation efficiency.

Q3) Outline the most sensitive components requiring troubleshooting for drip/sprinkler irrigation system.

Q4) By providing an example, briefly explain an equipment maintenance log (EML) which can be considered in irrigation.

ASSIGNMENT 2 : 25-07-2023

Discuss about;

- 1) Implementation of maintenance checklists of irrigation system components
- 2) Monitoring maintained components
- 3) Identification of investigated abnormal operation
- 4) Identification of actions to be undertaken for correcting operation fault
- 5) Identification of situations requiring special expertise
- 6) Ways to ensure routine review of equipment condition

ASSIGNMENT 3 : 25-07-2023

- 1) Participatory monitoring and evaluation
- 2) Discuss common detected malfunctions of pressurized irrigation system.
- 3) Identify situations requiring special expertise for an irrigation system.
- 4) Outline the important parts of an irrigation maintenance report.

4. CONTROL MAINTENANCE ACTIVITIES FOR PRESSURIZED IRRIGATION COMPONENTS

- 4.1. Implement maintenance checklists of irrigation system components
- 4.2. Monitor maintained components
- 4.3. Identify investigated abnormal operation
- 4.4. Identify actions to be undertaken for correcting operation fault
- 4.5. Identify situations requiring special expertise
- 4.6. Ensure routine review of equipment condition

4.1. Implement maintenance checklists of irrigation components

Normal functioning of irrigation system components

- The irrigation system consists of a (main) intake structure or (main) pumping station, a conveyance system, a distribution system, a field application system, and a drainage system.

4.1. Implement maintenance checklists of irrigation components

Normal functioning of irrigation system components

- [Drip Irrigation System](#) – Components and their Function

4.1. Implement maintenance checklists of irrigation components

Normal functioning of irrigation system components

- A sprinkler system usually consists of the following components (i) A pump unit (ii) Tubings- main/submains and laterals (iii) Couplers (iv) Sprinkler head (v) Other accessories such as valves, bends, plugs and risers.

4.2. Monitor maintained components

- ❑ Monitoring the maintained component
- ❑ Participatory monitoring and evaluation
- ❑ Advantages of monitoring the maintained component
- ❑ Performance indicators of the maintained component
- ❑ Pump efficiency
- ❑ Water distribution uniformity
- ❑ Monitoring and evaluation design and process
- ❑ Use of logical framework

4.2. Monitor maintained components

□ What is a Monitoring and Evaluation (M&E) system?

- In development work, a Monitoring and Evaluation (M&E) system represents all the things that need be undertaken before, during and after programme implementation, in order to track and measure progress (and success) in achieving the goal.

4.2. Monitor maintained components

❑ What is a Monitoring and Evaluation (M&E) system?

[Blank template for depicting a M&E System](#)

	INDICATOR	DEFINITION How is it calculated?	BASELINE What is the current value?	TARGET What is the target value?	DATA SOURCE How will it be measured?	FREQUENCY How often will it be measured?	RESPONSIBLE Who will measure it?	REPORTING Where will it be reported?
Goal								
Outcomes								
Outputs								

4.2. Monitor maintained components

❑ What is a Monitoring and Evaluation (M&E) system?

[The sample M&E system template completed](#)

	INDICATOR	DEFINITION How is it calculated?	BASELINE What is the current value?	TARGET What is the target value?	DATA SOURCE How will it be measured?	FREQUENCY How often will it be measured?	RESPONSIBLE Who will measure it?	REPORTING Where will it be reported?
Goal	Percentage of Grades 6 primary students continuing on to high school.	Number students who start the first day of Grade 7 divided by the total number of Grade 6 students in the previous year, multiplied by 100.	50%	60%	Primary and high school enrolment records.	Annual	Program manager	Annual enrolment report
Outcomes	Reading proficiency among children in Grade 6.	Sum of all reading proficiency test scores for all students in Grade 6 divided by the total number of students in Grade 6.	Average score: 47	Average score: 57	Reading proficiency tests using the national assessment tool.	Every 6 months	Teachers	6 monthly teacher reports
Outputs	Number of students who completed a summer reading camp.	Total number of students who were present on both the first and last	0	500	Summer camp attendance records.	End of every camp	Teachers	Camp review report

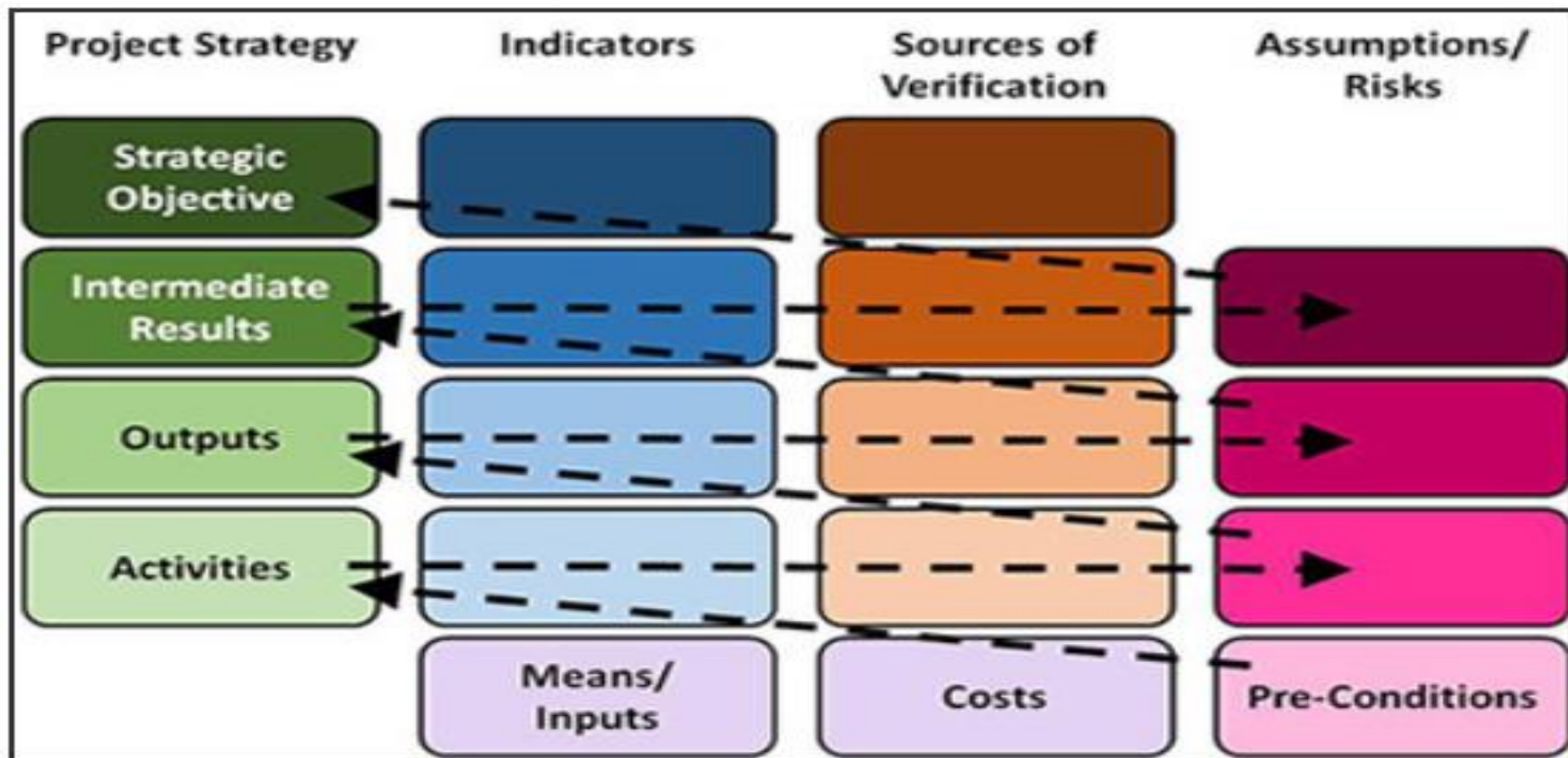
4.2. Monitor maintained components

❑ Use of logical framework

- A Logframe is another name for Logical Framework, a planning tool consisting of a matrix which provides an overview of a project's goal, activities and anticipated results. It provides a structure to help specify the components of a project and its activities and for relating them to one another.

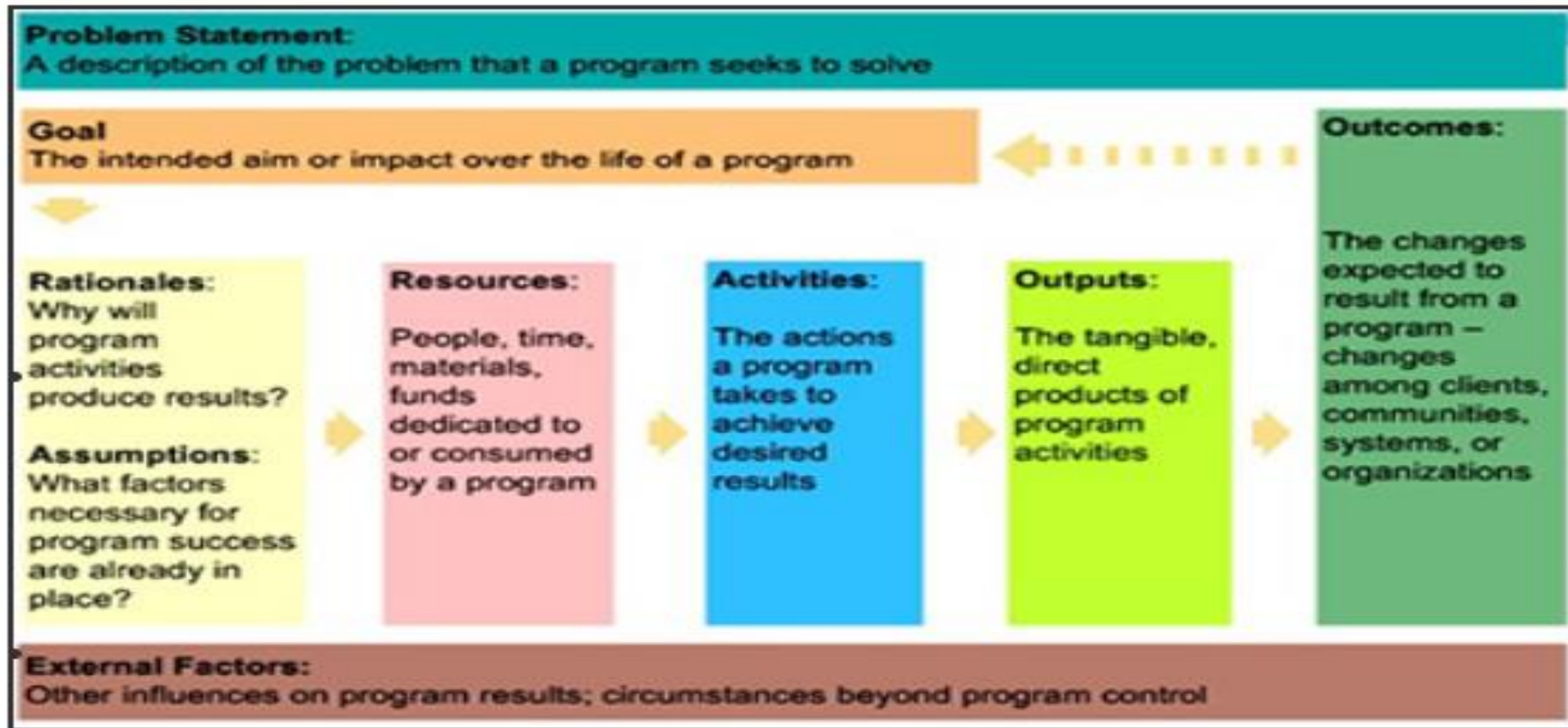
4.2. Monitor maintained components

❑ Use of logical framework



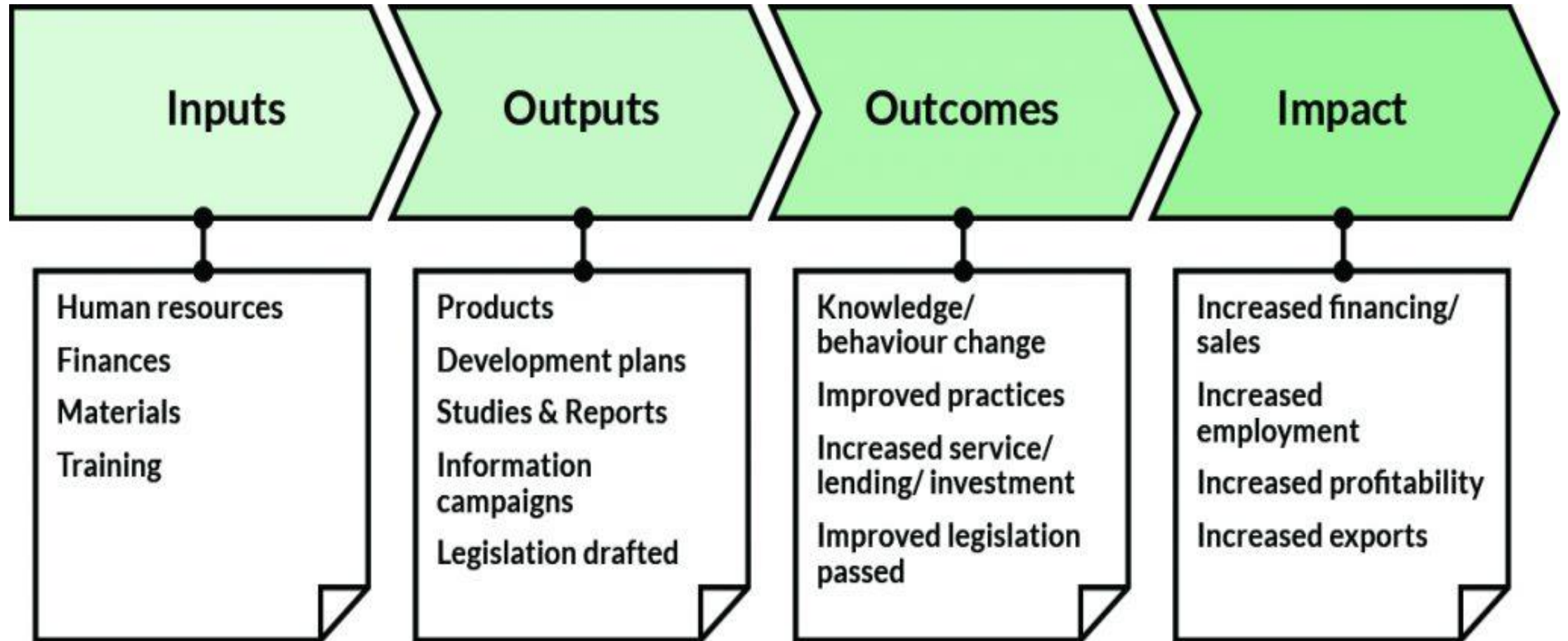
4.2. Monitor maintained components

□ Use of logical framework



4.2. Monitor maintained components

❑ Use of logical framework



4.3. Identify investigated abnormal operation or frequent and recurring breakdowns

Common detected malfunctions of pressurized irrigation system

- ☐ Leaking irrigation lines
- ☐ Lateral line leaks
- ☐ Leaking sprinkler heads
- ☐ Pump malfunctioning (Sucking failure, Pump overheating & Abnormal pump sound)

4.3. Identify investigated abnormal operation or frequent and recurring breakdowns

Common detected malfunctions of pressurized irrigation system

Filter Malfunctioning

➤ Filter clogging

High pressure differential

Identification of unpredicted phenomena:

- ☐ Fault controller due lightening and thunder strikes
- ☐ System running when it is raining

4.4. Identify actions to be undertaken for correcting operation fault

- ❑ Common operation faults in irrigation system
- ❑ Correct the operation faults in irrigation system

4.5. Identify situations requiring special expertise

- ☐ Identification of the fault
- ☐ Reporting the fault

4.6. Ensure routine review of equipment condition

- ☐Availing the emergency replacement parts or components
- ☐Identifying and inspecting the most sensitive components
- ☐Recording machine working hours

5. PREPARE REPORT FOR PRESSURIZED IRRIGATION SYSTEM MAINTENANCE

5.1. Record maintenance activities

5.2. Prepare and submit maintenance report

5.1. Implement maintenance checklists of irrigation components

- ☐ Identify maintained activities
- ☐ Use of Equipment Maintenance Log (EML)
- ☐ Steps to record maintenance activities in the EML or Maintenance Log book
- ☐ Importance of record making
- ☐ Record keeping
- ☐ Record management

5.1. Implement maintenance checklists of irrigation components

What is an equipment maintenance Log (EML) ?

- An equipment maintenance log is a document that organizations use to record asset maintenance activities.
- It enables them to monitor their system checkup processes and track maintenance tasks performed by technicians, the exact time the tasks were performed, and each specific task's purpose

5.1. Implement maintenance checklists of irrigation components

Example of an equipment maintenance Log (EML)

Equipment Maintenance Log						
Equipment Name				Manufacturer		
Serial Number				Manufacturer P/N		
Plant Location				Manufacturer's contact details:		
Date manufactured				Date in service		
Maintenance Activity						
Date	Maintenance description	Maintenance performed by:	Validated by:	Date of validation	Next activity due on:	Remarks

5.2. Prepare and submit maintenance report

- Report writing
- Report format
- Reporting procedures
- Report submission & Reporting channels
- Importance of reporting
- Common errors/mistakes done in reporting

5.2. Prepare and submit maintenance report

Importance of reporting

- A [report](#) is a tool to help stakeholders take decisions. A report is the basic management tool for making decisions and to help solve problems.
- **Communication with external stakeholders:** It helps to communicate information to not just the internal stake holders but also with external stakeholders.

5.2. Prepare and submit maintenance report

Benefits of Using a Maintenance Report

- **Assists in Maintaining Reliability:** A maintenance report can help improve your equipment's reliability by providing a record of all maintenance activities. If there are any issues with your equipment, you can refer back to the maintenance report to see if anything was missed.
- **Improves Maintenance Planning:** Another benefit of a maintenance report is that it can help with maintenance planning. By having a record of all maintenance activities, you can plan future maintenance tasks more easily. This is because you can see what needs to be done and when it needs to be done.

5.2. Prepare and submit maintenance report

Benefits of Using a Maintenance Report

- **Good Recordkeeping:** A maintenance report is also a good way to keep track of all the different maintenance tasks that have been carried out. This can be useful for businesses with a lot of equipment or machinery. By keeping a record of all the maintenance tasks, you can easily track what needs to be done and when.
- **Prevents Unexpected Breakdowns:** One of the most important benefits of a maintenance report is that it can help to prevent unexpected breakdowns. By having a record of all maintenance activities, you can ensure that all tasks are carried out properly and on time. This means that there is less chance of something going wrong and causing a breakdown.

5.2. Prepare and submit maintenance report

Benefits of Using a Maintenance Report

- **Helps to Achieve Maintenance Goals:** A maintenance report can also help you to achieve your maintenance goals faster. It can help you track your progress and identify any areas that need improvement. That way, you can focus your efforts on the areas that need it the most.
- **Saves Time and Money:** Finally, a maintenance report can save both time and money. By having a record of all maintenance activities, you can plan maintenance tasks more efficiently. This means that you can avoid carrying out tasks that are not necessary, which can save both time and money.

5.2. Prepare and submit maintenance report

How to Create a Maintenance Report Form

- Choose a reporting format.
- Identify the elements that should be included.
- Create the report.
- Review the report.

5.2. Prepare and submit maintenance report

Things to Include in a Maintenance Report

- Category
- Location
- Date and Time
- Description
- Pictures
- Signature

5.2. Prepare and submit maintenance report

Things to Include in a Maintenance Report

- **Category:** Maintenance managers and engineers should always assign a category to each maintenance activity. This will help keep track of the different types of maintenance tasks being carried out. Categories can include **preventative maintenance, emergency maintenance, or corrective maintenance.**

❑ Effective and efficient irrigation performance depends heavily on the mutual cooperation of all involved (Murray-Rust & Snellen, 1993).

Recommended Resources

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- Kuscu, H., Bölüktepe, E.F. & Demir, A.O. (2009). Performance assessment for irrigation water management: A case study in the Karacabey irrigation scheme in Turkey. *African Journal of Agricultural Research* 4(2):124-132

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- Ford, H.A. and Tucker, D.P.H., 1974. Clogging of drip systems from metabolic products of iron and sulfur bacteria. Second Int. Drip Irrig. Congr. Proc., San Diego, Calif., pp. 212--214.
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- Nakayama, F.S., Gilbert, R.G. and Bucks, D.A., 1978. Water treatment in trickle systems. J. Irrig. Drain. Div., ASCE, 104 (IRI): 23--34.
- Small, L.E., Svendsen, M. A framework for assessing irrigation performance. *Irrig Drainage Syst* **4**, 283–312 (1990).
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Recommended Resources (cont'd)

- ❖ Maintaining Drip Irrigation Systems | l'entretien d'un système de micro-irrigation: <https://www.youtube.com/watch?v=v1PjCvFyZ4M>
- ❖ Irrigation System Maintenance: <https://www.youtube.com/watch?v=ava89K3TqxQ>

Recommended Resources (cont'd)

- ❖ How to Clean Clogged or Blocked Drip Irrigation Emitters:
https://www.youtube.com/watch?v=TGm-dE_4OBY
- ❖ How to Troubleshoot and Repair Weak Drip Irrigation:
<https://www.youtube.com/watch?v=cBjCIWXd3i4>