

# **Risk Management in Public Utility Service: Assessment of Water Consumption Recording Risks**

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## **ABSTRACT**

Nowadays, water supply systems are inalienable part of apartment houses, because water is one of resources without which humanity could not exist. These two issues – water consumption risks and water losses are closely connected. The aim of the paper is to evaluate water consumption recording risks in apartment houses and develop risk management methodology for water supply system with a purpose to reduce risk impact on water consumption recording. Through this water consumption recording will become more reliable and stable. Research was done using qualitative research methods. The research findings can be used by apartment house managers to improve quality and reliability of their public utility services, at the same time decreasing or excluding risks which can influence water consumption recording. This report might be used as guidelines for apartment house managers to develop risk management methodology of water supply system in apartment houses.

**Keywords:** risk management, water consumption, assessment.

## **1. INTRODUCTION**

Water supply system establishment was an important milestone that gave added value to daily life of the population. Nowadays, water supply systems are inalienable part of apartment houses, because water is one of resources without which humanity could not exist. Several methods were used for water consumption recording. Initially methodology was based on the amount of water consumed divided by the number of flats in the apartment house. With the development of methodology, the amount of water consumed was divided by the number of people living in the house. As water resources became more expensive, approach was changed and accounting method was based on meter readings of water consumption. Water consumption risks are closely connected with water losses. Water losses were evaluated with the help of quantitative approach carrying out data collection, analysis and comparisons. Another important aspect is the question about water consumption recording risks. Some authors (Zechman, Pollard, MacGillivray, Strutt) assessed risks of water supply system. These researches were in the field of water quality and water accessibility. This paper evaluates water consumption recording risks in apartment houses and develops risk

management methodology for water supply system with a purpose to reduce risk impact on water consumption recording. With the help of this risk management methodology water consumption recording will become more reliable and stable. Research was done using qualitative research methods. On the basis of research and analysis, the authors developed risk management system according to which apartment house managers could evaluate and manage water consumption system in each apartment house. The research was restricted only to water supply systems of apartment houses and related water consumption recording risks. The research findings can be used by apartment house managers to improve quality and reliability of their public utility services, at the same time decreasing or excluding risks which can influence water consumption recording. This report might be used as guidelines for apartment house managers to develop risk management methodology for water supply system in apartment houses.

## **2. RISK MANAGEMENT DEVELOPMENT AND IMPORTANCE**

In the late 20th century and the beginning of the 21st century, the question of risk management developed in the context of business management. In 1993 K.Froot, D.Sharfstein and J.Stein came up with a risk management model, indicating that risk management is a set of strategic options [23, 18]. Thereby increased capital efficiency created synergies between different risk management activities. The aim was to avoid increasing risks and improve operational and strategic decision making [7, 14, 8]. From that we can understand that risk management is based on the constant implementation of the requirements and efficient risk limitation. Main provision in risk management is to create the value for the parties concerned.

Risk can be defined as the combination of the probability of an event and its consequences [21]. Risk is an essential element of strategic management and figures prominently in many empirical studies of industry, firm and business unit performance [1]. The authors endorse the view that risk is a combination of components, which in certain circumstances may have negative consequences for a particular product, process or person.

Over the time, risk management like risks has been given different definitions. Risk management is the process of determining the potential risks and their categorization, followed by the definition of an action to eliminate these risks

[26]. Risk management – a systematized complex process, which provides risk management framework for the company [15]. Risk management is a fast developing trend of improving enterprise activities [5]. Risk management – coordinated activities to direct and control an organization with regard to risk [16]. The authors believe that risk management is a continuous development process in which a set of risk elements is identified and the necessary monitoring and preventive actions are carried out, to minimize the likelihood of risk occurrence and increase operational efficiency by taking appropriate measures.

In Latvia, risk management system in non-financial companies was established on the basis of insurance and internal audit development as one of the business management activities [5]. Today, risk management refers to various types of organizations. Moreover, it refers to both – organizations engaged in production and selling, as well as those that offer different services.

Risk management is always a part of decision context. It is increasingly common that organizations need to measure and benchmark compliance risk elements to the strategies set and general principles of activities in the particular sphere. Important knowledge for risk analysts is what tools are available for decision analysis and what are the methodological and practical strengths and limitations of alternative approaches. At the same time risk management should be a continuous and developing process.

The authors believe that risk management must be integrated into the organisational culture with an effective policy and a programme led by the most senior management. It must translate the strategy into tactical and operational objectives, assigning responsibility throughout the organisation with each manager and employee being responsible for risk management as part of their job description.

### **3. PUBLIC UTILITIES SERVICES IN CONNECTION WITH WATER USAGE**

People have been dealing with water supply issues since ancient times with the aim to supply their households with drinking water and rural areas with water for irrigation. Urbanization brought about the necessity to supply certain regions with water in bigger amounts and often from more distant reservoirs, which contributed to the establishment of centralized water supply of urban areas.

Today, different countries often provide water supply in different ways, depending on availability of fresh water resources, geographical and climatic conditions. However, these are only methods and they are dependent on the use of various technologies to provide citizens and businesses with drinking water. Water supply is inherently a set of different engineering structures and management activities, under which water is taken from the water source (groundwater or surface water) and, if necessary, purified and delivered to consumers [22]. Water supply system in each region is set up slightly differently, at the same time with certain common characteristics.

In Latvia, about half of the municipal water supply is groundwater. Surface water supply is used in Riga and Ventspils. Drinking water supply system has been created and is provided in nearly all apartment houses. Basic principles of water supply system are common.

In the sphere of water resources, risk management is carried out to ensure drinking water quality compliance with the requirements and to prevent usage of health or life-threatening water. To assure that, the transition to an explicit risk management philosophy within the water utility sector is reflected in recent revisions to the World Health Organization's

Guidelines for Drinking Water Quality [12]. Some of the authors (Dewettinck, VanHeutte, Geenens, Hellier) point out that attention should be focused on the importance of water quality management, hazard analysis and critical control points approach. And some authors (Hrudey, Pollard) consider these elements of utmost importance as risk management measures within the water supply chain from catchment to tap [17, 4]. Many of the larger water utilities have connected their responsibilities for financial control with the risk management programmes that are implemented throughout their businesses, including the operational risk analysis and management activities at the process plant level [3]. Thus, risk assessment is carried out by regional water suppliers. They perform the necessary activities to ensure adequate water quality and plan the financial resources required for that purpose.

Risk management in the water industry provides for the need for continued monitoring. It is important not only to ensure that water meets certain conditions and is safe to be consumed, rather than simply manage risks. And other aspects should be taken into consideration, one of these aspects is water consumption, because it has a direct economic impact and significance in efficient use of resources as well as social responsibility. Risk factors so far have not been specified and evaluated with respect to water consumption.

### **4. MANAGEMENT OF WATER CONSUMPTION RISKS**

Risk management strategies and techniques are traditionally applied for broader application for any area, e.g. public health protection etc. Risk management has been studied extensively in recent years in order to ensure compliance with drinking water quality requirements. Water utility managers have to consider risks alongside one another, employ a range of techniques, and devise business plans that prioritize resources on the basis of risk [13]. Therefore organizations involved in water provision and supply should ensure risk management process at all levels. This should be done not only by regional water suppliers, but also organizations that carry out management of apartment houses. Otherwise, the whole water supply process is not fully exposed to risk management which can lead to irreversible consequences and financial costs necessary to stabilize the situation.

Risk management is a central part of organisation's strategic management. The optimisation of the expected utility is the ruling paradigm among economists and decision analysts [24]. The focus of good risk management is the identification and treatment of risks.

According to the authors' opinion, benefits from using risk management are:

- all the aspects of organization's internal environment system are mutually integrated to ensure effective achievement of the objectives, functioning and risk management strategically lead by the top management,
- the existing processes are enhanced, including decision making, planning, monitoring and prioritization,
- more efficient use of different types of resources within the organization is facilitated,
- the company's image is maintained,
- knowledge of the organization's staff, stakeholders and the general public is enhanced.

Over the past 20 years there has been a discussion in Latvia concerning water recording methods and conformity of the reported water consumption with the actual water consumption. This problem escalates during economic crisis and it has not yet been resolved. There are always potential risks, regardless of economic conditions and the number and liability of parties involved. In each situation, these risks may vary slightly, but

general trends and the main goal of the specific risk management do not change. According to the authors, risk management can be used as one of the methods which can reduce incorrect water consumption recording. The authors believe that risk management should be applied by the managers of apartment houses and it would not require large investments, but would help in solving several problems. That would be beneficial for all – the society, house managers, water suppliers, and other parties involved. The managers will also have an opportunity to improve efficiency, professional capabilities of service operations.

The approach starts with studies of actual cases of disaster and near disaster and then focuses on identification of the contributing factors [27]. In order to more comprehensively reflect risk management process, the authors have illustrated it by using the Deming cycle (plan, do, check, act) [2, 20] (see Figure No. 1). By taking successive steps in the process: planning (identifying risks), acting (assessing risks), checking (reducing risks) and assessing (risk review and monitoring), the number of risks and risk probability reduce and this tendency is best observed in the long-term. Certain principles and solutions can be explained by the fact that organized, sequential and continuous risk management process reduces a certain number of risks and likelihood of their occurrence in the long term.

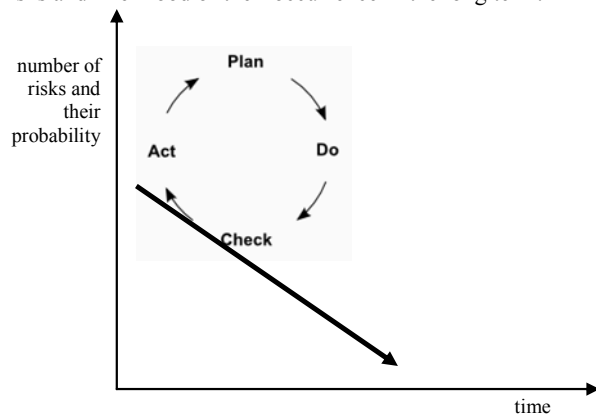


Figure No.1 – Activity cycle within risk management framework

To establish an effective risk management system, initially it is necessary to define the problem and set the goal the organization wants to achieve. The authors believe that the main problem in the apartment house water consumption recording is water losses and reliability of the reported water meter readings provided by the tenants. But the main aim is to minimize water losses in the internal water pipes of apartment houses and ensure the reliability of the submitted water meter readings. The issue has to be dealt with in a complex way, but it is not considered in this research. The article focuses on the establishment of a risk management system for apartment house managers, so that problems are minimized and the tenants are more satisfied with the service provided.

Risk management frameworks set out the relationship between the processes of risk identification, evaluation and management [10], which will be discussed in more detail in the next chapters.

#### 4.1. RISK IDENTIFICATION

Avent in his article points out that the International Organization for Standardization defines risk identification as

the ‘process of finding, recognising and describing risk. The risk identification involves the identification of risk sources, events, their causes and their potential consequences’ [19].

Risk identification process is effective, if risk connection and continuity are observed, which means clarification of inter-related risks. It is more appropriate to perform analysis by comprehensive examination of all business processes, rather than by assessment of individual activities [15].

In Table 1 the authors have identified the potential risks of water consumption measurements recorded by apartment house managers. The research results have revealed the main risks affecting water consumption records, and namely, information technology and water counters.

Within the framework of Technical Advisory Committee ‘Global water partnership’ it has been concluded that the public interpretation of risk is an important factor of social risk assessment, but this approach is not yet used in practice in water risk assessment processes [9]. The authors accept this view and consider that evaluation of this aspect is appropriate when carrying out risk identification and assessment. However, focusing on social risk is not significant for proper functioning of water consumption calculations.

It is recommended to involve in risk identification the apartment house managers and employees whose duties are directly related to maintenance of the water supply system of an apartment house, recording the amount of water consumed, monitoring of water consumption and performing water consumption calculations. It would be useful to periodically (at least once a year) involve the tenants – perhaps they have identified certain risks which have not been noticed by the organization's employees.

#### 4.2. RISK ASSESSMENT

The risk is a variable that cannot be assessed in every case. It varies according to knowledge, economic and social situation. Risk is a dynamic value that changes much faster than probability of hazards [9].

Risk assessment through risk analyses looks to the future to determine what can go wrong and how, the potential consequences and the relative likelihood of this, and finally the overall level of risk. Risk analysis is always part of a decision context [24]. Risk analysis – systematic use of information to identify sources and to estimate the risk. It forms the basis for risk evaluation, risk treatment and risk acceptance. Information can include historical data, theoretical analysis, informed opinions and the concerns of stakeholders [16].

Risk assessment is part of risk management. It provides a structured process that identifies how objectives may be affected, and analyses the risk in terms of consequences and their probabilities before deciding on whether further treatment is required.

Risk assessment attempts to answer the following fundamental questions:

- what can happen and why,
- what are the consequences,
- what is the probability of their future occurrence,
- are there any factors that mitigate the consequence of the risk or that reduce the probability of the risk [6].

The authors believe that the risk assessment matrix (see Table No.1) could serve as the basis for initial risk assessment by each manager, correcting it in accordance with the situation, if such a need arises.

Table No.1 – Water consumption recording risks

Types of risks	Types of related risks	Consequences	Parties involved	Causes of risks
1. Management and employees	1.1. Management staying away from problem solution 1.2. Unclear job responsibilities and tasks to be performed <u>1.3. Employee overload</u> 1.4. Ineffective motivation 1.5. Shortage of skilled employees 1.6. Inadequately skilled employees 1.7. Failure to comply with occupational safety requirements	Disorganization within the organization. Disagreements between the management and employees. Employee dissatisfaction and carelessness, probability of corruption. Deterioration of the organization's image. Delayed problem identification and delayed action to eliminate them. <u>Incorrect data input and billing.</u> Financial losses to the organization and / or the tenants.	Management and employees	Management and staff's lack of interest in organizational development and absence of orientation to provide services in accordance with society's expectations. Management and employee overload. Short- and long-term absences of the staff. Employee carelessness and negligence. Lack of qualified and experienced staff.
2. <u>Information technologies</u>	2.1. Information technology software and system nonconformity <u>2.2. Loss of data</u> 2.3. Damages to the system and data by computer viruses and third parties	<u>Delayed identification of potential risks and delayed actions.</u> <u>Incorrect data input and billing.</u> Failure to provide the necessary actions in due time. Data loss or misleading data. Possible third parties access to the tenants' personal data. Damaged organization's image. Financial losses to the organization and / or the tenants.	Information technologies, software, third parties, employees	Breaking of the security system. Technical problems in transmission, calculation and preparation of data. Amortization of information technology software and systems and their nonconformity with current requirements. Computer viruses.
3. Water meters and their readings	3.1. <u>Influencing water meters to hide the real amount of the water consumed</u> <u>3.2. False readings and submission of misleading data</u> 3.3. The location of the meter on the pipeline and the distance between the meter and the pipeline bends 3.4. Failure to carry out conformity assessment procedures	<u>Loss of meter readings reliability.</u> <u>Improper functioning of the meter.</u> <u>Financial losses to the organization and / or the tenants.</u> <u>Incorrect data input and billing.</u> <u>Increase of water losses.</u>	Third parties, employees, tenants, conformity assessment institutions	Management and staff's lack of interest. Tenants' willingness to perform fraudulent activities and hide the actual meter readings. Technical problems. Amortization of information technology software and systems and their nonconformity. Computer viruses. Employee carelessness and negligence. Lack of qualification and experience. Misleading information.
4. The internal water supply system of an apartment house	4.1. <u>Sudden damage, leaks</u> 4.2. Water pipeline damage and unauthorized connection to the water pipelines without a meter.	<u>Financial losses to the organization and / or the tenants.</u> <u>Delayed identification of potential risks and delayed actions.</u> Failure to provide the necessary actions in due time. <u>Increase of water losses.</u> Repairs of water pipelines, temporary water turn-offs. Damaged organization's image.	Third parties, employees, tenants	Technical condition of water pipelines in the building and worn-out pipes. Management, employees and tenants' lack of interest. Employee carelessness and negligence. Short- and long-term staff absences. Lack of qualification and experience. Unauthorized action of the tenants. Changing weather conditions.

After risk probability and impact assessment, composite risk index can be determined, it is calculated multiplying the impact of risk event by probability of occurrence. The impact of the risk event is commonly assessed on a scale of 1 to 5, where 1 represents minimum and 5 represents maximum possible impact of an occurrence of a risk. The probability of occurrence is

likewise commonly assessed on a scale from 1 to 5, where 1 represents a very low probability of the risk event actually occurring while 5 represents a very high probability of occurrence. Probability of identified water consumption estimation risk assessment and evaluation of the impact are

reflected in Figure 2, based on the information shown in the risk assessment matrix (Table 1).

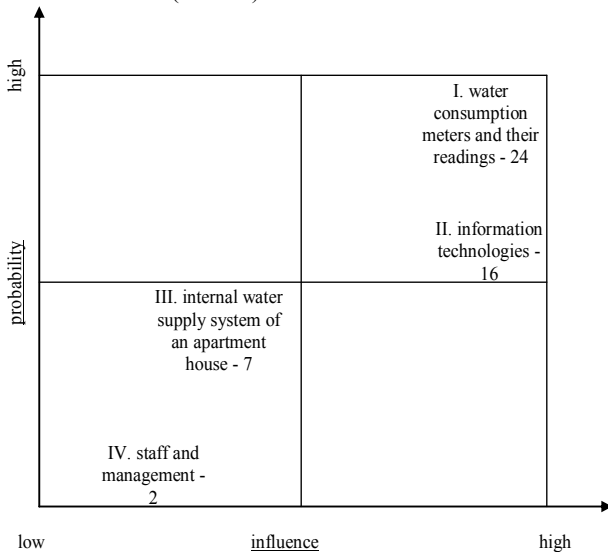


Figure No.2 – Risk probability and impact assessment

After the identified risk probability and impact assessment was performed, the authors concluded that the greatest risk likelihood and impact is from risks connected with water meters and their readings. The next most significant risk, according to the assessment performed, is information technologies risk. Based on the information shown in the risk assessment matrix (Table 1) and assessment model in Figure 2, it is possible to perform assessment of related risk probability. Thus, one can obtain a fuller picture of the existing risks within the organization, based on which future decisions on risk prioritization and how to deal with them can be taken.

### 4.3. RISK REDUCTION

Making credible and defensible decisions in organizations requires an institutional capacity to be proactive rather than reactive when managing risks and an aptitude to learn from experience. Implementing risk analysis strategies and decision-making frameworks requires clear, straightforward procedures that can be understood, agreed and operated at all levels in an organization.

In order to ensure mitigation of the number of risks and their impact, risk reduction method is applied – actions taken to lessen the risk probability or negative consequences, or both [16]. To reduce risks, it is possible to establish a separate assessment matrix for each probable type of risk. In this matrix, information of any actions to be taken in order to reduce the likelihood of risks and to avoid them should be included in the order of priority.

It is essential to review the risks regularly. Risk identification is an ongoing process for finding the potential risk. If it is done regularly with appropriate frequency, it is possible to provide comprehensive risk identification and monitoring within an organization.

The identified new risks need to be registered and reported to the person in charge, to carry out their assessment and inclusion in the overall risk matrix and to revise the likelihood and impact assessment in connection with them. Consumer decision-making is a dynamic process, however, it is driven by water resources policies, which are, in turn, based on the current quality and availability of water resources [11]. Consumers can be influenced to reduce their water consumption through, for example, setting different temperature on the water heater for

different time of day, drinking water restrictions and tariffs of water. The interactions and information exchange between the utility managers and consumers will dynamically influence the system hydraulics, increasing the complexity of the decision-making process for the utility managers [25]. In view of these considerations, it is advisable to involve tenants in the risk assessment and revision process. This would promote the tenants' awareness of the whole process, at the same time enhancing their knowledge of the particular field and encouraging them to be socially responsible.

The next step in risk management process is defining possible alternatives and choosing methods of action. One of the alternatives in this case would be to install water meters with remote digital display option. This option would be possible on condition that all apartment house tenants replace the existing meters with water meters with a remote digital display option, and such a meter would be installed in the house as the input meter for the monitoring of total water consumption in the house. This solution would be to some extent most effective. This is connected with large financial resources and decision by the tenants' general meeting on such action, which in not all cases is simple and quick matter to be resolved. However, this alternative option would minimize the problem but not eliminate it entirely. Therefore, within the framework of the research, the authors chose to adapt to real situation, identifying the most appropriate of the possible methods and risk management models.

## 5. CONCLUSIONS

The essence of risk management is to create higher value for the parties concerned.

This report might be used as guidelines for apartment house managers to develop water supply system risk management in apartment houses.

It is necessary to develop risk management standards. Their application would be on an optional basis.

Those who are most knowledgeable about risks and their assessment are parties involved in water consumption records, including tenants. This would allow for a comprehensive risk management in a particular house. At the same time it will increase the tenants' responsibility for water consumption and its recording process as a whole.

Risk management can be considered as added value to the organization through which society can get much more qualitative product and service.

The research has identified the highest risk factor which is water consumption meters and their readings risk.

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