

Household responsiveness to water demand management incentives in Windhoek, Namibia

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Abstract

Water demand management is seen as a useful tool for curbing luxury water demand, improving efficiency and increasing awareness about water scarcity. In this paper, the response by households to pricing and information, as part of water demand management, in both the formal and informal areas of Windhoek is analysed. The results imply that the effectiveness of block tariffs is overestimated when applied to middle and high income areas. Instead urban lifestyle and accessibility to water dominates behavioural patterns at a certain consumption level. In addition, information about water scarcity was adapted among most households in the squatter areas.

Keywords: Accessibility; Block tariffs; Information; Urban lifestyle; Water demand management

1. Introduction

The rapid growth of cities involves not only an escalating need for water from the urban domestic sector, but also an increase in water use per capita. An improved access to water seems to have a direct effect on the amount of water people use. The trend worldwide is that cities will become nodes of an increasing need for large water quantities, which in many cases has or will lead to large scale water transfers. To solve the problem, both the rapid rate of urbanisation as well as water demand must be curbed. However, stopping people from migrating to urban areas is a very difficult task in countries with limited rural opportunities for work, education and social services. Reducing the demand for water from the urban population is easier to achieve. A useful tool in this respect is water demand management, by many researchers (among others van der Merwe, 1999 and Haddad & Lindner, 2001) seen as the low cost solution in comparison to, for example, water transfers and desalination. Through economic (pricing) and non-economic (information, regulations and new technology) incentives, authorities aim to reduce luxury water use, increase awareness and water efficiency, improve the level of equity between

socio-economic groups and improve cost recovery within the water sector. Water pricing and especially block tariffs, are generally regarded as the most effective way to lower water use at household level in middle and high income areas. The aim of demand management in low income and informal areas (where present) is primarily to increase water efficiency (leakage detection and reduction of illegal connections) and increase water awareness as a precautionary measure. Information campaigns about water scarcity are applicable and useful both in the informal and in the formal areas. The problem is that the effectiveness in reducing demand by information is more difficult to measure than for pricing. Few studies have been made on this topic and according to Michelsen *et al.*, (1999), little information exists on the effectiveness of public information and education in reducing water demand.

In Windhoek, the capital of Namibia, water demand management has shown promising results since it was initiated in 1994. The residential water demand level was lowered from 201 to 130 l per capita per day between 1992 and 1999 (van der Merwe, 1999). With very limited local availability of water and an urban growth rate above 5% per year, authorities in Windhoek took action against an escalating demand for water, to be able to postpone new bulk water supply investments for years to come. In this respect, it is important to find out how effective the different parts of the strategy are. It is therefore the purpose of this paper to analyse and discuss how effective water demand management incentives are in terms of changing household water use behaviour and attitude to saving water. The focus is on how households in different socio-economic groups perceive and respond to economic (pricing/block tariffs) and non-economic (information) incentives. One of the key issues is to find out what motivates people in various social categories to go from being water aware and accepting an incentive to actually saving water. The intention is to add knowledge to the effectiveness of water demand management strategies in developing countries. It is clear that different groups of people react and act differently on water strategies. To make water management more effective, better consideration must be given to making the strategy more socially specific.

The study was performed in the formal and informal areas of Windhoek. More than 60 households were interviewed from three different socio-economic groups: squatters, low income and middle/high income. The paper presents the concept of water demand management and presents a more thorough description of the strategy implemented in Windhoek. Thereafter, results from the interviews in terms of response to incentives are given, and finally the role of pricing and information in motivating people to act according to the aim of the strategy is discussed.

2. Water demand management

After decades of focus on water supply solutions, the importance of curbing water demand is highlighted on the water agenda in many parts of the world. A brief introduction to the meaning of the term is necessary to understand the context of this paper. The primary measures of water demand management (WDM) are market mechanisms, including pricing and fines, and direct interventions, like regulations, technical improvements and education (Biggs & Williams, 2001). Arntzen *et al.*, (1999) refer to a definition whereby WDM concerns any measure aimed at restricting water demand. WDM can therefore be defined as a demand-oriented strategy, essentially concerned with water use, but in the extension it is also supply oriented since the overall aim is to reduce the need for additional water supply, as, for example, in the case of Botswana, where the key objective with WDM is to reduce the need for continuing expansion of conventional water supply systems (Arntzen *et al.*, 1999). But as

interestingly pointed out by the Department of Water Affairs and Forestry in South Africa (1999), demand management should not be the objective, but rather a strategy to meet a number of objectives. The department proposes the following definition of WDM: “The adaptation and implementation of a strategy (policies and initiatives) by a water institution to influence the water demand and usage of water in order to meet any of the following objectives: economic efficiency, social development, social equity, environmental protection, sustainability of water supply and services and political acceptability”. This definition gives a clear indication that WDM should be seen in a wide societal context and that in many poor developing countries where water availability is becoming a constraint to future development, it could be an efficient tool for improving the water situation, which in turn probably generates positive economic, social and health effects. But for WDM to work as planned, it is necessary that water consumers accept and take an active part in the strategy. According to Bethune *et al.*, (1999), WDM involves the adoption of policy and investments by both the water authority and water consumers, to influence and remove inefficient consumer demand.

Both Arntzen *et al.* (1999) and the Department of Water Affairs and Forestry of South Africa (1999) argue that water management must be viewed in terms of both water demand and water supply solutions. Arntzen *et al.* (1999) include, for example, increasing supply from non-conventional water sources and water loss reduction from conventional sources as important parts of WDM. But Haddad & Lindner (2001) stress that if the main focus is on developing non-conventional sources, the potential water saving attained from improving WDM practices is undervalued. The Department of Water Affairs and Forestry (1999) proposes that demand management should include the entire water supply chain – from the point of abstraction to the point of usage. A conclusion can be made that urban water management must integrate supply and demand oriented strategies and start by curbing water demand before new large scale projects are initiated.

The problem with existing water demand management practices is that they are not always focused on holistic solutions. One reason why the full potential of WDM is overlooked is because it is often perceived in a limited context, for example only in programmes like communication campaigns or tariff increases (Department of Water Affairs and Forestry, 2001). This is exemplified by Haddad & Lindner (2001) in their study of the Middle East, where they conclude that demand management strategies are poorly developed in this region because they are mostly related to system efficiency, i.e. to lower the amount of un-accounted for water in the network. There is also a tendency to see demand management only from a technical perspective, as is done by Tejada-Guibert & Maksimovic (2001) in their interpretation of demand management. They argue that the concept of demand management implies changing lifestyles with emphasis on technical aspects as recycling, leakage reduction, re-use and reclamation as the main strategies for reducing demand (i.e. a supply-side orientation). The importance of social responsiveness, by awareness raising and through regulations, is not mentioned in the context of changing water use behaviour. However, the authors later include increasing social awareness as one important element for future sustainable urban water management, but do not elaborate further on the issue.

Even though the purpose of introducing WDM may differ, the tools of a comprehensive strategy are more or less the same: economic, legal, educational, institutional and technical measures. But Bethune *et al.* (1999) stress that for a strategy to be successful, a combination of all of these are necessary. In sum, WDM consists of incentives to lower water use and increase water efficiency, improvements to the level of water awareness, conservation techniques to reduce losses and an institutional context for setting the framework to consumers.

2.1. Demand management in Windhoek

As a result of high urbanisation rates, the use of all existing local water sources and a severe drought in the early 1990s, a thorough water demand management strategy was implemented in Windhoek in 1994 (Sjömander Magnusson & van der Merwe, 2002). The main objective was to remove luxury water demand and thereby reduce the pressure and reliance on primary water sources (Bethune *et al.*, 1999). Since 1994, the strategy has been further refined and today it consists of four cornerstones: policy issues (including volumetric pricing and block tariffs), information campaigns, legislation and technical measures. In this study, household responsiveness to two of these measures are analysed: water pricing/block tariffs and information campaigns.

Since more than 90% of the urban population are served by public water services in Windhoek (defined as water services being accessible within 200 m walking distance), demand management practices are more or less reaching the entire city. Block tariffs, which had already been introduced at the end of 1992, influence households with private water connections in the formal areas, including low to high income households. In Table 1 the block tariff structure for Windhoek between 1993 and 2001 is presented and in Figure 1 the development of the tariffs for selected volumes of water are given. Between the first two years, 1993 and 1995, a more specified division of consumption levels was made. In 1993, the tariff for 60 m³ was 1.85 N\$/m³. Two years later in 1995 it was 5.30 N\$, i.e. a 290% increase. Between 1999 and 2001 households using between 37 and 45 m³ were actually charged at a lower rate, from 6.88 N\$ to 5.85 N\$, which is a 15% reduction. It is also evident from Table 1 that between 1995 and 2001 the minimum charge increased by 20–30% for each interval. Full cost recovery was reached during the financial year of 2001 (Brinkman, 2002, personal communication).

The informal areas (defined by the City of Windhoek (2001) as informal structures of ultra low-income people) are supplied with public standposts and the price of water is said to reflect the cost of supply. The price, which is 5.85 N\$/m³ (=US\$ 0.65) (Brinkman, 2001, personal communication), is the same tariff as for households with private connections using between 7 and 45 m³. In most squatter areas, households pay a water rate, a standardized price invariant of volume, to a committee member for the use of a public standpost. The committee member divides the cost for water by the number of households. This means that each household pays an average cost for water, which is not directly linked to how much they use, although, in some informal areas a refillable pre-payment card is used, whereby the households pay for the exact amount of water they use.

In 1997 an extensive information campaign was launched. It consisted of two parts: one at household

Table 1. Block tariff structure for Windhoek between 1993 and 2001.

1993		1995		1997		1999		2001	
Volume used (m ³)	Tariff (N\$)	Volume used (m ³)	Tariff (N\$)	Volume used (m ³)	Tariff (N\$)	Volume used (m ³)	Tariff (N\$)	Volume used (m ³)	Tariff (N\$)
0-60	N\$1,85	0-10	N\$1,85	0-8	N\$2,20	0-6	N\$2,92	0-6	N\$3,51
61-90	N\$2,60	11-30	N\$2,65	9-15	N\$3,10	7-15	N\$4,07	7-45	N\$5,85
90+	N\$3,70	31-60	N\$3,70	16-36	N\$3,80	16-36	N\$5,23	45+	N\$10,77
		60+	N\$5,30	37-45	N\$5,00	37-45	N\$6,88		
				45+	N\$6,50	45+	N\$8,97		

Source: Brinkman, 2001 (personal comm.).

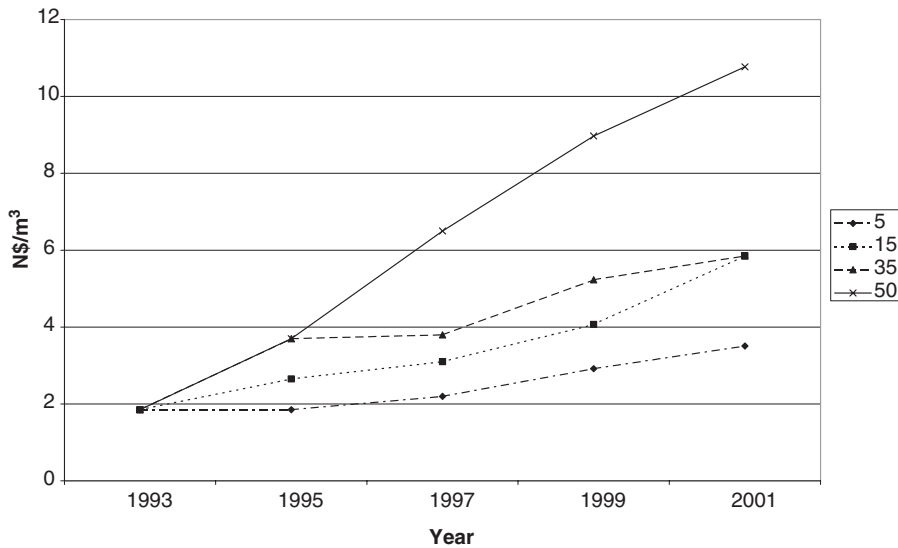


Fig. 1. Development of block tariffs in Windhoek for selected volumes of water.

level and the other at public level. The household campaign reached all households with private water connections. Pamphlets were sent together with the account, with the purpose of increasing awareness, reducing consumption and increasing efficiency. Practical advice was given on how each household could reduce their water use inside the house and outside in the garden. The public campaign, which was available to all citizens in the newspapers, on television and on radio, on the other hand mostly aimed to create a sense of awareness about water being a scarce resource. The municipality was also regularly informing the public through the media about water levels in the three dams supplying the city with bulk water. The educational programme for schoolchildren on the subject of water management was also an important part of the public campaign.

The implementation of WDM in Windhoek did have an effect on residential water demand. A clear reduction was visible from 1994/95 to 1995/96 when the daily per capita residential consumption dropped from 161 to 136 l (van der Merwe, 1999). But even though the water consumption per capita in Windhoek is still decreasing to some extent, in 2000/01 it was estimated to be 115 l/capita/day. The reason for this is probably because an increasing share of the urban population is poor and thereby using less water per person. Of the population of Windhoek 25% is estimated to live in poor areas and of the 150 households that are migrating to the city every month, 110 are settling in these areas (City of Windhoek, 2001). The consumption in top high income areas can still be between 500 and 1000 l/capita/day and no significant decline has been detectable in these areas over the last few years. This may be attributed to the income elasticity of demand, i.e. that not only the price of the goods, but also the income of the buyer influences the level of demand.

2.2. Introduction to discussion about the role of pricing and information

Analyses on water pricing are numerous. Many researchers (among others van der Merwe, 1999 and Dinar & Subramanian, 1998), argue that pricing is one of the most important tools for curbing water demand and improving water use efficiency. van der Merwe (1999) states that water is constantly

overused when it is consistently under priced. Water pricing is therefore a measure often used in demand management. The main reasons for charging for water are different: some wish to recover costs, others to cross-subsidize between sectors, to improve water allocation or for the purpose of saving water (Dinar & Subramanian, 1998).

Two main types of pricing structure exist in urban areas: a flat rate or a progressive rate. A fixed rate gives little incentive to use water more efficiently and create awareness. Variable charges on the other hand affect water use behaviour according to Dinar & Subramanian (1998). These authors conclude that if the price structure is accurately designed, it gives water users information about how to make choices regarding water use. They thereby argue that block tariffs reduce water consumption and improve water efficiency. Abu Qdais & Al Nassay (2001) refer to results showing that the effect on water demand is higher for water pricing than for other practices like education, i.e. the total number of consumers that will react to price changes is higher than those who will react to other non-economic measures. But Wegelin-Schuringa (2001) points out that block-tariffs are most effective in the middle income group because rich people tend not to save water because of high prices. Both Wegelin-Schuringa (2001) and Lee *et al.* (2001) point out that block tariffs can have a negative impact on low income families, because they often share one tap with other families or buy from a neighbour who owns a private tap, thereby ending up in a higher tariff bracket because of the high number of users. Also Rietveld *et al.* (2000) conclude in their study of block tariffs in Indonesia that the effect on equity is lost, since household size rather than income influence water consumption. Even though the aim of block tariffs is to favour low income households, only families with low water consumption are benefiting from such pricing system (Rietveld *et al.*, 2000).

The demand for water in economic terms indicates a price–quantity relationship, i.e. if the price of water increases the demand for water decreases (Groom & van der Merwe, 1999). This is often termed “price elasticity of demand” and tells us something about how sensitive consumers are to changes in price. However, the relation between demand and price is not constant. The elasticity of the function reveals that price sensitivity is higher at certain price increases than others. But some studies show that a “threshold price” is needed for significant changes in behaviour. According to Groom & van der Merwe (1999), despite major increases in some water customers accounts after the implementation of the block tariff system in Windhoek, there was no discernable change in the water consumption pattern. The authors point out that the threshold price in 1998 to encourage middle and high income groups in Windhoek to use less water, was approximately 5.00 N\$/m³ (= US\$ 0.55).

Abu Qdais & Al Nassay (2001) found in their study from Abu Dhabi city, that one quarter of the households did not reduce their water consumption even though the price of water increased roughly three times. The authors attribute this to the fact that those consumers had a high income. The price of water in Abu Dhabi is now covering one third of the cost of supply, and the authors conclude that there is obviously room for price increase in the future.

But it is not only the richest segments of society that seem to be unaffected by an increase in price. In an interesting study by Cairncross & Kinnear (1992), a weak relationship between a high price of water and a reduction in water use was found in squatter areas outside Khartoum in Sudan. The authors attributed this to a “consumer surplus”, i.e. the value of water to the consumer is greater than the price they pay for it. The conclusion was that the poor households put a high value on their access to water and that they had reduced their consumption to a minimum. There was therefore a low effect of price increases on water use. A conclusion from the discussion about water pricing and block tariffs is that it is a very useful tool for curbing water demand in the middle and high income groups, but that the

structure of the tariffs is very important if it is to meet the objective of reduced consumption and improved equity between socio-economic groups. There seems to be a lack of discussion about the effect of water pricing on attitudes, an interesting topic for future study.

The majority of authors, however, advocate that it is absolutely necessary to combine pricing with other non-economic mechanisms to effect long-term changes in behaviour patterns. The need for information and education as a complement to pricing is unquestioned. These concentrate on improving knowledge, acquiring new skills, changing behaviour and attitudes as well as developing ethical values (Skogsfors & Dzikus, 2000). Abu-Zeid (2000) stresses that education plays a vital part in strengthening the fulfilment of public policies and creating co-operation between both water managers as well as water users, which in turn leads to long-term collaborative relationships. The active involvement of an informed society makes water management more efficient and provides a foundation for the implementation of WDM. But as interestingly pointed out by Asmal (2000), educational needs are perhaps most acute among the water managers themselves. The reason for this, according to the author, is mainly that cities are such complex systems and that for the planning and management of urban water resources, methods must incorporate environmental, social and economic factors. The reason why information campaigns are mostly seen as a second order demand management instrument after water pricing, is probably because it is more difficult to measure the effects. Even though there is no question about the importance of information, few papers analyse the effects on water use behaviour. But the results from Michelsen *et al.* (1999) show that it is evident that non-price conservation efforts (like information and education) can significantly reduce residential water use. However, they conclude that there is often insufficient data at the water utilities to perform statistical analysis on the effectiveness of a single programme.

3. Household response to pricing and information

The aim of this interview study was to analyse how effective the demand management strategy is in Windhoek. Two incentives were chosen for deeper analysis: pricing/block tariffs and information. The purpose was to analyse how households in different socio-economic groups accepted and reacted to these incentives and how effective these measures are in relation to (1) reducing water demand and improving water efficiency (reduced leakage and illegal connections) and (2) increasing awareness about water scarcity and saving water. But first some background is given about how the interviews were conducted.

More than 80 interviews were performed in both the northern, ultra poor and low income areas, as well as in the richer, southern and eastern parts of the city. After only a few interviews in each socio-economic group, a pattern in the response to questions emerged. About 20 interviews were not used because of incomplete or inconsistent answers. In total, 63 respondents were consistent and clear in their answers and therefore selected for the analysis. The definition used for squatters was that they lived in informal areas with access to public standposts, and for low income households that they lived in formal areas with access to a private yard tap. Only 15% of the low income respondents had access to a tap inside as well as outside their dwelling. The middle and high income group was easily defined by residential area and these households had access to water both inside as well as outside. Respondents were asked about their water use behaviour, attitude to water and reaction to measures taken by water authorities. An interpreter was used in the squatter and low income areas. Both questions as well as

answers had thereby to be interpreted by this person, which may be a possible source of error that is difficult to account for. However, the purpose and layout of the study was thoroughly discussed with the interpreter before the interviews, to minimize misunderstanding. Respondents in the squatter and low income areas were interviewed on a door-to-door basis. Respondents in these areas were chosen with the help of two local guides. Without their help, few people would have been interested in answering questions and more importantly, they were more “open-minded” owing to the fact that most of them knew our guides and trusted them. In the middle and high income areas it was very difficult to arrange a personal meeting with the respondents. Therefore 90% of these interviews were conducted by telephone. Respondents were randomly selected from a computer at the municipality water division, based on the area of residence. No interpreter was needed. In all areas, the interviews lasted for between 15 and 20 minutes, depending on the length of the answers to the open-ended questions. The answers were written down by hand and later the same day entered into summary sheets. A quotation by a specific respondent is referred to by a number within brackets because anonymity was promised. Further details about the respondents are available from the author.

3.1. Water rates and block tariffs

The price of water has two different purposes in Windhoek. In the informal areas the price of water is supposed to reflect the access cost and in the formal areas the purpose is mainly to curb luxury water demand and increase efficiency (reduce leakage on the premises and illegal connections), but also to increase awareness about saving water. Household response to the role of pricing in effecting water consumption is summarized in Figure 2.

Households with two different types of payment for water were interviewed in the informal areas, those paying a water rate (an average cost) each month to a committee member and those using a pre-

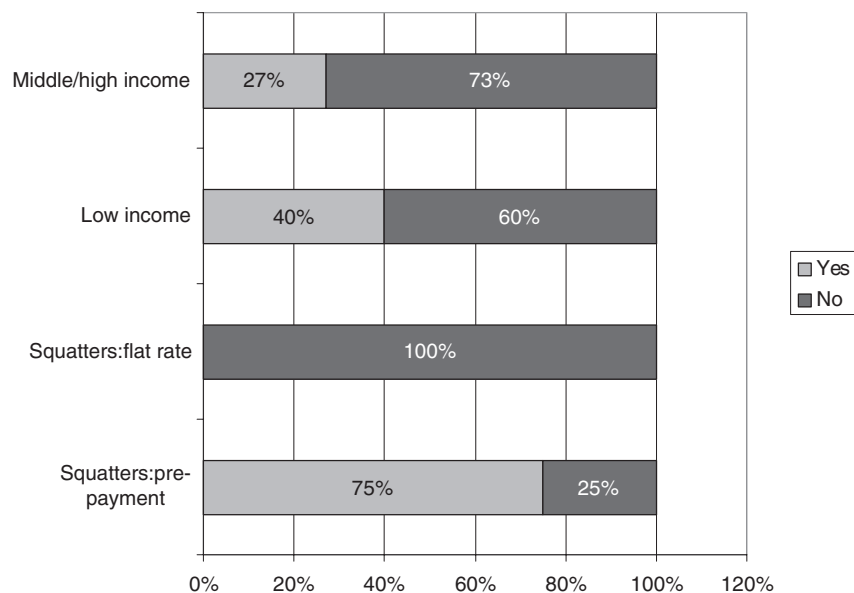


Fig. 2. Household response to the role of pricing in influencing water use.

payment card, which was individually refilled by each household at a local municipality office. The first group paid about 20–30 N\$/month (1N\$ = US\$ 0.11) for an unlimited amount of water from the public standpost, when it was open. Standposts in these areas were often closed at night and some were only open a few hours per day. Of the respondents, 45% found the price of water expensive, but felt that they were unable to influence the price since they paid a standardized price invariant of volume. Price was thereby no economic incentive to use water more efficiently. More than half of the households complained about the effort needed to carry the water back to the house from the standpost, and they would prefer that water was accessible during all hours of the day to minimize long queues and to have access to water whenever they wanted. There had been a change in water use behaviour when more taps were introduced in the neighbourhood. “Before when the area only had one tap we used less water – we use more today when there are two taps” (No.35). And one-fifth of the respondents concluded that if the taps were open for longer hours, they would use more water. From this it is clear that the price of water has no effect on water use behaviour where a water rate based on an average cost divided on all households is paid. Instead, the accessibility to water proved to influence their behaviour more.

In the pre-payment card areas, the households paid 10–45 N\$ each month for water. Water from these standposts was metered volumetrically at the tap. Here, 75% said that they had decreased their water use as an effect of the pre-payment card. “Now we use less water because we have to pay for the exact amount of water that we use” (No.3). Price was thereby an important incentive to change water use behaviour, which is also evident from the following quotation, “If I would have more money, I would use more water” (No.1). A conclusion is that there is obviously room for changes in water use even in informal areas where the population is using close to a minimum amount (about 30 l/person) of water per day. But it was interestingly found in these areas that under two circumstances price was no incentive to use less water. First, in households where children had been born, the need for water increased for a few years, which effected their behaviour more than price. Second, in households where the family income was acceptable, price was no objective to use less water. “The payment for water has doubled since the introduction of the pre-payment card, but our family can afford it” (No.8). It can thereby be concluded that not only water needs but also “water wants” absolutely affect water use behaviour even in informal areas, and sometimes more than the price of water. No respondent in the pre-payment card area complained about the access to water (standposts were open 24 hours a day), but said that they would prefer their own tap. All of them agreed that the pre-payment card system had improved the water supply in the area, because there was no misuse and that the water was of better quality.

Households in low income areas paid between 150 and 700 N\$ to the municipality each month for water. A majority of the respondents found the price of water too high, but 60% concluded that price did not affect their water consumption. “We use what we need” (No.25) and “We don’t lower our consumption because we have no problem in paying the water bill” (No.26) were common responses, even though the water bill had increased significantly during the last few years. There were also complaints in one-quarter of the households about the estimation of water use by the municipality. Water meters were seldom checked thoroughly and the water bill was based on estimates, which provided no incentive to use less water: “If it showed on the bill, we would use less water” (No.29). But about one-third interestingly said that they could save water if the price went up more, for example wash more seldom and use less water in the garden. A conclusion therefore is that there seems to be room for saving water even in low income areas, but that the present tariff structure and way of payment do not really affect water use levels. In two households where the tap had been closed owing to non-ability to pay the bill, it had definitely led to a decrease in water use: “We use less water now than before when

we had our own tap” (No.28). It seems that access to water close to home influences behaviour more than price in most low income families.

In the middle and high income areas, the households paid 200–1000 N\$ for water each month, and 18% paid between 2000 and 3000 N\$ or more. This probably depended on the size and layout of the garden. The role of block tariffs in this income group is mainly to reduce luxury water consumption, but more than 90% of the respondents said that price did not have an effect on their water use at all. On the question of what would motivate them to change their behaviour, one-quarter responded that nothing would motivate them to change their water use and two-thirds said that they could save water if they had to, but that price was definitely not an incentive. The remaining said that social pressure or a heavy price increase could affect their water use behaviour. But the general conclusion can be made that the majority of these households did not want to lower their consumption. “You can always lower your water use if you have to, but I don’t think that we do” (No.54). The attitude towards water seems instead to be very much influenced by lifestyle, expressed as: “Yes we can lower our water consumption, but then it touches the quality of life” (No.60). The value of having a green garden seems also to be very important to this group of households. Some respondents said that they cannot reduce their water consumption because they want their garden green, and that green gardens are part of human nature. This was firmly expressed by one respondent who said that “They can’t strangle me with high water prices, I am keeping my garden green” (No.45).

But even though the majority of these households have green gardens with big lawns and lots of plants and flowers, it is important to point out that an increased awareness about drought resistant plants has arisen in Windhoek over the last few years, owing to information campaigns directed at people interested in gardening (Wentzel, 2001, personal communication). Besides price and lifestyle, one other incentive that was found to be effective in controlling water consumption in these households was the prevailing climatic conditions. More than one-third said that they used water differently during droughts. The drought of 1996–97 seems to have been especially influential on water demand. Some households had installed water saving techniques, like rainwater harvesting and re-use of bathwater in the garden, but it seemed to be of less importance today. “Our water use decreased during the drought of 1996–97, but then it went back to normal” (No.56). The responsibility to save water seems thereby to be dependent on the amount of rainfall in Windhoek: “If there is lots of rain, we don’t save water” (No.57). Even though climate influences water use behaviour, lifestyle is the dominating behaviour among the majority of the middle and high income households. But it is interesting to conclude that action is taken more often by many of these households during periods of drought.

3.2. Information campaigns

As already mentioned, the information campaign consisted of an individual and a public part. In Table 2 the types of information received by the three groups of respondents are summarised. The conclusion can be made that people in squatter areas take an active part in reacting to more types of information than both the low income and middle/high income respondents. Friends and neighbours as well as written material contributed to spreading the message. As an effect of input of information, they had begun, for example, only to wash once a week and never water their pots during summertime. One woman in Hakahana, a squatter area, said that she was very cautious with water during dry years, when the government told them that there was less water in the dams. Another woman in the same area, said that she could use more water during wetter periods because more water was available. Both

Table 2. Sources of information received in different socio-economic groups.

Type of information	Squatter areas	Low income areas	Middle/high income areas
Radio/TV	15	9	2
Pamphlets/newspapers	12	2	–
Newsletter with water bill	–	7	9
Committee member	1	–	–
Friends and neighbours	4	–	–
No information	4	3	13

these statements show that even households in the poorest areas are reached by public information from the municipality, and have to some degree reacted to it, even though they live very close to a minimum level of water use. What is remarkable is that so many of the respondents from the middle and high income group had not received/taken notice of any information. Further, only one of nine of those who said that they got a newsletter together with the water account, emphasised that the information from the newsletter was useful. This may be due to the fact that most of the respondents in middle and high income areas saw themselves as already enlightened and that they were already water aware. “Information does not influence us because we are already water aware” (No.57). The majority of these households tried, as they said, to re-use bathwater in the garden and store rainwater for watering. However, these measures to save water were perceived as more important during prolonged periods of drought and not on a permanent basis. The attitude of some of these households was that they were not the main targets for information about saving water. Almost one-fifth of the respondents said that the poor, uneducated people were the ones that needed more information, exemplified by: “More education must be given to the poor people because they are not water aware” (No.58) and “Poor people are not aware and use water without thinking about tomorrow” (No.51). The conception that people in poor informal areas are not aware about water scarcity is clearly rejected by findings from this study. This is first because there were many sources of information that had attracted their attention and second owing to the fact that very few (four in squatter areas and three in low income areas) had not received any information at all, compared with 13 in the middle and high income areas.

Knowledge about water scarcity, received through public information, is important in shaping attitudes to saving water. According to Blake (2001), environmental concern is dependent on the individual context, i.e. individual perceptions of the local environmental situation have a big effect on behaviour and attitudes. Respondents in this study were asked about their perceptions about the water situation in Windhoek, to see whether a link between knowledge and attitudes towards saving water was present. The awareness among the poorer segments of the society, squatters and low income households, of water being a scarce resource is highlighted by the fact that as many as 40–55% of these households defined the water situation in the whole of Windhoek as serious. It is however important to stress that respondents can have different reasons for defining the situation as serious, for example, the high price of water or the different accessibility to water among socio-economic groups. It may not be based on awareness about water being a scarce resource. Two-thirds of respondents in the middle and high income areas, on the other hand, defined the situation as fair, and none as serious. This perception is probably a result of the satisfactory accessibility of water in these areas. The respondents probably interpret the water situation in Windhoek based on the context of their own reliable access to water.

Another important aspect to stress is that so many respondents from the squatter areas mentioned the value of water. Not only did they express ideas like “water is life” and “use water wisely”, but interestingly they felt a tendency towards a common responsibility to save water. “Everybody has to save water – otherwise everybody gets problems” (No.8). One respondent explained that she had changed her water use behaviour during the last years because, “We all have a responsibility even though there is water in the standpost” (No.1). This is clearly a high level of awareness and acceptance of water scarcity that has shaped the attitudes among these households.

An important part of the information campaign was also to inform and educate school children about saving water. Even though the main purpose was to educate the next generation of water users, an interesting aspect in the context of this study was to find out whether this knowledge was shaping the attitude to water in each household. Of those families in the poor and low income areas that could afford to send their children to school, there was a clear difference between households in squatter areas and in low income areas. In the squatter areas, parents knew very well that their children learned about water, and three-quarters said that they talked about it at home and that it affected their way of using water. The perception however, is that the information from their children probably improved awareness about water, rather than directly affecting the use of water.

If the level of awareness influenced by school children was relatively high in ultra poor communities, families in low income areas seemed less interested. More than two-thirds of the respondents said that their children learned about water, but only one-quarter said that they talked about it at home, i.e. in the rest of the cases, the families did not talk about it and it had no effect on their water use. In the middle and high income areas, 90% of the households with school children knew that they learnt about water and two-thirds talked about it at home. But no household said that it had an effect on their water use behaviour. It was more of an informative character as one respondent said. In less than half of the cases, water education was not discussed at all.

4. Effect of pricing and information on acceptance and behaviour

To be able to evaluate the effects generated by economic and non-economic incentives, it is important to put the findings into context with the aims of the strategy. In the case of Windhoek, the primary objectives are to reduce luxury water demand and increase awareness about water scarcity and saving water. Key aspects like intended or actual behaviour, effects of social (urban) norms and accessibility to water are used when evaluating the effectiveness.

4.1. Evaluation of household responsiveness

In evaluating the different incentives, the difficult task is how to measure the effects. The effect of pricing in reducing demand is relatively easy to analyse because it can be measured in absolute numbers. The role of pricing in shaping awareness among water users, however, is more difficult to assess. Also, the level of awareness and changes in water use influenced by information campaigns is difficult to estimate since it represents a subjective interpretation. But still, these are very important aspects for understanding and evaluating the full responsiveness to water demand management. The discussion is based on a qualitative analysis of the performed interviews. Sjömander Magnusson and van der Merwe (2002) refer to stages like awareness, acceptance and action in the discussion of improving the efficiency

of urban water management. The key idea is that for long-term success, for example, in demand management, the link between awareness and behaviour (action) must be understood, to create a high level of acceptance of measures and trust in authorities. These concepts will be used in the following discussion.

The effects of water rates and block tariffs on water demand differ from area to area, depending on the ability to pay and in squatter areas on the mode of payment. The general conclusion can be made that pricing is most efficient in using water more wisely in squatter areas where a pre-payment card is used. It is clear that in these areas, where the ability to pay and the accessibility to water is low, the responsiveness to price is high. Here, 75% of respondents said that the price clearly influenced their water use behaviour. Block tariffs are also efficient in the majority of the middle and high income areas, but only initially, as was seen in Windhoek after the implementation of block tariffs.

In Figure 3 the relationship between pricing and reduced water demand in middle and high income areas is shown. Increased block tariffs do affect the level of water demand among a majority of this income group down to a certain consumption level, which can be termed “urban lifestyle aspirations”. It was quite clear that this group responded to increased prices, but not below the quality of life (i.e. aspirations to uphold an urban lifestyle). Urban lifestyle in the context of water demand can be defined as having access to taps inside as well as outside, a washing machine, a dishwasher, shower/bath and perhaps a swimming pool. The level of urban lifestyle water needs is obviously different from household to household, but during certain circumstances, for example droughts or prevalence of information campaigns, they were willing to go below this level and save some more water. But as soon as these circumstances were not present, the water demand went “back to normal” again. The conclusion is that in middle and high income areas, block tariffs are not effective indefinitely and that the presence of recurrent information must be given higher priority. Even in the low income areas, 40% said that pricing effected their water use behaviour, but it was found when cross-checking the responses from the interviews, that pricing did not really effect their behaviour. They all used water according to their needs (basic and non-basic needs) even though the water bill had increased during the last few years. The accessibility of water probably influences their water demand more than the price of water. Only in one area was pricing found to be totally ineffective, and that was in the squatter areas where a flat rate was

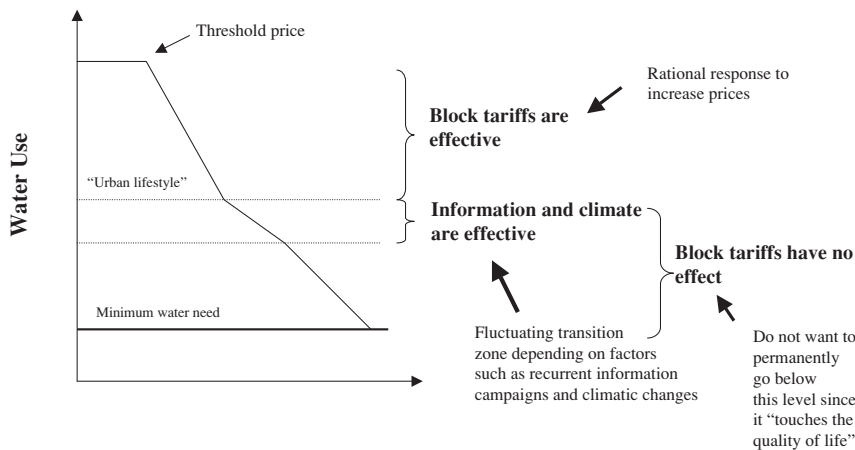


Fig. 3. Demand responsiveness to different incentives in the middle and high income group at different consumption levels.

paid. The respondents in these areas defined access to water to be more important in influencing water use behaviour than price.

The effects of information campaigns can be evaluated both in terms of increased awareness as well as in changing water use behaviour. In both the squatter areas and the middle and high income areas, information had led to increased awareness about water being a scarce resource, even though the middle and high income group thought that they already had knowledge about saving water. But in low income areas awareness was not as obvious and a secondary priority behind complaints about high water prices. However, and more interestingly, in the analysis of whether the knowledge among households actually led to saving water, the link in middle and high income areas was weak. Few households had made permanent major changes to their way of using water, but saved water during periods of severe drought, i.e. when information was more available. What seems to be the case is a fluctuation in acceptance of water saving measures rather than in awareness of water scarcity. The level of awareness does not diminish over time, but instead the level of acceptance of the necessity to act fluctuates according to conditions (the prevalence of information and periods of drought).

In summary, the introduction of block tariffs in the formal areas definitely led to action (changing water use behaviour) in many households. The daily water use per capita was lowered from 201 l to 130 l in only 7 years, something that partly could be attributed to an increasing number of poor people in the city using less water per capita. But the response was also a rational reaction to the high increase in water prices. Even though the block tariffs have increased over the years, the response from the more affluent water users has declined, clearly showing that water pricing is not the ultimate tool for curbing water demand. The value of water to the consumer seems to be higher than the effect of price increase at a certain water consumption level. And it seems not to be the case, as Dinar & Subramanian (1998) stated, that block tariffs give the consumer information about choices in water use. Instead, what the above discussion has shown is that the role of information and climatic conditions is very important in affecting peoples behaviour. Saving water at the household level seems most of all to be a result of increased knowledge and acceptance of water scarcity. The conclusion is that pricing is an efficient tool for changing water use behaviour initially, but that recurrent information is vital for increased awareness, which in turn also changes behaviour. The two components, pricing and information, must therefore interact for improved results.

4.2. What motivates people to act?

An interesting and important aspect of water management is to find out what triggers people to act in line with the objectives of water managers. In the case of Windhoek, it is clear that block tariffs are not the most efficient tool in motivating behavioural changes, and information is important but only during certain circumstances. It is interesting to find out why the strategy is not received and accepted as anticipated. There are three probable alternatives: (1) that the prices are too low, (2) that the value of water to the consumer is high and (3) that there is a lack of trust in the authorities.

Even if the water tariffs were raised now, it would probably not be as efficient in lowering water demand as in the initial phase. The reason for this is as stated above, that the value of water motivates people to act or not act more than increased prices at a certain level. The value to the consumer is connected to and influenced by four conditions: accessibility, lifestyle, income and environmental concern. How likely households are to act in line with demand management measures is probably a result of these conditions. The importance of socio-economic variables in affecting water use behaviour

was also found by Syme & Nancarrow (1992) in their study of public involvement. In Windhoek, lifestyle was found to be the most important reason for action in the formal areas. Lifestyle includes a range of graded, individual preferences, some of which are not negotiable (for example green garden, washing machine, dishwasher, swimming pool etc.) and some which are negotiable, but only during certain circumstances, such as droughts.

In Figure 4, a summary of the responses to saving water in the three different socio-economic groups is given. The accessibility to water increases from the bottom to the top of the figure. In the middle, a fictitious “urban lifestyle minimum water use” is marked to act as a standard (defined above) which people in urban areas seem to strive for. This line is obviously individual to each household, but it is meant to define a water use level for an urban standard of living, most importantly including in-house water connection. People in squatter areas interestingly found themselves with enough water for their purposes. At present, this group is outside the boundaries for reaching urban lifestyle and is using near to a minimum of water needed per day (30–40 l/capita/day). Naturally, the ability-to-act to make water use more efficient (reduce leakage and illegal connections) is low, even though it was found in the pre-payment card areas that some measures had been taken to save water. In the low income areas, people were most of all eager to improve their living situation. The focus of these respondents was on the high price of water and low trust in authorities. Even though the water use per capita is relatively low in this income group (70–80 l/capita/day), which of course affects the ability-to-act, they live more or less close to the level of urban lifestyle water use, where access to and lifestyle preferences rather than price control their way of using water. Since it is likely that some of these households will improve their income in the future, information as a precautionary measure to improve the level of awareness about the importance to use water more wisely is definitely necessary.

The middle and high income group could be divided into three separate types of respondents related to awareness about water scarcity and saving water: (1) a high level of awareness and savings of water in large quantities, (2) a moderate to high level of awareness, but with no permanent, large-scale saving measures and (3) a moderate awareness, but reluctant to save water. In a study of public involvement in urban water management and planning made by Syme & Nancarrow (1992), a distinction was made between the intention to act and participate and actually doing it. This is also referred to by Olli *et al.*, (2001) as actual or intended environmental behaviour. This division of behaviour can be used for group

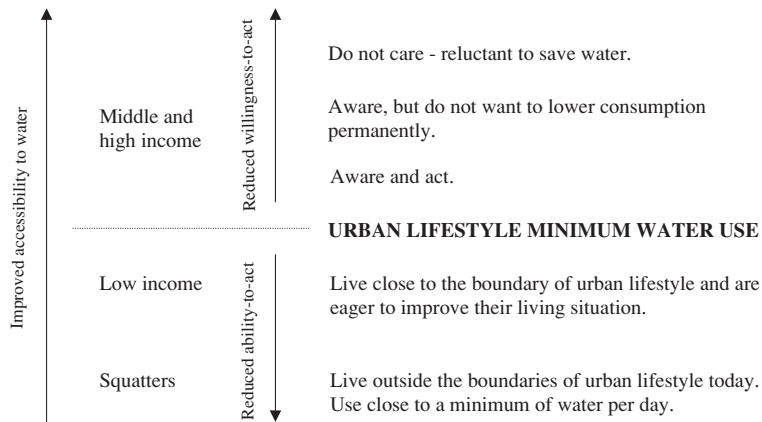


Fig. 4. Summary of the response to saving water in the three different socio-economic groups.

1 and 2, defined above. In the first group, respondents used close to a minimum of water to up-hold the so-called urban lifestyle, and they were water aware, influenced by environmental concern and acted according to it. The level of actual involvement in saving water was thereby very high among these households. The second group was aware of water scarcity, but did not want permanently to lower their consumption, even though they could. Most of these households reported that they were saving water, even though on a small scale and not on a permanent basis, but they all agreed that they could and would save more water if it was necessary, i.e. an intended behaviour. However, it was quite clear that they would not change their behaviour if it touched the quality of life, i.e. their modern household conveniences. The willingness-to-act was thereby reduced and even though initially they were influenced by price, this was no longer an important incentive. Rather, urban lifestyle and a high ability-to-pay for water influenced their behaviour. If this group is going to save water on a permanent basis, the prevalence of recurrent information is probably much more important than price. In the last group, there was a total reluctance towards saving water. These households were moderately aware of water being scarce, but did not care and were not willing to change their water use behaviour at all. The willingness-to-act thereby more or less did not exist.

In Windhoek, three probable causes maybe given as an explanation of why the strategy is not reaching its full potential: the price of water, the value of water and trust in the authorities. First, the price of water is too low in the middle and high income areas to be effective in changing behaviour permanently, and a water price invariant of volume, paid in some squatter areas, is definitely no incentive to use water more efficiently. For an improved effect on water demand, prices need to be raised in the upper income groups. Stevens *et al.* (1992) made a study of the effect of block tariffs on water demand, and found that increasing block rates *per se* did not yield greater conservation. The focus should be on finding the right price level instead of block structure (Stevens *et al.*, 1992). If the right price level is not in place, there is a danger that the price of water becomes a “licence to use” for high income households: we are paying for it – therefore we can use it as we want. Second, the value of water to urban consumers is very high. Lifestyle is a dominating factor motivating behaviour. With improved socio-economic conditions and accessibility to water, the value of water is very important at a certain level. Recurrent information and education as well as compensation programmes for saving water may be the only way to change these attitudes. Third, a low trust in the authorities does not create a platform for responding to strategies. To achieve greater acceptance and reaction among the low income households, a more thorough billing system could be introduced. The positive aspect for the future of WDM, however, is that the majority of the consumers of Windhoek was part of either the low income group (>50% of the total urban population) or the “aware but do not act group” (80% of the respondents) in the middle and high income areas. These two types of water consumers are able to save water (to different degrees) and make water use more efficient, if their willingness-to-act, based on acceptance and trust in the authorities, is improved. Water managers should therefore focus on these users to increase the efficiency of the water demand management strategy.

It is most important to find ways to motivate people to change their water use behaviour. Syme & Nancarrow (1992) conclude that it is important for water authorities to find out what the substantive issues are that each socio-economic group may be interested in, in order to participate in and change intended into actual behaviour. It is clear that different socio-economic groups react and act differently to incentives. It is therefore important that the economic and non-economic tools of the demand management strategy are adjusted according to the situation of each socio-economic group of households.

5. Conclusions

Even though some part of the reduced demand for water per capita in Windhoek between 1992 and 1999 could be attributed to the rapid influx of poor people, the effect of pricing/block tariffs and information as tools to curb water demand, improve efficiency and increase awareness should not be underestimated. Increased prices for water definitely affected water demand initially in the middle and high income areas of Windhoek, and information campaigns influenced water awareness and more importantly informed how to make choices regarding water use. But accessibility to water and urban lifestyle are two factors influencing water use behaviour more than economic and non-economic demand management incentives at a certain consumption level. The general conclusion is that the willingness to respond to demand management is reduced with improved ability-to-pay and access to water.

This study has also shown that the level of awareness about water scarcity and the need to use water more efficiently is higher among poor households than in the middle and high income group. It was found that the awareness was very high in the informal areas of Windhoek, even though these people use close to a minimum of water per day and do not receive individual information from the authorities. At the same time, people in the middle and high income areas saw themselves as already enlightened about water scarcity. They regarded the poor as not being water aware and occasional information campaigns did not motivate them to save water.

Instead of relying on the short-term effects generated by block tariffs and occasional information, it is vital for long term success of demand management to mobilise a permanent platform of individual water responsibility, especially when living under water stressed conditions. This responsibility will affect attitudes and behaviour to water use, which can only be achieved by understanding household responsiveness to strategies and modifying measures to be specific for each socio-economic group. However, the results from this study show that it is difficult to change people's perceptions of urban lifestyle through pricing and information, particularly in the middle and high income areas that have the highest water demand per capita. But there was clearly elasticity in saving water in parts of this income group which should be made the most of, since a relationship between climatic conditions and water saving was found. Also, compensation programmes (a reduced rate if major water savings are achieved), proper maintenance and installation of water saving techniques can reduce the demand for water from the domestic sector. Recurrent public and household information is on the other hand important to make people act according to increased awareness.

Overall, the two-fold situation water managers face in the fast growing cities in the developing world is in satisfying water demand for the urban lifestyle and at the same time striving for reduced consumption. These are two opposite but equally important objectives for future urban development and stability.

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