Finding the sustainability in water supply and distribution systems

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Layout of the presentation

• Introduction
• Why sustainability is such a challenge
• Sustainability factors
• Efficiency
• Finding the sustainability
• Conclusion
Introduction

• Sustainable water systems should provide adequate water **quantity** and appropriate water quality for a given need, without compromising the future ability to provide this capacity and **quality**.

• Accessing the sustainability features in water supply (the three-fold goals of economic feasibility, social responsibility and environmental integrity) is linked to the purpose of water use.
Why sustainability is such a challenge

There are many inter-related reasons why the achievement of sustainability poses such a challenge (3 particularly important reasons stand out):

1. Limited capacity (in the sense of knowledge, skills and material resources) of communities, local government institutions and other service providers to manage systems.

2. Inadequacy of financial revenues to cover the full operation, maintenance and capital maintenance costs of infrastructure.

3. Relates to the historical approach to service delivery by different departments. This has been carried out in a fragmented way, with sometimes competing agendas.
Sustainability factors

Quality of project designs, Type of technology, Quality of infrastructure, Proper handover of new infrastructure, Spare parts supply, Infrastructure that works as required, Continuous upgrading of infrastructure, Preventative maintenance, Rate and extent of breakdown of infrastructure, Performance by consultants, Performance by contractors, Capacity to maintain infrastructure, Capacity to operate infrastructure, Performance by suppliers, Use of alternative water sources, Efficiency of using water resources, Rewards for good operation, Rewards for good maintenance, Involvement of trained personnel, Involvement of motivated personnel, Organisational structure adaptation to a project, Organisational culture adaptation to a project, Human resources management, Realistic objectives, Stability of operating environment, Population growth rate, Developmental improvements, Equity in distribution of water resources, Environmental considerations, Protection of water source, Perennial source of water, Quantity of raw water, Quality of raw water, Stakeholder participation, Gender and poverty focus, Social considerations, User involvement, Demand-responsive approach, User satisfaction with a service, Equity in distribution of water supply services, Achievement of benefits by users e.g. health and economic benefits, Community participation, Full cost recovery tariffs, Collection of all generated revenue, Operation cost, Maintenance cost, Institutional set-up, Management type of water supply system, Assessment and addressing of risks, Lessons from past projects/organisational learning, Involvement of senior managers, Troubleshooting, Continual evaluation and improvement, Post-project implementation external support, Project owner requirements, Project sponsor regulations, Health and safety measures, Supervision by superiors e.g. district authorities, government ministry, Water loss that is within acceptable levels, Water demand management, Climate change impacts, Continued use of supplied water, Growth of water demand, Age of infrastructure, Continued training, Incentives for stakeholders, Political support/ interference, Geographic focus, Supply of maintenance tools, Institutional set-up, Availability/adequacy of supplies e.g. power supply, Appropriateness of policies, Wasteful usage of water, Leaking water supply facilities, Activities taking place in water catchment area, Realisation of service provider expectations......

Sustainable factors

The 7 combined effects are:
1. Quantity of available raw water;
2. Quality of available raw water;
3. Capacity of infrastructure to produce and supply adequate water continually;
4. Capacity of infrastructure to produce safe water continually;
5. Continuity of infrastructure to function as required at the design stage;
6. Capacity to operate the infrastructure; and
7. Realisation of service provider expectations.
Sustainable factors

“When you can measure what you are speaking about, and express it in numbers, you know something about it”

-Lord Kelvin (1883)

“To measure is to know”
Efficiency

“A level of performance that describes a process that uses the lowest amount of inputs to create the greatest amount of outputs”

The title of this presentation is:

Finding the sustainability in water supply and distribution systems

i.e. finding the “inputs and outputs”
Finding the sustainability

Let's look at 2 of the 7 combined sustainability effects:
1. Quantity of available raw water;
2. Quality of available raw water;
3. **Capacity of infrastructure to produce and supply adequate water continually;**
4. Capacity of infrastructure to produce safe water continually;
5. Continuity of infrastructure to function as required at the design stage;
6. **Capacity to operate the infrastructure;** and
7. Realisation of service provider expectations.
Finding the sustainability
Capacity of infrastructure to produce and supply adequate water continually
Finding the sustainability

Capacity of infrastructure to produce and supply adequate water continually
Finding the sustainability

Capacity of infrastructure to produce and supply adequate water continually

• Performance assessment based on plant operating records;
• Evaluation of the individual unit processes at the plant;
• Identification of performance limiting factors;
• Determine the inputs (water quantity, chemicals, man-hours, electricity etc.);
• Determine the outputs (water quantity, performance).
Finding the sustainability
Capacity of infrastructure to produce and supply adequate water continually

- Performance assessment based on pump stations operating records;
- Evaluation of the individual components of the pump station (suction pipework, pumps, delivery pipework, valves, controls etc.);
- Identification of performance limiting factors.
- Determine the inputs (water quantity, man-hours, electricity etc.);
- Determine the outputs (water quantity, performance);
- Efficiency (duty point), Scheduling opportunities.
Finding the sustainability

Capacity of infrastructure to produce and supply adequate water continually

- Performance assessment based on pipeline operating records;
- Evaluation of the pipeline system (material, joints, roughness, biofilm etc.);
- Identification of performance limiting factors;
- Determine the inputs (water quantity, electricity etc.);
- Determine the outputs (water quantity (leaks?), performance (friction loss, biofilm, failures?)).
Finding the sustainability

Capacity of infrastructure to produce and supply adequate water continually

- Performance assessment based on pipeline appurtenances operating records;
- Evaluation of the pipeline system components (valves, covers etc.);
- Identification of performance limiting factors;
- Determine the inputs (water quantity, electricity etc.);
- Determine the outputs (water quantity (leaks?), performance (secondary losses, failures, operational flexibility?)).
Finding the sustainability

Capacity of infrastructure to produce and supply adequate water continually

• Performance assessment based on reservoir operating records;
• Evaluation of the reservoir system (valves, storage, etc.);
• Identification of performance limiting factors;
• Determine the inputs (water quantity, electricity etc.);
• Determine the outputs (water quantity (leaks?), performance (structural integrity?)).
Finding the sustainability

Capacity of infrastructure to produce and supply adequate water continually

- Performance assessment based on WDS operating records;
- Evaluation of the WDS;
- Identification of performance limiting factors;
- Determine the inputs (water quantity, patterns etc.);
- Determine the outputs (water quantity (leaks?), performance (pressure, friction and secondary losses)).
Finding the sustainability

Capacity of infrastructure to produce and supply adequate water continually

A few examples of “inputs and outputs”:
• Air pockets
• Biofilm growth
• Scheduling
• Absolute roughness
• Localised energy generation

All of the above could be identified if you were measuring and monitoring
Finding the sustainability

Capacity to operate the infrastructure

City of Tshwane (6,370km²)
Finding the sustainability

Capacity to operate the infrastructure

City of Tshwane Areas
Finding the sustainability

Capacity to operate the infrastructure

City of Tshwane
Regions
Finding the sustainability

Capacity to operate the infrastructure

Population

Population +- 3 million
Finding the sustainability of the capacity to operate the infrastructure

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Finding the sustainability

Capacity to operate the infrastructure

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Finding the sustainability
Capacity to operate the infrastructure
Finding the sustainability

Capacity to operate the infrastructure

Distribution of sites
Finding the sustainability

Capacity to operate the infrastructure

• Management and operational
• Human resources
• IMQS
• Digitizing of water infrastructure
• Monitoring (everything)
• Control room (bring it all together)
Conclusion

• A water supply system will be sustainable only if it promotes efficiencies in both the supply and the demand sides. Initiatives to meet demand for water supply will be sustainable if they prioritize measures to avoid water waste.

• On the supply side, it is fundamental to enhance operation and maintenance capabilities of water utilities, reducing non-revenue water (NRW), leakages, and energy use, as well as improving the capacity of the workforce to understand and operate the system.

• Concrete possibilities of economic savings, social benefits and a range of environmental gains make the adoption of water efficient technologies viable.

• Sustainable water supply involves a sequence of combined actions and not isolated strategies.

• The challenge is to create mechanisms of regulation, incentives and affordability to ensure the sustainability of the system.