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STANDARDS OF WATER SERVICES QUALITY LEVELS WITH REGARD TO THE RELIABILITY OF WATER SUPPLY TO THE RECIPIENTS

STANDARDY JAKOŚCI POZIOMU USŁUG WODOCIĄGOWYCH Z UWZGLĘDNIENIEM NIEZAWODNOŚCI DOSTAWY WODY DO ODBIORCÓW

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***Abstract**: During the period of the structural changes in the processes of the European integration and regionalisation, the issue of the water services quality standards, which is associated with the social, economic and demographic development of the country, becomes more and more important. A properly functioning collective water supply system (CWSS) should ensure a continuous water supply to the recipients, with a suitable quality and adequate quantity (required pressure), at a specific time. These parameters must be maintained at the required level, which in reality is not so simple. Also indicators used for assess water services reliability for recipients are proposed. These indicators clearly evaluates the consequences of failures and at the same time retains the simplicity of estimation, which allows for its widespread usage in risk management.*

***Keywords:** water supply infrastructure, water services reliability standards and indicators*

***Streszczenie:** W wyniku przemian strukturalnych powstałych na skutek procesów regionalizacji i integracji europejskiej, problematyka związana z jakością świadczonych usług wodociągowych, stanowi istotne zagadnienie w zakresie kształtowania polityki rozwojowej przedsiębiorstw wodociągowych, oraz służy polepszeniu istniejących rozwiązań organizacyjnych i eksploatacyjnych. Prawidłowo funkcjonujący system zbiorowego zaopatrzenia w wodę (SZZW) powinien zagwarantować ciągłą dostawę wody do odbiorcy o odpowiedniej jakości, oraz odpowiedniej ilości (wymaganym ciśnieniem) w określonym czasie. Powyższe parametry muszą być utrzymywane na żądanym poziomie, co w rzeczywistości nie jest takie proste. W pracy przedstawiono propozycję konsumenckich wskaźników, określających standardy jakości usług wodociągowych oraz wyznaczono ich wartości w oparciu o dane z eksploatacji.*

***Słowa kluczowe:** infrastruktura wodociągowa, wskaźniki oraz standardy niezawodności dostawy wody*

1. Introduction

Currently in Poland water companies operate in a monopoly situation. Such situation can cause an excessive increase in the price for the water supply and a reduction in service quality. Consumers are partly protected against such action of the water companies by market restrictions. These restrictions are based on the fact that a company cannot provide more water than the capacity of the water network allows, and the price for water supply cannot be too high, but it must be such that consumers are willing to pay (Rak and Pietrucha 2008). On the other hand, however, companies can take advantage of the fact that water is essential in every household and virtually in all industrial processes, so they can increase water price because consumers will pay. Therefore, to prevent the excessive use of a monopoly position by the water companies, a legal system was created that regulates the monopoly market. This system must affect both the monopolist and the recipient in such a way that it protects the recipient against being used by the water company and an excessive concern for the customer does not exclude the possibility of rational functioning of the water supply company. This system consists of legal acts, which define relations between the water supplier and the water recipient. Specially established state institutions ensure compliance of these regulations. Out of 90 decisions issued by the Office of Competition and Consumer Protection that concerned the protection of the collective interests of consumers, 36 decisions were connected with the punishment of water companies, and 335 decisions were related to the abuse of a dominant position (126 completed by the penalty decision). The act on collective water supply and sewage disposal regulates many aspects of services delivered by the waterworks companies but does not introduce the concept of a guarantee water services quality level, that is the rules of quantitative reliability and safety of water supply. In the European Union countries a significant interest in this subject is seen, in the European Union and worldwide there is a trend to improve the quality of services rendered by the waterworks company. In the United Kingdom The Water Services Regulation Authority OFWAT exists, which regulates the relationship between the recipient and the supplier of water, using the precise criteria for, among others, the required degree of reliability, the procedures of dealing with consumer complaints. In figure 1 a way of control of the water supply sector in the selected European countries is presented. It generally occurs at the national level, however, if it occurs at a regional level, it usually involves adapting the relevant legislation. As mentioned before, reaching the monopoly situation by the water company in the water supply market is an unfavorable situation for the recipient, because a monopolist without competition cannot maintain a certain quality of service. In this issue Poland acts well, in comparison to other countries it is very active in anti-trust area.

Not only the recipient but also the water supply company bears the consequences of failure to comply with the quality parameters, resulting in financial losses for undelivered water and additional costs associated with failure of water distribution system.

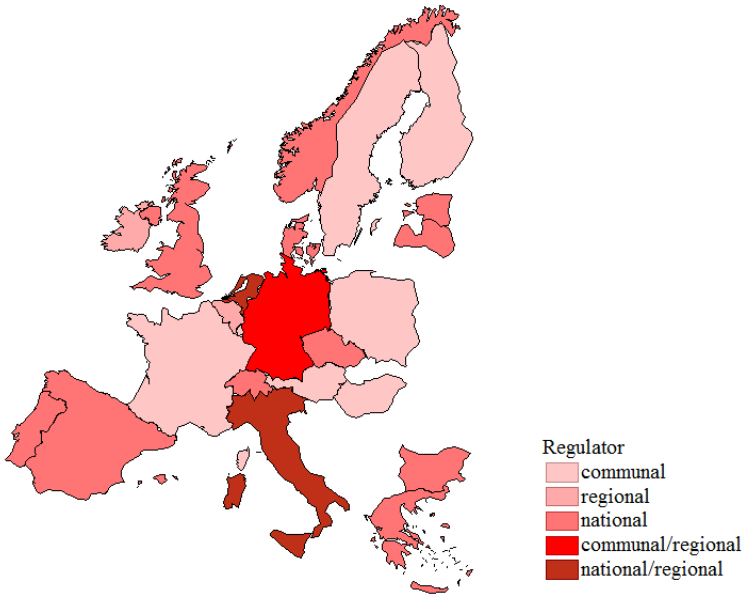

Fig. 1. Regulation of water companies in the selected European countries [own elaboration].

Immediate improvement of water quality is in practice not possible because the change in organizational and technical structure needs time and financial effort. For losses resulting from the failure of water pipes the following areas of occurrence can be distinguished:

- in relation to waterworks companies: losses resulting from the repair of failure, including the costs of preparing for the repair, its execution, return of segment to service and restoration of the area to its original state; losses associated with the volume of water which was not sold because of the failure - it can be estimated as the average water consumption during the failure, additional losses resulting from the failure, such as the costs of the removal of flooding, changes in traffic organization, etc., costs arising from the responsibility of waterworks company towards water consumers, for example, penalties for lowering the standards of water supply; costs associated with keeping the maintenance service in readiness,
- in relation to water consumers: costs associated with the lack of water supply - for industry and services they are understood as, for example, the value of reduction of production or production of lower quality goods, for housing they are more difficult to estimate, the valuation may be performed by the discretionary methods; costs of the loss of health resulting from difficulties in the maintenance of hygiene; potential costs associated with the inability to use tap water to extinguish fires.

The act on collective water supply and collective sewage disposal (based on Article 19, paragraph 2) imposes an obligation to adopt the rules defining the rights and obligations of the water supply company and the recipients of the services.
They concern:

- a minimum level of services provided by the company for the water supply,
- the detailed terms and conditions for contracts with the recipients of the services,
- the method of accounting based on the prices and charges set out in the tariffs,
- the conditions for connecting to the network,
- technical conditions defining the possibility to get the access to the water services,
- the course of action when the service is not continuous and water does not have proper parameters,
- a level of service to the recipients of the services, and especially the ways of handling complaints and the exchange of information on disruptions in water supply.

However, legal regulations regulating the operation of water supply companies and conditions of receiving water have certain deficiencies. One example is the lack of clear rules that would strictly define minimum level of services provided to water customers by water companies. These rules are based on local legislation that is approved by the local authorities. Thus, relatively large diversified rules for the provision of water, depending on the region. These rules contain criteria that are a base for evaluation of various characteristics of water supply, such as pressure, the smell of water, acceptable duration of breaks in supply (Pietrucha-Urbanik 2012).

2. Guaranteed standards of water services quality levels

Initially, the guarantee was closely related to the mass production of technical goods and it was an agreement between the seller of a technical object and the recipient (buyer). In that agreement, the producer of a technical object ensures the proper functioning of a technical object for a certain time and it declares to cover the costs of repair in case of failure in the guarantee period. The buyer, however, declares to use the technical object in according to its intended purpose.
With the occurrence on the market a larger scale of services, appeared the so called guarantee of the service quality (Service Level Agreement - SLA), which can be defined as an agreement between the service provider and the service recipient (buyer). In this agreement the supplier agrees to maintain the service at a certain level, as agreed with the customer. The agreement also includes penalties incurred by the service provider in case of a reduction in the quality of service below a certain level. The use of the service level agreement began with the provision of ICT services, where the service provider was obliged to the proper functioning of all the network components so that the recipient could use the service at any time. In the case of water supply the provider (that is the water company) is obliged, under the guarantee, to supply water with specific parameters (pressure, water quality, etc.). The difference between the guarantee for the technical object and the

guarantee for the quality of the services is that in the first case the recipient gets the guarantee for a technical object that he holds physically, while in the second case the recipient receives the guarantees for the proper operation of the network that is the technical objects, which he does not hold physically (e.g. in the case of water supply network - pumps).

For the service recipient the most important thing is that the supplier has the ability to meet service parameters throughout providing the service. The service recipient is given such a certainty from the guarantee of SLA, which ensures the service recipient the ability to enforce sanctions from the service provider if he fails to comply with appropriate service quality. It can be said that the SLA guarantee represents a certainty that services will be maintained at a certain level by the supplier, by which the supplier is gaining the confidence of the recipients. Based on the SLA guarantees the service recipient can precisely express his needs (for services), and the service provider can recognize these needs.

Regardless of the guarantee the SLA should specify:

- The criteria and standards for water services ranked in order of priority:
  1. Safety of life, health and well-being of water consumers of water related to water quality [Acts of Minister of Health, No 61, item. 417].
  2. Amount of water supply (pressure, capacity) (Bylka 2002).
  3. Economic efficiency.
- Remedies in case of any deterioration in the quality of services provided.
- Exoneration Causes, in practice the range of exoneration reasons is broadly defined (especially in the case of force majeure) because the service providers tend to limit their liability.

In addition to these points, any SLA guarantee contains other provisions that are dependent on the type of service (Rak and Pietrucha 2008, Bylka 2002).

3. Indicators defining the standards of water services quality

In order to standardize the quality of water services it was proposed to adopt consumer indicators that allow for clear description of the system for both the CWSS exploiter and the water recipient. The introduction of a group nuisance indicator (GNI) for the lack of water supply, as a measure of the synthetic size of the lack of water supply, taking into account the size of the group and the duration of the event, was proposed. The determination of the GNI covered by the guarantee requires a database for the duration of the lack of water supply and the size of affected population. Nuisance which is caused by the lack of water supply, depends on time of day and the duration of interruptions in water supply. This nuisance is proportional to the size of failure, the number of people affected by failure and the duration of interruptions in water supply (Studziński and Pietrucha-Urbanik 2012). The methodology of determining consumer indicators, defining water quality standards for services was given below, and their values were determined based on data from the operation:

- Customer Interruption - CI. The number of interruptions per year per recipient - it is an indicator that informs how many unplanned interruptions of water supply are, on average, for one recipient.
- System Average Interruption Frequency Index - SAIFI. This type of indicator is calculated by dividing the number of water consumers exposed to the consequences of this kind during the year by the total number of supported users. This indicator does not include interruptions in water supply shorter than two hours.
- SAIDI - this index determines how long during a year the recipient of water can expect interruptions in water delivery. It is calculated as the sum of the products of duration of interruptions in water supply and the number of consumers exposed to the consequences of interruptions in a year, divided by the total number of the supported users.
- CAIDI - using this index we define the average time necessary to restore the water supply in case of unplanned interruptions in water delivery. This index is calculated as the sum of the duration of all interruptions in the water supply divided by the total number of water interruptions.
- ASAI - it is the quotient of the time of the continuous water supply throughout the year and the time when there was the demand for water.
- ASUI - this index is calculated as the quotient of time of the water supply interruptions during the year and the time in which there was the demand for water. This index is called the index of the unavailability of water supply.
- CAIFI - this index is defined as the quotient of the total number of the unplanned interruptions in the water supply and the number of customers cut off from water supply during the unplanned interruptions.
- MAIFI - this index is calculated as the average number of short interruptions in the supply of water (up to 2 hours) which the water recipient can expect. It is calculated by dividing all short interruptions in the water supply during the year by the number of customers connected to the water network.
- EWENS - the amount of undelivered water to customers during the year.
- AWNS - Average Water Not Supplied - it is the quotient of the undelivered water to customers in the year to the number of customers connected to the water network. This index determines the amount of undelivered water per year to one recipient.

In Figure 2 the values of chosen consumer indicators, on the example of the city of Rzeszow, were presented.

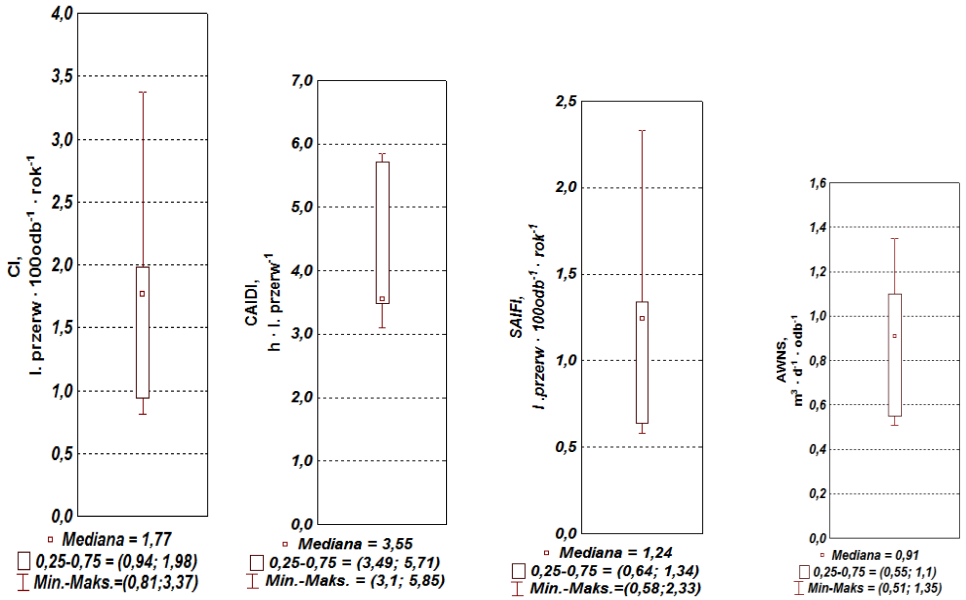

Fig. 2. The values of chosen consumer indicators

4. Conclusion

The presentation of the methodology for defining consumer indicators and estimation of their values will allow a reliable assessment of the quality of service and will be a basis for a series of actions on CWSS operating. Focus on meeting the needs and expectations of consumers will soon cause the necessity to provide the guarantee standards of water services quality levels. The need for the provision of the water services quality levels related to the CWSS operation is increasingly being reflected in national legislation. Water consumers increasing awareness of their rights causes that waterworks companies are more and more focused on the client. The recipient who bears costs in the form of fees, is entitled to demand an adequate level of service. More and more often the parameters of water supply are standards, according to which the agreement between the water supplier and the water recipient is concluded. In the agreements concluded between the supplier and the recipient, the recipient should have the right to negotiate the price if the supplier does not fulfill water quality standards. Specific identification of indicators describing the quality of water services prevents misuse of monopolistic position by the water supply company. The SLA should specify the obligations of the supplier to the recipient for failure to obtain guaranteed water supply parameters and determine the compensation rules and procedures for resolving conflicts, as well as ways of giving rebates and discounts, e.g. using methodology described at this work. The basis for such an agreement should be arrangements for customer service quality standards, therefore the establishment of the priority criteria (the parameters of water supply) and the permissible values of deviations of these parameters from the acceptable parameters.

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