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SOCIAL RESPONSIBILITY AND ITS ECONOMICAL IMPACT ON SOCIETY: WATER USAGE REPORTING AND WATER LOSSES

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Abstract. The aim of the paper is to emphasize responsibility of individual apartment building households over their water consumption and correct reporting, and demonstrate the financial impact that socially irresponsible water consumption reporting has on individuals' monthly utility payments. Quantitative research method, based on actual data analysis, has been used to analyse the economical impact of water losses caused by irresponsible reporting. The paper forms a part of a more extensive research. The findings shall also reflect what economical impact on payment for the consumed water amount can be made by irresponsible actions of the household residents.

Keywords: social responsibility, economical impact, water loss.

Jel classification: D14, D18, M14, O18, O33, R21

1. Introduction

Nowadays drinking water forms an inseparable part of our daily life. It is vital for both social and economic development. In order to provide water supply to residents of apartment buildings in compliance with the construction regulations, drinking water quality requirements and other provisions, the water-supply system is created in regional centres. Apartment buildings are provided with water by regional water suppliers.

Calculation of consumed water amount is based on two elements: information submitted by the house's residents about readings of the water meters in their apartments; and on readings of a house's water meter, monitored by the representtative of a house-manager. The price of drinking water per cubic meter (water tariff) is set by a house-manager and a water supplier and comparatively seldom becomes a subject to changes. Readings reported by the apartment residents are defined as essential for calculation of the consumed water costs, because they represent variable and easily influenced data. Therefore, it is important to define and ensure credibility of these data, as well as to enhance social responsibility regarding this matter. It is crucial to bear in mind that the payment for the consumed water and the total volume of water consumption loss of the house depends on the readings reported by the house residents.

The aim of the paper is to emphasize responsibility of individual house-managers over their water consumption and correct reporting, in order to demonstrate the financial impact that socially irresponsible water consumption reporting has on individuals' monthly utility payments.

Quantitative research method, based on actual data analysis, has been used to analyse the economical impact of water losses caused by irresponsible reporting.

The research is topical because it shall result in improved society's awareness of its responsibility and fairness and credibility of its reported readings. The findings shall also reflect what economical impact on payment for the consumed water amount can be made by irresponsible actions of the household residents.

2. Social responsibility for usage of water resources

Water resource is a key to ensure living. Although in general it seems to be more than enough around the world, but it is not sufficient everywhere and for everyone. Therefore, it is crucial to ensure that society and the organisations involved bear responsibility for their impact on water resources (Lambooy 2011).

One of the cornerstones for the economical usage of resources is a social responsibility of all involved parties, and it can be based on three aspects (Fig.1):

- social responsibility,
- responsibility towards the environment,
- stimulation of a long-term economical activity.

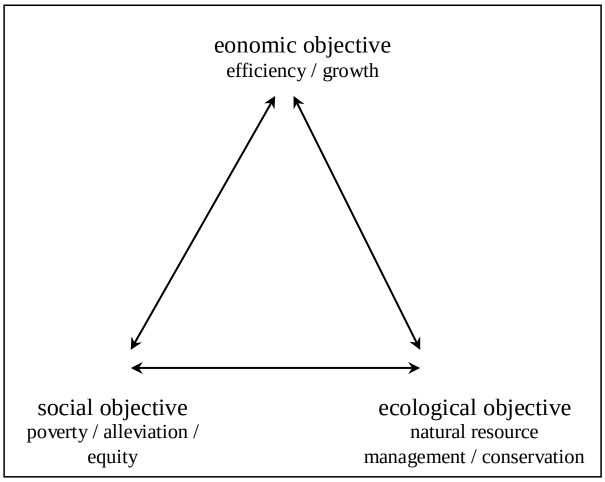

Fig.1. Approaches to sustainability (Source: Munasinghe 1993)

Households use water for a number of needs: as drinking water, for food making, for hygiene needs, to maintain cleanness and heating, etc. Our daily life cannot be imagined without water.

Percentage of residents having access to a public water supply system, and water consumption per capita greatly varies in member states of the European Union and in different regions of some countries. Considerable difference lies also in water network efficiency, water tariffs and percentage of water costs in the ratio to household incomes.

Water consumption is closely connected to the individuals' decision-making process and their understanding about the concept of economical water consumption (Strengers 2011). Therefore, the residents play a major role in the water resource saving, because they are social responsible for this process and can ensure efficient use and saving of water through simple daily actions. That is why it is important to work with the society and inculcate the value of water in people since childhood, educate and encourage them to save this resource. Education and social actions are to be emphasized as vital factors in this matter.

Careful and rational use of natural resources is among main goals of the environmental policy. In terms of sustainability, water shortages are rated as one of the five biggest risks to the world's sustainable future (Goldman 2008).

The following activities might be considered as environmental-friendly:

- decrease in the water consumption,
- waste reduction, sorting and recycling,
- use of environmental-friendly goods and services,
- optimisation of energy consumption.

Responsibility towards the environment is also directly connected to social responsibility, because the water pollution results from the human action. Therefore, not only economical and efficient use of the resources must be ensured, but also their sustainability must be maintained.

Inefficient maintenance of the water resources makes possible problems even more complicated. Integrated water resources management is a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems (Cheret 2000). In line with improvement of social understanding and awareness regarding this matter, the possibility to ensure sustainable maintenance of water resources will also increase.

Not all water problems are located in poorer areas of the world. Water is an important issue even in locations where there are substantial financial resources (Phipps, Brace-Govan 2011).

A comprehensive framework for the measurement and reporting of responsibility in water supply was developed, comprising the environmental and sustainability issues of resource protection and water supply, social responsibility and long-term economical development (Staben, Hein, Kluge 2010).

Consequently, it is important to create management systems responsible for decisions on water use aiming at enhancement of the economic development, cost adequacy and stability, as well as sustainability. It is crucial for all parties involved to follow the collaboration principle underlining the work towards achievement of common goals. Furthermore, the water resource management must include plans of economic and social areas that are directly or indirectly related to the quality and sustainability of the water resource, and might affect it in the future.

3. Economic theories and water resources

The economists have been studying the importance of the water resource and its impact on successful organisation of the national economy, by representing water as a good. Initial failures in such researches are related to the perception of water as a free-of-charge resource and unawareness of its real value.

About two centuries ago Adam Smith put forward so called the diamond – water paradox theory (White 2002). Surprising was that water is more important for human to survive, but the price of the diamonds is substantially higher (Douglas, Charles 1996; Stigler 1950). Classical economists saw labour, rather than use-value, as the determinant of price (Walsh, Lunch 2003).

Marginal utility of a good depends on how much this particular good is necessary for people and how vital it is for their daily life and existence ensuring. Therefore, such goods must be especially demanded and expensive. However, the market reality is completely different. Price of such goods is comparatively low, and these goods are freely available. It is related to the total amount, availability, usefulness, acquisition type and recovery of the particular resource. As soon as one of these aspects changes, for instance, the drought period comes and people face the lack of water resource, the price of the resource shoots up. The world is not running out of water, but it is not always available where and when people need it (Rost 2011). The water demand would also grow in case of the global disaster – then the residents of the affected region would be aimed at acquisition of the resource to provide the reserves for longer period.

Over the last 25 years, the focus of economic water policy models has evolved in concept, theoretical and technical methods, scope and application to address a host of water demand, supply, and management policy questions. Because of the many different types of demand for water, different methods of valuation are needed.

Randall characterized this situation as moving from an expansionary water economy where the benefits of developing new supplies exceeded the cost to a mature water economy where new supply costs exceed the benefits (Randall 1981).

Mehta finds the idea of water as an 'economic good' troubling, because it is a reductionist way to view a multifaceted resource; it ignores localised visions concerning water and water resources management, and market forces do not operate in a vacuum, rather they build on existing social and power relations (Mehta 2000). McNeill and Briscoe also agree with this idea: water should be 'managed as an economic good', meaning that economic ideas from neoclassical welfare theory, which call for an efficient allocation of (environmental) goods by the means of prices to maximize social welfare should be taken into account in water resources management (McNaill 1998; Briscoe 1996).

Young theory was that we need to use the term 'inductive' to describe economic modelling techniques implemented via statistical inference from empirical observations, and 'deductive' for models implemented by deducing demands and benefits from hypothesized theoretical models empiricized with appropriate case - specific data (Young 2005).

Freeman has been regarded as a primary authority on nonmarket valuation theory, on this thinking the basic concepts used as measures of demand and value are willingness to pay or willingness to accept compensation (Freeman 2003).

The changed demands for water modelling have called for different types of models. In this review, we categorize models not by their economic properties, but by the policy question they have to address, or their methodological focus (Booker *et al.* 2011).

From mentioned we can remind that with technological development arise possibilities to analyse questions related to water more deeply, globally and allow to model lot of elements. But the main thing not changed – water is more necessary than diamonds.

4. Elements of water metering system

Accurate water metering and calculation of the payment for consumed water represent essential information for both water suppliers and consumers. These aspects must be also considered by water resource-related policy makers. Usual approach of how to calculate the quantity of residential water demanded is included in equation (1). These usually include income, household structure and size, non-price water restrictions and so on (Arbuès *et al.* 2003).

$$Q_d = \int (P, Z), \tag{1}$$

where:

- Q_d – quantity of residential water demanded (more likely consumed),
- P – some measure of water price,
- Z - independent variables thought to impact upon residential water demand.

That's one of methods how to calculate quantity of consumed water. On the other hand, it is important to define main elements forming the basis for those calculations, because only valid input data can ensure credibility of the consumed water volume and compliance with the real situation.

The authors have identified that the public utility payments for the consumed water volume in Latvia are based on the water metering system incorporating a number of elements and are calculated for a specified time period (usually on a monthly basis). Each element is linked to the person who is responsible for value of the particular element or for precise readings of the metering unit (Fig. 2).

A key feature of demand side management policies is the pricing structure used to apply to water services, called as water tariffs or water costs per cub.m., which itself represents a constant value in a long-term period.

Water tariffs: price of water charged by service providers to users. Water tariffs vary for different users: households, industry and agriculture (European Court of Auditors 2010).

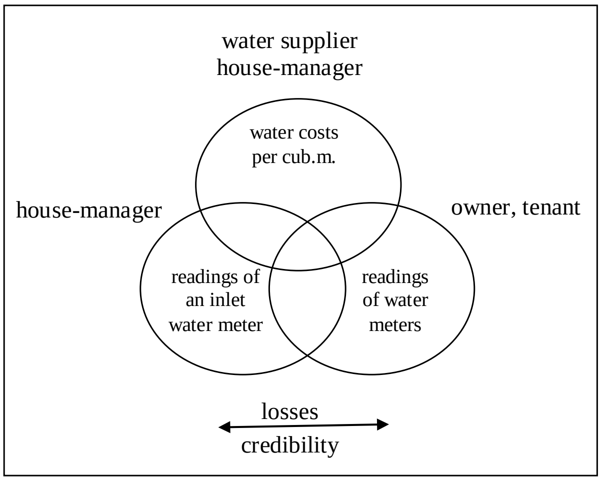

Fig.2. Water metering elements (Source: chart by authors)

At the same time the idea of a water pricing strategy is not only to take neoclassical environmental economics as a principle, but to bring this principle closer to reality by recognizing the importance of pursuing multiple objectives in the implementation of an actual reform (Bernsen 2011).

Water prices need to fulfil various conflicting objectives like economic efficiency, equity, ecological sustainability or the cost recovery of water services providers, 'taking into consideration specific local conditions' (OECD 2009).

In Latvia the water tariffs are defined by the person responsible for engineering and technical infrastructure of the water supply in the particular region. Prior to approval, the company's tariffs are to be confirmed with the Public Utilities Commission in accordance with the established procedure of the regulatory enactments. Usually each region has its own company. Mainly these are state capital companies.

As an example, in the administrative territory of Valmiera city and municipality, which represent one of the largest area of Latvia and one of the most developed region in Vidzeme, provision of water and collection and treatment of wastewaters is ensured by "Valmieras ūdens" Ltd., which is Valmiera's city municipal capital company. Residents of Valmiera form 75% of service receivers, 10% represents state budget institutions, and 15% falls at industrial companies. For example, "Rīgas ūdens" Ltd., which is Riga's city municipal capital company, is responsible for supply of drinking water to the city residents, drainage, collection and treatment of wastewaters in the capital city Riga.

The authors offer to get acquainted with "Valmieras ūdens" Ltd. approved water supply tariffs for the time period since year 2005 in the table 1.

Table 1. "Valmieras ūdens" Ltd. approved water-supply tariffs (without VAT)

No	Period	Tariff (LVL)
1	01.11.2005 – 31.12.2006	0.26
2	01.01.2007 – 31.03.2008	0.343
3	01.04.2008 – 31.07.2010	0.50
4	01.08.2010 – until now	0.64

Each apartment building is managed. House-managers periodically (once per month) draw up an invoice for the utility services received during previous accounting period. By comparing prices presented by the water supplier and a house-manager, one can see that they are different. For instance, "Valmieras namsaimnieks" Ltd. water tariff since September 2010 is 1.38 LVL/cub.m. without VAT, and it is more than twice higher than the water tariff approved by the water supplier (0.64 LVL/cub.m. without VAT).

The findings indicate that the residents actually pay not only for water itself according to the water supplier's tariff, but also for the house-manager's services and works related to maintenance of the water system in the particular apartment building. These costs include services considered by the house-managers as related, and also form the tariff. Unfortunately, the residents on their part cannot influence inclusion of the mentioned services and in most cases they are even not informed about the house-manager's services included in the tariff. Therefore, in order to improve social responsibility and fairness in fulfilment of house-manager's functions, it would be relevant to ensure transparency of his activity and pricing.

The water tariff can have an impact on water consumption to a certain extent, because the higher prices would force residents to explore the possible opportunities of improving the current consumption and further consume less water in a more economical way.

The authors would like to take a closer look at the inlet water meter of the apartment building as the next water metering element. This is the main meter and its readings form a basis for calculation of the payment for the water consumed in the particular apartment building to ensure its internal water supply system.

The internal water supply system of the building is a set of equipment ensuring water receipt from the external water line and its pressurized supply to the building's internal water dispensers (Lediņš 2007).

The readings of the inlet water meter of the apartment building are taken once. Usually this procedure is performed by the house-manager's appointed representative on a monthly basis at all apartment buildings being under supervision of the corresponding house-manager. Taking of meter readings does not require additional knowledge, and application of special devices is needed very seldom. Special devices are used only if a building has water meters with the automatic data reading system. In such cases water meter readings can be taken both remotely and automated, as well as in person with special devices.

This element – reading of the inlet water meter of the apartment building – is credible, because the metering gauge is being periodically checked, and the person taking the readings is not financially interested in the results. It leads to the growth of credibility of the mentioned element and its stability.

At the same time in general, most of the literature on water management advocates the introduction of household metering (Yepes, Dianderas 1996; Dalhuisen, Nijkamp 2001; Dalhuisen, de Groot, Nijkamp 2001; Bartoszczuk, Nakamori 2004).

Information reported by the apartment residents on periodical readings of the water meters installed inside their apartments plays a significant role in calculation of the payment for consumed water. The authors consider this as a variable and easily influenced element. Therefore, it is important to ensure its credibility and stability by raising social responsibility in this regard. The payment for consumed water and the norm of water consumption loss in the particular apartment building relies on this element – reported readings of consumed water volume (cub.m.).

Factors such as demography, economy, climate changes and development of technologies are traditionally considered the most important in forecasting of drinking water consumption in the cities (Rubulis, Sproģis 2001).

There are factors affecting water consumption behaviour – individual's attitude towards the environment and its conservation, personal interest, habits, income, household size and number of its residents (Gregory, Leo 2006). Therefore, the water meter reading is related to a number of psychological factors. Personal involvement is based on one's motivation to act and to process information, and in turn varies by the level of personal relevance attached to an object, situation, or action (Zaichkowsky 1985). These points of view substantiate the authors' common opinion that the consumed water readings are partly related to the income, age and habits of the apartment's residents. Currently most apartments are equipped with water meters without possibility of automatic data reading. Therefore, the credibility of meter readings is crucial, because it can be affected by the apartment's residents reporting false data. This factor can be avoided only through regular monitoring by house-managers, especially regarding the apartments in which the improper reading of the water meter was identified.

To achieve more effective water governance it is necessary to create an enabling environment which facilitates efficient private and public sector initiatives (Rogers, Hall 2003).

Therefore, it is important to improve social awareness and responsibility regarding this matter, by motivating to report actual water meter readings for a specific time period.

5. Water loss and its economical impact

Non-invoiced water: difference between the volume of water abstracted and the invoiced consumption, also known as unaccounted-for water. It includes leakages, illegal consumption, inaccuracies in measurement and free use of water services. While leakages can only be estimated, non-invoiced water is a measurable parameter for which data are available in almost all the water supply systems (European Court of Auditors 2010).

The authors hold a view that the matter on water losses shall be studied by forming two categories – water losses in the common city water system infrastructure and losses in the internal water system of apartment buildings.

The opinion is hold that the leaks in the water infrastructure do not have to be large to have a major effect on water loss. Large watermain breaks receive much more media attention, but these types of failures only account for 1% of water loss caused by leaks (Baird 2011). The authors partly agree to this statement and consider that this situation applies only to the cities having the water supply infrastructure regularly monitored, renovated and arranged in line with the modern technological solutions. Besides, the system has organised so that leakage, if any, can be promptly eliminated and minimized. As an example can serve the abovementioned Valmiera's water supply system maintained by SIA "Valmieras ūdens".

The study of the European Court of Auditors shows that such non-invoiced water (% of total water abstracted) in the EU member states on average amount to 7 – 55 % (European Court of Auditors 2010). This study relates water loses both to the city water system and the water system of the apartment building.

Within the framework of the particular research, the authors have mainly focused on water losses in the internal water system of apartment buildings caused not only by technical problems and unexpected system breakdown, but also by residents' reported inaccurate readings of consumed water. It is also thought that there are residents trying to 'steal' water by using different methods.

Unauthorized water usage cannot be controlled but can be possibly limited by installation of water meters equipped with magnetic protection. Installing the water meters outside the flats can combat this problem as well as can decrease the number of inaccurate readings. This could be an effective solution, although it would require major rebuilding of water supply lines in buildings (Rubulis, Šnīdere, Briedis 2001).

The opinion is hold that water meters with automated data reading system are required to prevent false readings. This could eliminate a human impact factor. Due to the automated system it is possible to take meter readings in preferable time periods or when necessary. The authors consider that such water metering system could be applied mostly in newly built apartment buildings, by installing the mentioned water meters in the entire building already during its construction. Implementation of this system in existing apartment buildings could cause some problems, because preconditions of the automated system's functionning lie in installation of the mentioned water meters in the entire building. It would mean a replacement of current water meters requiring sound investments.

Latvian regulatory enactments state the critical point of water losses as 20%. If such loss rate is reached three months in a row, the house-manager must perform assessment of the internal water system of the apartment building for the cause of excessive leakage.

There are several options to cover the occurred water losses:

- application of an average loss rate;
- re-calculation of water tariff based on losses;
- loss splitting pro rata to consumption;
- inclusion of loss payment in house-management costs.

The economical impact on water charge, by applying the water tariff 1.38 LVL in combination with the abovementioned loss coverage methods, is reflected in Fig. 3 Economical impact of losses on a water tariff.

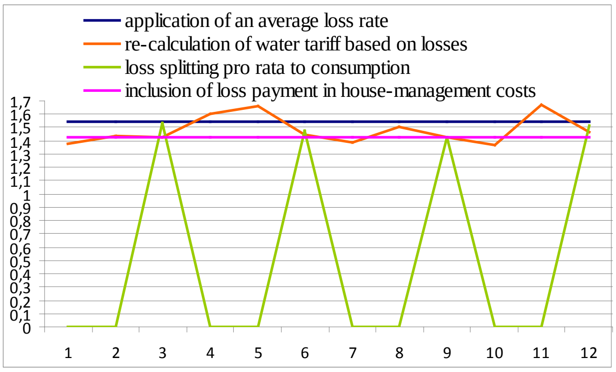

Fig. 3. Economical impact of losses on a water tariff (Source: chart by authors)

Application of the average loss rate requires long-term calculations of loss amount. At the same time, the residents are not interested in determination of the losses, but in their minimization. Therefore, by determining and applying such rate, the residents agree to raise the water tariff without even knowing the actual situation during application of the rate, because actual losses could be lower than charged.

It is possible to re-calculate the water tariff on the monthly basis to cover the losses occurred. This would result in a variable and unpredictable water tariff. The water tariff would also be easily influenced, because the residents in this case would be interested to present consumed water readings as rare as possible, by indicating bigger consumed water volumes in one accounting period so that the water tariff costs for the corresponding accounting period is the lowest.

There is a possibility to connect the losses with consumed water volume, so that the bigger water consumers would pay more also for water losses. Such calculation method is more stable comparing to the previous one. However, it might be affected by presenting data on consumed water periodically rarer and in bigger volumes. As a result, payment for water losses for the corresponding accounting period will be smaller than as compared to the regular payment.

The authors consider the last option – inclusion of loss payment in house-management costs – as the most appropriate. According to this scenario, the residents would pay for water in compliance with the readings of the water meters, and the house-manager would identify average water losses and include them into house-management costs – water tariff position.

However, it must be taken into consideration that any chosen solution shall have a direct economical impact on residents, because anyway they are covering occurred losses.

6. Conclusions

To improve social responsibility and fairness in fulfilment of the house-manager's functions, it would be relevant to ensure transparency of his activity and pricing.

The house-managers have to inform residents about the water loss dynamics changes once per quarter.

When organizing general meeting, house residents should include questions regarding water losses in the agenda.

The methodology should be defined for the house-managers to be able to identify false readings of the water meter reported by residents. Once such situation is identified, the check of the suspicious water meters must be done.

The house-manager has to perform the water loss analysis if the loss exceeds 10% of total water consumption per quarter.

Responsibility for the reporting of false water meter's readings should be defined, and the actions of the house-manager when identifying such situation must be determined.

After having assessed a possible economical impact of the water loss on water tariffs, the conclusion is drawn that the water loss must be included in house-management costs.

To ensure transition to the consumed water payment system which includes water losses in the water tariff, initially a detailed research on water losses in each particular apartment building should be conducted.

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