

WATER MARKET BETWEEN DEMAND, SUPPLY AND SUSTAINABILITY

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Abstract

The paper presents some of the most representative figures about water supply and demand, available on literature, and connects them to sustainability concerns. Within this context, we highlight the importance of consumers' attitude on water and analyse a study case on consumers' evaluation of drink water. We used a simple random survey and the results showed: a low interest (19%) in receiving drink water related information, low availability (10%; self evaluated) to change behavior according to the information received, rather positive evaluation of general tap water quality (60%-good), categories of improvements wanted in water quality (66% requested safety).

Key words: water supply, water demand, sustainability, drink water, consumers' evaluation

INTRODUCTION: WATER MARKET

Water market comprises all the markets where supply and demand for water, water rights, water related services and products meet and prices for them are set. The water market has numerous participants, including: users/owners (irrigators, farmers, rural water utilities, irrigation infrastructure operators, industry, urban water utilities, environmental groups), intermediaries (brokers, conveyancers, solicitors, banks, money lenders), researchers, government, public (investors, community groups, general public) [10].

WATER: SUPPLY, DEMAND, SUSTAINABILITY

A well known estimation of the size of the global water market is about \$375 billion (in 2012), with an annual growth rate of 4-5%; within that amount, the key segments are: 50% municipal utility services revenue, 27% consulting, engineering, construction, operations, other services, 21% equipment, technology, chemical treatment sales, 2% residential water treatment equipment [12].

The global water supply-demand imbalance is increasing due reduction of available reserves and increased

contamination, both consequences of population growth (especially in arid, water-short regions), incorrect pollution management, and inefficient utilization of available supplies. Consequences of clean water shortages are high risk of geopolitical conflicts, increased food imports, population shifts, health problems, environmental decline etc.

The fresh water available for human consumption is a very small fraction of all water on Earth, as shown in Table 1.

Two decades ago the fresh water on Earth (ground fresh water, fresh water in lakes and rivers) available for extractions was estimated at 10,623,120 km³, which represented 0.7% of all water. Since than, population increased, contamination also, precipitation distribution changed, global warming rised. More recent assessments of UNEP estimate: the total volume of water on Earth is about 1.4 billion km³ and the volume of freshwater resources is around 35 million km³, 2.5% of the total volume [13], but not all of it is accessible to humans and the available part is unevenly distributed in relation to the needs.

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Table 1 Water distribution on Earth

Water source	Water volume, in cubic kilometers	Percent of freshwater	Percent of total water
Oceans, Seas, & Bays	1,338,000,000		96.5
Ice caps, Glaciers, Permanent Snow	24,064,000	68.6	1.74
Ground water	23,400,000		1.7
Fresh	10,530,000	30.1	0.76
Saline	12,870,000		0.93
Soil Moisture	16,500	0.05	0.001
Ground Ice, Permafrost	300,000	0.86	0.022
Lakes	176,400		0.013
Fresh	91,000	0.26	0.007
Saline	85,400		0.007
Atmosphere	12,900	0.04	0.001
Swamp Water	11,470	0.03	0.0008
Rivers	2,120	0.006	0.0002
Biological Water	1,120	0.003	0.0001

Source: <http://ga.water.usgs.gov/edu/earthwherewater.html>, apud Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (ed.), 1993, *Water in Crisis: A Guide to the World's Fresh Water Resources*, Oxford University Press, New York

At six billion inhabitants level, the global water used was 54% of all the accessible freshwater contained in rivers, lakes and underground aquifers and water use has been growing at a rate more than twice of population increase in the last century ([13], apud Food and Agriculture Organization of the United Nations, World Water Assessment Programme). At the same time, freshwater withdrawals have tripled over the last 50 years. Demand for freshwater is increasing by 64 billion cubic meters a year (64 km³/year). The world's population is growing by roughly 80 million people each year and changes in lifestyles and eating habits in recent years are requiring more water consumption per capita [14]. An

OECD projection of future global water demand estimates it at 7517 km³ for 2050 (compared with 5565 km³ in 2000; [11]).

According to Aquastat, at global level, most of the water withdrawals are used in agriculture, which comprises water for irrigation, livestock and aquaculture [9], [2]: 70% agricultural, 11% municipal, 19 industrial. Aquaculture is a small, but growing agricultural use of water. Freshwater commercial fisheries may also be considered as agricultural uses of water, but have generally been assigned a lower priority than irrigation. The estimated increase by 2050 in demand for edible fisheries products is shown in Table 2.

Table 2 Estimation of demand for edible fisheries products

Year	Population (billion)	Fisheries products consumed (million tonnes)		
		Total	Capture	Aquaculture
2009	6.91	117.8	62.7	55.1
2050	9.15	156.0	63.0	93.0

Source: C. Boyd, 2012, p. 8

Taking into account present trends (population growth, pollution mismanagement, increased food needs, increased environmental sensitivity etc), many concerns are linked to aquaculture: destruction of mangrove, wetlands, and other sensitive aquatic habitat by aquaculture

projects; conversion of agricultural land to ponds; water pollution resulting from pond effluents; excessive use of drugs, antibiotics, and other chemicals or aquatic animal disease control; inefficient utilization of fish meal and other natural resources for fish and shrimp production; salinization of land and

water by effluents, seepage, and sediment from brackish water ponds; excessive use of ground water and other freshwater supplies for filling ponds; spread of aquatic animal diseases from culture of organisms to native populations; negative effects on biodiversity caused by escape of non-native species introduced for aquaculture, destruction of birds and other predators, and entrainment of aquatic organisms in pumps; conflicts with other resource users and disruption of nearby communities ([1], p. 18-19).

However, not all water uses and generated values are included here. Water footprint and virtual water are additional indicators that can complete the picture of real water use and demand – they indicate the volume of water embodied in a product.

In certain cases of water use, water market can help for a better allocation and use of this resource. In order to function effectively, a certain market needs to have property rights clearly defined, enforceable, and transferable; thus, they will lead to the allocation of rights to their highest-valued use. Water rights can refer to actual water volume, a share of a given water body or water flow etc. For instance, the owner of an orchard pays nothing or a very small price for the water he uses and he has access and right to use more than he needs, which usually leads to a wasteful manner of managing water, and he also has the right to sell his water use right; at the same time, there is an owner of a fishery that lacks water and is willing to buy it, the orchard owner can sell the water he can save or doesn't need to the fishery owner. The water market allows both buyer and seller to gain and leads to a better allocation of a scarce resource, from economical perspective and, sometimes, also from environmental one.

MATERIAL AND METHOD: SURVEY DESIGN AND IMPLEMENTATION

The objective of the research described in the case study was to evaluate propensity to change behavior towards drink water and evaluations of the tap water of the customers of the water company. The results belong to a broader study on the attitudes of the

customers of a regional water company (SC Compania de Apa Somes SA – CASSA), as a part of the ISPA measure ISPA 2000/RO/16/P/PE/008 Rehabilitation and Modernization of the Water and Sewerage Infrastructure for the Area of Cluj. We implemented a simple random survey, in the municipal area of Cluj-Napoca (NW Romania) using home interviews. The margin of error was 5%, the confidence level was 95%, the total number of valid questionnaires was 384 [7].

RESULTS AND DISCUSSIONS: CONSUMERS AND DRINK WATER

Information is the fuel that gets going a certain behavior. Information is essential for shaping consumer's behavior and when the receipt of information is accompanied by the interest in the subject of the message, the chances to retain the information and use it to influence behavior are higher. On a higher level on an imaginary interest scale, active search for information implies flexibility and propensity to change behavior in order to reach some expected results (better health, environment protection etc). At the other end of the scale, lack on interest in the subject hinders the retention of information and sustains the rejection of behavioral change suggested by the message; the reason is that consumers (people, in general) seek safety, equilibrium, certainty, and avoid change, novelty, which is accompanied by uncertainty. Information behavior may comprise stages like initiation, search, selection etc [5], [6].

Interest in water as a natural resource usually starts with interest in drink water, because the latter is more closely related to the individual.

Option between bottled and tap water may appear when consumer perceives differences between the two and needs a certain quality when uses it either to drink it, to cook food or for aquaculture, cultivating sensitive plants etc. We aimed to find out if consumers are interested in knowing more about quality differences between bottled and tap water. The question used was: "*Are you interested to read information about the*

drink water – a comparison between the bottled and the tap water?” (Figure 1)

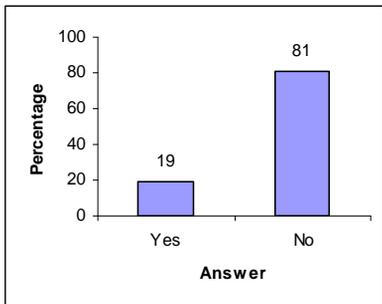


Fig. 1. Interest in receiving drink water information

Around one fifth of the customers are interested in receiving information about the water they drink, while the majority (81%) is not. The explanation may be: this is a reflection of the general attitude of the subjects shown during the research – a lack of interest for any subject that doesn’t bring immediate and material benefits; also,

consumers may have strong convictions about tap and bottled water or they don’t believe they can get reliable information or they do not see any use of additional information. Whatever the case, this is rather an unfriendly situation in relation to water education.

Increase in bottled water consumption during the last two decades is obvious, at least on Romanian urban markets. The reasons behind this choice may not always be correct. When consumer receives information, the probability to change behavior will depend directly on four main factors: consumer’s propensity to change (or indirectly in the case of resistance), importance of the subject for the consumer, consumer’s trust in the source of information, external factors (more the factors that stimulate the adoption, higher the probability to happen, less the factors that hinder the adoption, higher the probability to adopt the new behavior) (Figure 2).

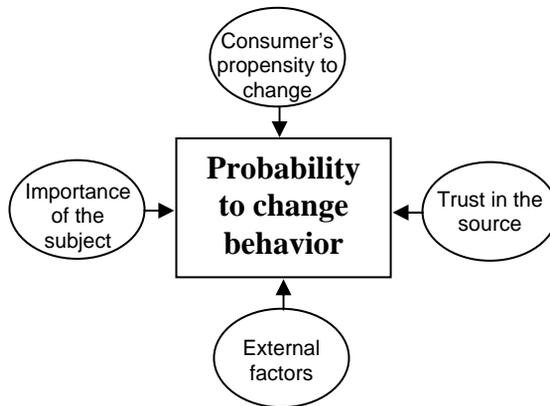
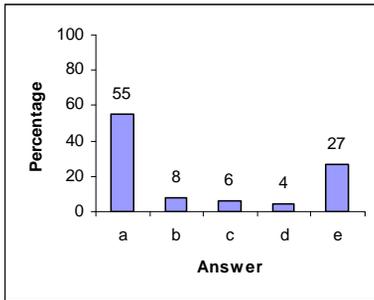


Fig. 2. Factors that influence the probability to change behavior
Source: author’s elaboration

Based on the assumption that the water company delivers good quality water, comparison tap-bottled water may put the first one under a positive light. We wanted to know how consumers estimate their own availability to change behavior according to the information received. The question was: “If you read a study that says that the tap

water is better than some of the bottled waters, will you behavior related to drinking water change?” (Figure 3). This information can complete the picture of consumers’ tap water image and indicate ways of influencing consumers towards a behavior that would bring them more benefits and would be more sustainable.



a – no, because I already drink tap water
 b – no, because I will still not trust tap water
 c – yes, I will start drinking tap water
 d – yes, I will stop drinking the bottled water brands indicated as poor by the study, but I will not drink tap water
 e – I don't know

Fig. 3. Self evaluation of availability to change behavior according to the information received

The customers perceive themselves as hard to be influenced by the information received. Due to this context it is very important they perceive the information a neutral and fair one and not as an attempt of manipulation. A relatively low percentage

declares (12%) they cannot be convinced to drink tap water.

Perception of the water quality is essential in the consumption process. In order to determine consumers' evaluations we asked: "How is the quality of your tap water?" (Figure 4).

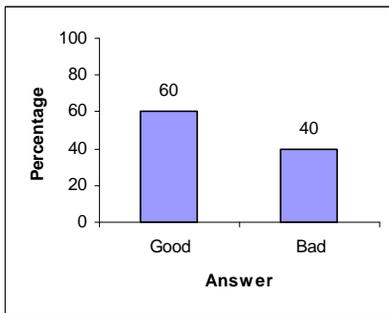


Fig. 4. Evaluation of tap water quality

More than half (60%) of the subjects believe tap water quality is good, which means they are satisfied (at least) with the quality of their tap water. However, even these 60% can feel improvements are possible or desirable. The percentage of positive appreciation can be increased through improved awareness on the good quality of the water and through improvement of the private water networks. The "Bad" evaluations may be shifted from the reality, when the water quality is good, but it is perceived as bad because of various reasons (high expectations, group influence etc), or real, when the water is bad indeed, due to the influence of the client's degraded private pipes network. The water company delivers high quality water that meets all the legal standards, so the quality of the water

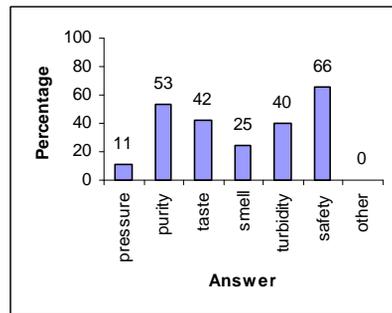


Fig. 5. Categories of improvements in water quality

delivered to its clients is good. EU member states are required to ensure that the prices charged to water consumers for services such as for the delivery of fresh water and the collection and treatment of wastewater reflect the full costs of extracting, treating and transporting it to consumers [4]. The customers suffer from this situation because they pay for a high quality and then receive a lower one, being forced to consume it or to pay an additional price (to buy bottled water, water purifiers etc) in order to compensate the need of high quality water. The results of a previous research (2003) revealed that 39% of the population did not drink bottled water, which made them exclusive consumers of tap water (simple or purified) [3].

Satisfied customers have a positive attitude towards the company and are more

likely to get involve in actions promoted/requested by the company, to accept its explanations, to pay attention to its messages.

For deeper understanding of the previously mentioned evaluations, we searched what improvements are needed and we asked: “*What would you like to be improved?*” (Figure 5).

The perception of tap water safety and purity must be improved because when the customers have the chance to ask for improvements, more than half refer to these (53% for purity and 66% for purity). Taste and turbidity are also mentioned as needing improvements by 42% and 40% of the subjects. One quarter perceives bad smell of the water. The situation can be improved by showing the real causes of the problems when they are present and by correcting the wrong perception of the reality. If the degree of quality decrease is perceived as high (regardless of its accuracy in relation to objective quality), water use may suffer changes not only in direct consumption, but also for other uses, like cosmetic use, plant watering, aquaculture etc; this can led to negative consequences on consumer’s (as he will pay additional prices for higher quality water, give up opportunities for wrong reasons), environment (unnecessary consumption of resources) etc.

CONCLUSIONS

Water is one of the most important commodities and a natural resource put under pressure by rapidly increasing demand and reducing supply. Consumers’ attitude on water influence the degree of sustainability of their behavior. Survey results show rather good evaluation of tap water quality (60% of consumers), a low interest on receiving drink water information (19% eager to find out more) and numerous expressed needs for improvement concerning safety (66%) and purity (55%) of tap water, but of low intensity, as they do not affect extensively the

overall evaluation of tap water quality (60% perceive it as good).

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