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Water Evaluation and Cost Recovery Mechanisms in the Developing Countries of the Mediterranean Region Malta Case

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1. General characteristics of the island

Malta forms part of a small archipelago comprising some six islands and islets situated in the middle of the Mediterranean sea (Figure 1) 93 kilometres south of Sicily, 288 kilometres north of Libya, 1826 kilometres east of Gibraltar and 1510 kilometres west of Alexandria.

Malta and Gozo have an area of 246 and 65 km^2 respectively with the NW Region covering almost 73 km^2. The longest distance in Malta, from the south-east to north-west is about 27 km and the widest distance is 14 km in an east-westerly direction. The total length of coastline is 136 km round Malta and 43 km round Gozo. The highest topographic point lies in the NW Region, at Dingli and is 250 m above mean sea level (Figure 2).

The Maltese islands are very densely populated with a population of only 378,518 (Malta Central Office of Statistics, 1999) but with a population density of 1198 inhabitants per km^2. To these, one needs to add approximately 1.1 million tourists per year who visit the island. Needless to say, urbanisation has rapidly increased to almost 23 % of the surface built up in contrast to 5% in the sixties. The Maltese islands have a characteristic Mediterranean climate with heavy and intense rainfall over a short span of time followed by long spells of dry weather, a karst geological formation, thin soils and a historical lack of water resources. Malta had a mean annual rainfall of about 568 mm, which has increased over the last ten years to more than 600 mm. No surface water streams and only a few perennial springs exist. The main water table is conceptually a lens overlying seawater and is termed as an unconfined aquifer.

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Figure 1. Malta in the Mediterranean Sea (by MedHycos)

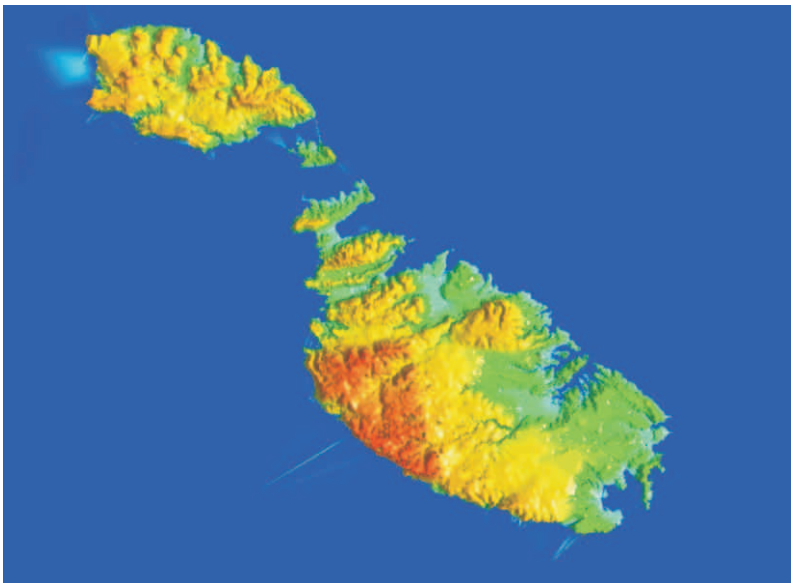


Figure 2. Map of Malta

Since the mid-sixties, distillation and later in the eighties, other desalination methods had to be employed to produce potable water in lieu of and as a supplement to groundwater production which had been, prior to 1968, the only source of water supply to meet the country's demands. Based on 2000-2001 figures, approximately 50 % of Malta's water production is derived from Reverse Osmosis Plants with the remainder coming from various groundwater sources spread all over the island. Depending on the amount of sources at any particular instant, this percentage tends to fluctuate from day to day. This means that there may be times when more groundwater is extracted than desalinated water is produced.

Water Authorities undergo significant financial pressure because of the ever-increasing demand due to urban growth and deteriorating equipment and infrastructure. This, together with the increasingly stringent EU drinking water-quality regulations as well as a result of a recurring lack of precipitation and the difficulty to develop alternative water resources together, water has become scarce and expensive commodity. Unfortunately, there are times when water supply entities fail to address these problems because of imposed regulations as well as other national priorities.

In an attempt either to prevent monopoly pricing and/or adopt a subsidy scheme, water tariffs have generated several forms of inefficiency. First and foremost, one must note that it is sad to register that water has and still is highly misused and at times under-used. Misallocation of water resources of different standards and for various uses together with poorly designed rates among different consumers resulted in insufficient revenues to cover costs. Secondly, the lack of incentives or measures to minimise water production and distribution costs created cost inefficiency. Thirdly, natural resources such as storm water are wasted when the costs of harvesting, treatment and distribution exceed the benefits. Last but not least, one must not forget that there are times when the cost of regulation by far exceeds the benefits accrued as a result of this regulation. Thus, from a purely economical point of view, this regulation is discarded with the result that a long-term adverse impact may be exhibited in the future. No environmental considerations are ever taken so that electricity generation costs are justly reflected in the water costs thus rendering other alternative use and reuse of natural water resources more viable.

2. Consumption of water

Table 1 shows the demand by sector as classified by WSC. The data caters for randomly picked sample local councils across the whole island.

Table 1. Breakdown of consumption for 1999/2000 by sector

Consumer type		Number of active accounts as at 15/6/01	Billed consumption (m^3)	% of total consumption	Average bill (including service charge) per account
Domestic	Residential	160,250	10,547,000	59%	34.08
	Social assistance	12,878	715,000	4%	13.52
	Other	15,230	173,000	1%	22.84
Industrial		1,054	1,333,000	7%	728.54
Farms		1,822	1,139,000	6%	154.81
Tourist		1,997	1,448,000	8%	642.46
Government		1,935	1,391,000	8%	825.13
Commercial	Bars and restaurants	1,557	290,000	2%	180.8
	Other	16,409	738,000	4%	54.68
Other		662	228,000	1%	141.59
Total		**213,794**	**18,002,000**	**100%**	**52.32**

When compared with the 16,500,000-m3 consumption of the previous year, one would note a 9 % increase. The water conservation effect, which was evident after an increase in tariffs, started to wear off. Due to lack of information regarding the private extraction of groundwater by farmers and other third parties, the above data is not complete and may, following a thorough survey and accurate extraction measurements, show different results.

3. Current water tariff system

With regards to domestic consumption, one should note that in residential premises 81.6% is subsidised at US $ 0.396 /m^3. The remainder is billed unsubsidised namely at US $ 2.64/m^3. This unsubsidised value of US $ 2.64/m^3 resulted from the 1996/97 Profit and Loss Accounts of the Water Services Corporation. It is the result of considering the total operating costs plus the depreciation divided by the amount of water produced. Table 2 shows a list of tariffs for potable water used in Malta.

Table 2.

Type of Consumer	Meter rent	Consumption charge	1999/2000	2001	2002
Domestic	\$9.6	0-11m^3 /person > 11m^3/person rebate/person>4	\$0.396/m^3 \$2.64/m^3 \$2.64	\$0.396/m^3 \$2.64/m^3 \$1.44	\$0.396/m^3 \$2.64/m^3
Social Assistance	Free	0-5.5m^3 /person - 11m^3/person > 11m^3/person rebate/person>4	Free \$0.396/m^3 \$2.64/m^3 \$2.64	Free \$0.396/m^3 \$2.64/m^3 \$1.44	Free \$0.396/m^3 \$2.64/m^3
Agriculture and agrofoods	\$19.2	0 - 2270m^3 >2270m^3	\$0.288/m^3: \$0.6/m^3	\$0.36/m^3: \$0.72/m^3	\$0.432/m^3: \$0.84/m^3
Personal health use in field	\$19.2	0 -5m^3 >5m^3	\$0.324/m^3 \$0.96/m^3	\$0.432/m^3 \$1.2/m^3	\$0.54/m^3 \$1.44/m^3
Industrial	\$19.2		\$1.44/m^3	\$1.68/m^3	\$2.04/m^3
Food and beverage	\$19.2		\$0.96/m^3	\$1.2/m^3	\$1.44/m^3
Tourist Flats	\$19.2	0 - 84m^3 > 84m^3	\$1.8/m^3 \$2.64/m^3	\$1.8/m^3 \$2.64/m^3	\$1.8/m^3 \$2.64/m^3
Hotels	\$19.2	0 - 14m^3/bed >14m^3/bed	\$1.8/m^3 \$2.64/m^3	\$1.92/m^3 \$2.64/m^3	\$2.16/m^3 \$2.64/m^3
Laundry	\$19.2	0 - 2270m^3 > 2270m^3	\$1.8/m^3 \$2.64/m^3	\$1.8/m^3 \$2.64/m^3	\$1.8/m^3 \$2.64/m^3
Sea Craft	\$19.2		\$2.64/m^3	\$2.64/m^3	\$2.64/m^3
Government	\$19.2		\$2.64/m^3	\$2.64/m^3	\$2.64/m^3
Boat-house, Garden, Garages	\$9.6	0 - 10m^3 >10m^3	\$2.04/m^3 \$2.64/m^3	\$2.04/m^3 \$2.64/m^3	\$2.04/m^3 \$2.64/m^3
Non-commercial	\$9.6	0-57m^3 >57m^3	Free \$0.84/m^3	free \$0.84/m^3	free \$0.84/m^3
Commercial and other	\$19.2	0 - 57m^3 >57m^3	\$1.2/m^3 \$2.64/m^3	\$1.2/m^3 \$2.64/m^3	\$1.2/m^3 \$2.64/m^3

Apart from the above tariffs, there exists within the Water Services Corporation a fixed water tariff of US$ 0.108/m^3 for non-potable water. This tariff is normally used to recover costs related to use of second-class water coming either from groundwater and/or treated sewage effluent. To be correct, one must note that with regards to treated sewage effluent, there are two main users namely agriculture and industry. The former is charged at US $ 9.6 per tumolo (1124.5 m^2), whilst the industry is charged at the normal US$ 0.108/m^3. When one works out the irrigation requirement to irrigate a tumolo it would add up eventually to approximately US$ 0.108/m^3. The total operating costs to treat sewage to irrigation standards has been estimated at circa US $ 0.288/m^3. It is evident that the tariff does not reflect in any way the actual production cost. Apart from this, the treated sewage effluent distribution system is highly inefficient (20% efficient). This is mainly due to two factors namely the open culvert gravity system which subjects it to evaporation losses and uncontrolled overflows and also the extensive theft in the pumping distribution network since all pipes leading treated effluent from the plant to the distribution reservoirs pass through private open fields. However, the fact that the rate has been fixed according to area, there are no incentives to conserve water.

4. Problems arising from current Water Pricing and Costing Approaches

The Water Services Corporation manages public Water Production, treatment and distribution in Malta. The Water Services Corporation Act XXIII of 1991 served as a legislative basis and included all tools and instruments for water resources management issues. Thus, the Act regulated the whole water cycle (acquisition, transformation, production, distribution of drinking and non-drinking water, disposal and reuse of sewage and wastewater, reuse of storm water runoff) as well as water trading rights between individuals. It set up the Water Services Corporation as a corporate body in charge of water management in Malta. The Malta Resources Authority Act 2001 has empowered the Malta Resources Authority with the regulatory responsibilities, which previously were part and parcel of the WSC responsibilities. Moreover, the operation and maintenance of the sewerage network and wastewater treatment and reuse is still being contracted to the Drainage Department within the main Government.

Being a Government-owned corporation, the management of the water supply in Malta can be considered as a natural monopoly. The fact that a large fixed capital investment characterises the running of a system of production, treatment and distribution of water makes a single water utility the most-efficient form of providing water service. Structured the way it is, water utilities in general and WSC in particular, face little or no competition. National priorities have compelled Government to regulate itself thus preventing monopoly pricing.

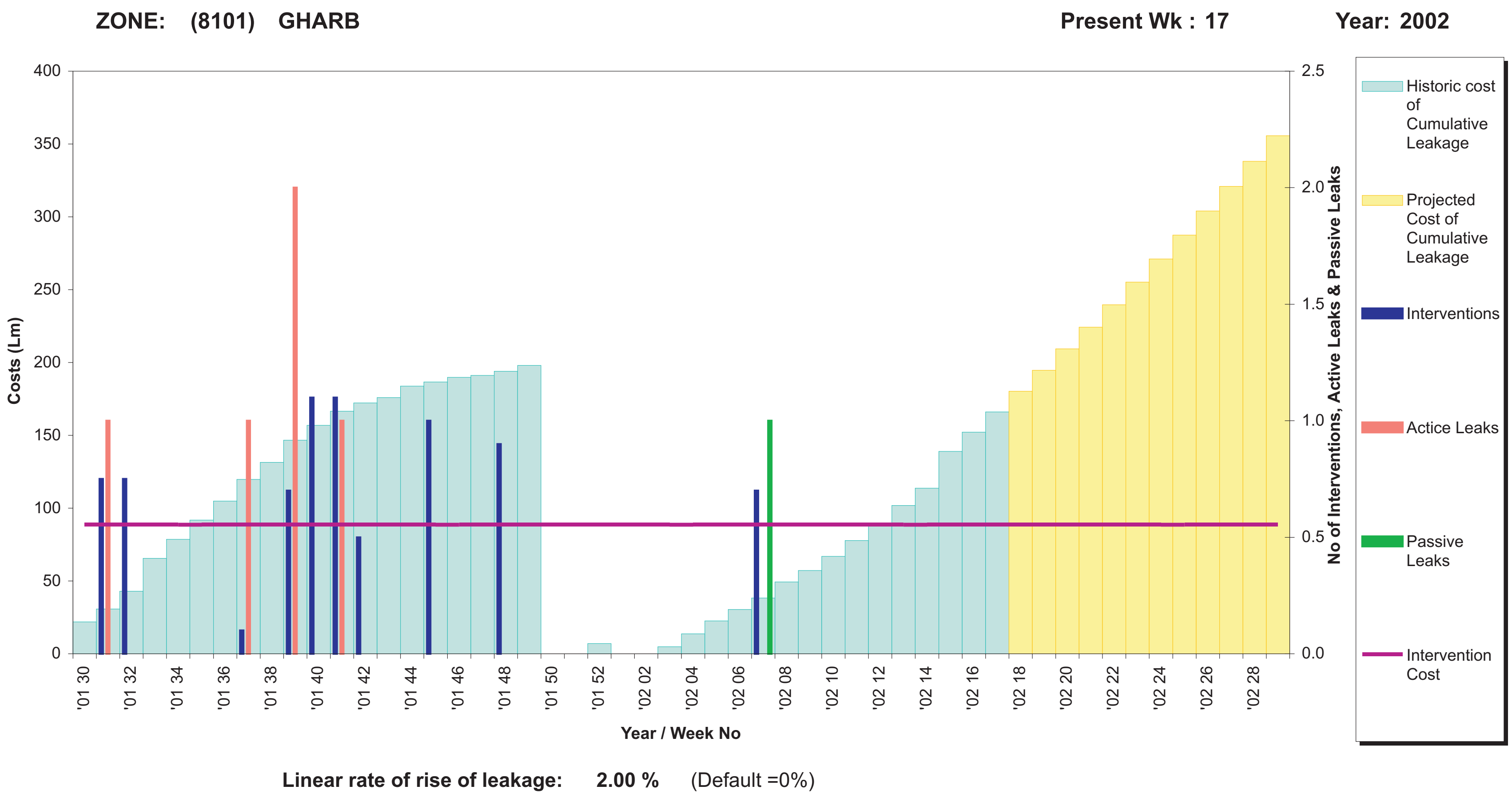
Apart from the above issue, one must keep in mind that in Malta, water has a social aspect. This is mainly due to the fact that as mentioned previously, its supply is totally managed by the Government. Thus, since it is heavily subsidised, Government tends to invest on educational programmes as well as water conservation methods so that water is conserved. Unfortunately, due to the fact that there were periods when water shortage demanded heavy investments on desalination plants, today, the more water is conserved, the less would be the revenue since fixed costs in the form of infrastructure and labour already exist and need to be used to render them cost effective. Our groundwater and surface water supplies are limited. Moreover, groundwater quality has deteriorated significantly thus rendering the use of Reverse Osmosis Plants imperative to guarantee a continuous and sound supply of potable water. In this case, no capital costs are today required since as explained before, most of the existing plants have been constructed to meet heavy demands which today have decreased due to a heavy water conservation campaign. Only marginal costs are borne in the form of electricity consumption, chemicals and membrane changes.

Thus, the balance between water conservation and increased water revenue needs to be established to ensure that the most cost-effective solution is adopted.

5. Cost cuts alternatives

Cost cuts are possible by decreasing production costs or distribution costs most of which (45 %) are labour costs whilst 24 % constitute electricity costs. These are the most obvious. However, there are other ways of cutting on cost namely by considering the possibility of reducing the discrepancy between the water supplied and the billed amount. This discrepancy is a result of either under registration of meters, theft and leakage. Whilst the first two are a matter of efficient administration and enforcement, the leakage problem had to be given more attention in order to understand the nature and extent and thereafter tackle it in the most cost-effective manner.

The graph below shows the model being used for one sample zone in Gozo



The economic value of leakage control is looked upon from two perspectives;

- the savings made when reducing water leakage compared to the expense of reducing this leakage, and
- the deferred capital resulting from a long-term leakage control strategy.

Taking the Malta scenario, the reduction in water leakage to the tune of 10 million gallons per day since 1995 has reduced production trends from 31MGD to 21MGD and has allowed for the cancellation of the building of a new RO plant and various other savings in deferred capital investments. It is more difficult, however, to build a picture of the economic level of leakage control, i.e. how not to spend too much or too little money on leakage control. To solve this issue the WSC has developed an innovative "*economic leakage intervention model*" that is utilised in a practical fashion to plan for leakage control.

The model depicts the cumulative cost of 'avoidable' leakage as a bar chart (light blue for historic data and yellow for projected data). The horizontal violet line depicts the cost of a standard leakage control intervention, or activity. The economic leakage intervention point is where the bar chart crosses the line (i.e. point A). At this point one intervention should take place and the avoidable leakage (blue bar chart) should go down below the violet line, due to the result of a leak being found and repaired. Actual interventions are shown as vertical dark blue lines and leakage found is shown as red or green vertical lines.

At point B the WSC has lost money. The cumulative cost of avoidable leakage is at this point is at around US $ 480. The economic intervention level is at around US $ 216. US $ 264 has been lost before the leakage was eliminated. Interventions prior to this point were unsuccessful in reducing the leakage.

The model serves as a tactical planning tool that guides the WSC towards the optimum economic management of leakage.

6. Conclusions

Cost recovery options are various and are effective to different extents. As explained before, the Malta case is somewhat different from other countries where the water supply is not limited and managed on a private, non-monopoly basis. The heavy investment made by the central Government in the water sector in the eighties and early nineties to meet demand, sometimes excessive, followed by intensive water conservation programmes which decreased water consumption has rendered equipment, labour and other infrastructure, idle and has resulted in decreased revenue from direct billing. Moreover, stricter EU water quality standards are compelling the Maltese Government to invest on Groundwater polishing plants. To be correct, the present inoperative plants are being re-designed so as to meet the current needs. However, one must note that these plants were normally sited near the coastline, whilst the groundwater sources are situated inland. Thus, certain distribution costs exist and so, again, one must take into consideration all the possible alternatives namely either re-location of the plants and/or pipework to lead groundwater to the plants themselves.