ASSIGNMENT MODULE 4

Daniele Cervellera

Student of WASH post-graduate diploma (Course Code: PGD002) in

The Strategia Netherlands

02/12/18

1. **List and briefly describe the measures by which the success or otherwise of a public–private partnership providing water supply services can be assessed.**

A public-private partnership can be defined as a collaboration between a private entity and a public body, such as a municipality or the government.
This collaboration can be assessed considering the following parameters:

- Accessibility
- Affordability
- Cost recovery
- Minimisation of non-revenue water
- Water quality
- Operational efficiency

The accessibility refers to the possibilities that the population has to reach a water point. According to the study of Pickering and Davis (2012), the further away a water source was, the less water was used. When the distance was more than 30 minutes away, households collected less water than the necessary for basic needs.

The affordability is related to the cost of the water, that should not exceed the 5% of the household income (Simpson, 2012). The cost recovery is the recoup of the cost to provide the service.

The assessment will consider if the non-revenue water is below 15% and if the water quality is adherent to national standard. Analysing the efficiency of the system, the quantity of the water supplied per capita and the number of hours per day of the water supply will be assessed.

In order to have the chance to understand whether the partnership is a success or not the data (before and after the creation of the partnership) for these parameters has to be compared.

2. **Give six possible causes of water emergencies, three due to natural causes and three due to humans.**

b. What are the options for safe water supply during a water emergency

A water emergency can be defined as a sudden, unexpected and hazardous event that disrupt the normal water supply and that it requires an immediate response.

There are water emergencies that happen due to natural causes or due to humans. In the first category belongs drought, flooding, earthquake, while in the second one falls the situations where deliberately someone affected the water supply system (i.e. poisoning) or it happed due to accident by human error or neglect. An important aspect of the emergency is the timing, because to qualify as “emergency” the event has to be sudden.

Contamination of water can be caused by different materials including chemical, biological agent or radioactive material (in case of a terrorist attack). In the first category it can be mentioned pesticides and insecticides. The second one includes bacteria, fungi, viruses and toxins (Sharan, Tal & Coccossis, 2007).

When an emergency occurs, the fastest and most feasible solution has to be found, because it affecting seriously the life of many people. In the most serious situation, for instance where the population has to migrate to another area due to floods or a war, there will be some places that will have a high growth of water demand.

The high concentration of people should be considered very seriously because the risk to have water-borne diseases is high.

In the emergency situation, during the acute moment, distribution of safe water to the population can be done trough the use of water tankers or plastic bottles. Since this strategy is not sustainable, the strategy will change and the intervention should give to the consumers the possibility to treat water for themselves. So, it should be done using cloth, sand or a ceramic pot to filter the water. Disinfection can be undertaken by boiling or solar methods, or by using chlorine or commercial water treatment products.

The idea for a safe water supply is to replicate the processes of a permanent water treatment works. So, a simple system can include the treatment with aluminium sulphate coagulant, that is left to flocculate and settle for six hours(sedimentation). After it is chlorinated with a solution of calcium hypochlorite and sent with a residual chlorine level of about 0.5 mg per litre to the distribution system.

In case there is the opportunity to build something more complex, the water will be filtered by sand and micro filtrated. These two additional processes take place between flocculation and chlorination.

Other options are the use of groundwater, including hand-dug wells, drilled wells and springs. The water from these sources usually requires less treatment than the surface water, so it considered a good option. Rainwater in areas where there are no factories or towns is often a high-quality water and it can be considered under some circumstances (Townes, 2018).

Here below there is a complete table with the different options of water during emergency.

Water Source	Advantages	Disadvantages
Surface	• Quick access • Easily extractible in large quantity	• Exposed to potential microbiological and chemical contamination • Multiple treatment steps may be required
Hand-Dug Well	• Groundwater may be higher quality than surface water • Can be dug using locally available tools, materials, and labor • Low cost	• Water table subject to seasonal variability • May be subject to surface contamination if not well protected
Borehole	• High water quality and less susceptible to contamination than shallow wells • More consistent supply of water if aquifer is penetrated	• Requires drilling equipment and skilled staff to identify sites • May be high in minerals, affecting taste or water quality • Pumps for extraction require operation and maintenance
Spring or Seep	• High water quality • Lower operational costs if gravity-fed system is used	• Risk of contamination if spring is not adequately protected • Flow may vary depending on season • Location may be far away from population
Rain	• Lower risk of pollutants in rural and nonindustrial areas • Low cost and easy to maintain	• Difficult where rainfall is limited or unpredictable • Limited to available storage capacity

Table 1: Available options of water during emergency (Davis and Lambert, 2002, quoted by Townes, 2018)

3. **You are about to set off to conduct a sanitary inspection of an abstraction point at a river.**

(a) What would you take with you?

(b) Explain four things you will be looking for during your inspection.

A sanitary inspection is a key activity that has the task to identify the hazards at the water source. It includes the survey of the surrounding area of the water source to understand the possible source of hazard and pollution.

Usually it is an activity that is undertaken by individuals, and many times is planned to be conducted periodically.

During the inspection of an abstraction point at a river, the sanitary technician has to check the situation of the preventative measures that the abstraction point should have, like the fencing. The technician should reach the site with the bottle to take a water sample, to be analysed in the laboratory.

The best way to capture the situation of the abstraction point is to have a checklist, where standard questions are listed. Useful information that should be collected are:

- Presence of human settlement, farm animals or crop/industrial production upstream
- Risk of landslide or mudflow in the catchment area
- Presence of fencing and screening of the intake installation
- Presence of a device like a dam where the water flows in a box
- Presence of filter in case of high presence of silt, and conditions of functionality
- Situation of the flow rate (too high, regular or too low)

All these aspects will contribute to score the risk of contamination of the water system.

He should also have a notebook to record all the useful information that are not related to the checklist form, and a camera to collect visual evidences that can help in reporting.

The sanitary inspector, in the case where he is staff part an institution, can interact with the communities, because they can also conduct sanitary inspections on regular basis as part of operation and maintenance in the area around the water source (Hogward & Claus Bogh, 2002).

4. Explain briefly why a Water Safety Plan is necessary

A Water Safety Plan provides for an organised and structured system to minimize the chance of failure through oversight or lapse of management and for contingency plans to respond to system failures or foreseen events (World Health Organization, 2008).

The most effective means of consistently ensuring the safety of a drinking-water supply are through the use of a comprehensive risk assessment and risk management approach that encompasses all steps in water supply from catchment to consumer (WHO 2004, quoted by Bartram et al., 2009).

In this way, the quality of the water is proactively managed so that poor quality water does not reach consumers. The key idea is that the prevention of a problem from occurring is much better in terms of quality of services and financially than having it occur and then trying to minimise its impact.

The creation of a Water Safety Plan should have the intention to consistently guarantee the safety and adequacy of a drinking-water supply. Its development should take care of the context, so to fit the reality where the water supply system is, otherwise it will be a useless and inefficient tool.

The first and immediate emphasis of the Water Safety Plan is on the chance of water contamination that reduces the quality of the water and its safety; at the same time, it is necessary for any other situation that can affect the water supply that are not directly involving the water quality, such as availability and trustworthiness of power supply, the availability of adequate quantity of water at the source, the protection from environmental hazard like floods, the quality of treatment chemicals, security of the system, presence of qualified staff and reliability of communication systems.

5. **Distinguish between the two types of maintenance at a water utility and give reasons why one of them is better**

Each utility works to provide safe and adequate water supply to the consumers as a core aspect of its existence. The utility is also responsible of the efficiency and effectiveness of the water treatment plans. In order to keep it running, it is necessary to operate maintenance in its two forms: preventative and breakdown maintenance.

Preventative maintenance can be defined as “efforts ranging from all nonemergency maintenance to intervention based on time, volumes, condition monitoring, or statistical prediction based on data from equipment history” (McKenna, Oliverson, 1997). Instead breakdown maintenance is the intervention that take place when an equipment breaks down.

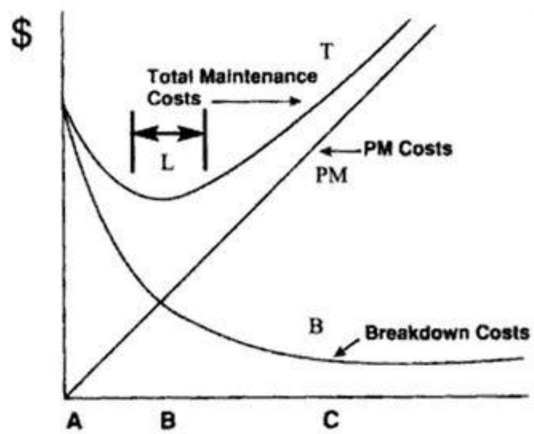
As it is clearly expressed by Mishra and Pathak (2012), “through experience it is established that the proper planning and scheduling of preventative maintenance can save time and money and therefore reduce overall maintenance cost reduction”. So, the preventative maintenance is definitely the best option for any water utility.

The preventive maintenance detects any condition that can cause a breakdown before it occurs. It is divided in the following activities (McKenna, Oliverson, 1997):

- Routine attention
- Routine examination
- Preventive replacement
- Inspection measurement

These four activities explore the system in different levels of depth and they consider vary tasks.

The following graph illustrates which is the best balance point between an excessive preventative maintenance and a too limited one, and that is the area indicated with “L” letter. The simple logic is that without any preventative maintenance, the cost of repair will be maximum, but also a too high maintenance conducted also when not necessary is going to increase the overall costs.



T- Total Maintenance Costs and non-maintenance costs below the waterline.

PM costs: Increasing as tasks are added. Downtime for PM included

L- Area of lowest overall cost

B- Breakdown costs start going down as PM increases but at somepoint the costs start to stabilize as PM gets to be less effective

Curve showing lowest overall costs based on increasing PM costs to an optimum level

L- The goal is to have the lowest overall costs of production or lowest costs to deliver a service. You can see that the lowest overall costs results from a certain level of PM, no more and no less.

B- All breakdown costs, including such costs as, quality, etc. These items are termed costs below the waterline in the next chapter.

PM- All PM and PdM costs, including labor and material costs and downtime to accomplish PM

T- All costs of maintenance, downtime, labor, parts, above and below the waterline.

Picture 1: Graph of the best option for maintenance cost (Levitt, 2003).

BIBLIOGRAPHY

Bartram J., Corrales L., Davison A., Deere D., Drury D., Gordon B., … & Stevens M. (2009). *Water safety plan manual: step-by-step risk management for drinking-water suppliers*. Geneva: World Health Organization.

Davis J. & Lambert R. (2002). *Engineering in Emergencies: A Practical Guide for Relief Workers*. London: ITDG Publishing.

Howard, G. & Claus Bogh J. (2002). *Healthy Villages: A Guide for Communities and Community Health Workers.* Geneva: World Health Organization.

Levitt J. (2003). *Complete Guide to Preventive and Predictive Maintenance*. New York: Industrial Press Inc.

McKenna T. & Oliverson R. (1997). *Glossary of Reliability and Maintenance Terms*. Houston: Gulf Professional Publishing.

Mishra R.C. & Pathak K. (2012). *Maintenance Engineering and Management*. New Delhi: PHI Learning Pvt. Ltd.

Pickering A.J. & Davis J. (2012). Freshwater Availability and Water Fetching Distance Affect Child Health in Sub-Saharan Africa. *Environmental Science & Technology, 46*, 2391-2397.

Sharan Y., Tal A. & Coccossis H. (2007). *Water Supply in Emergency Situation*. Tel Aviv: Springer.

Simpson, R. (2012). *Lessons Learned from PPIAF Activities: Pricing and Affordability in Essential Services*. Washington DC: Public Private Infrastructure Advisory Facility (PPIAF).

Townes, D. (2018). *Health in Humanitarian Emergencies: Principles and Practice for Public Health and Healthcare Practitioners*. Cambridge: Cambridge University Press.

World Health Organization, (2004). *Guidelines for drinking-water quality: third edition*. Geneva: WHO Library Cataloguing-in-Publication Data.

World Health Organization, (2017). *Guidelines for drinking-water quality: fourth edition incorporating the first addendum*. Geneva: Licence: CC BY-NC-SA 3.0 IGO.