

Sewage Purification Business Process Management

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Summary

This paper presents the current level of drainage and sewage purification facilities built in the Autonomous Province of Vojvodina, a territorial unit of the Republic of Serbia. It also points out the issues related to organized business management in companies involved in this business.

The management of business processes in sewage purification involves a comprehensive cycle: business organizing process, issues of standard, investments, workforce, and information system design as factors in establishing an effective organization of business processes. The definition of gap existing between the current approach to organizing business activities and the need to establish an approach based on knowledge, information technologies, and effective business process management points to the necessity for organization redesign and standard definition in business process management.

Sewage purification business process management in Vojvodina, the Republic of Serbia has been elaborated through theoretical presentation and a practical example realized by electronic ISO 9001:2008 system of quality management in public water utility company JKP "Vodokanal" Sombor.

Keywords

waste water purification, business processes management, information system

1. Introduction

Public utility businesses represent the activities of production and supply of utility products and the provision of utility services performed in order to satisfy the requirements of the utility products and services users, and an irreplaceable condition for the life and activities of citizens and organizations existing in a specific area.

According to law, public utility business, in addition to other things, implies the drainage of precipitation and waste water, and the system of canals represents a system of technical, functional, and organizational measures providing continuous and systematic gathering and transportation of waste water produced by citizens and businesses, its purification and placement into reservoirs.

The facilities of the sewer system include: internal sewer installations of the users, public sewer network, re-pumping stations, sewage purification installations managed by system operators, as well as facilities for taking purified water into reservoirs which are within the scope of responsibility of national water resources management companies.

The basic motive of this work was the need to observe the capability of the public utility organization to adapt to the environment - while doing the utility business using know-how as a critical factor of business growth, and to improve

the living standard of the utility service users. Under contemporary conditions of doing business, companies are obliged to optimize their business finding new means and approaches that enable a more productive business and higher profitability.

2. Sewage Purification

The Republic of Serbia covers an area of 88,361 km² and has a population of 7,498,001 (Statistical Office of the Republic of Serbia, n.d.). The Autonomous province of Vojvodina, in the north of the Republic, covers 24.33% of its territory and has 27.10% of its total population. There are 37 municipal sewage purification facilities in Serbia with total capacity of 1,000,000 ES; however, less than 10% of the collected sewage is purified in these facilities.

2.1. Sewage Management in Vojvodina

In the Province, 2,031,992 people live in 749,925 dwelling units; 57.36% in towns and the rest in other populated places; 94.71% of them have provides water supply in their homes; 84.34% have found a technical solution for draining sewage (Republički zavod za statistiku, n.d.). There are 497 water polluters registered on the territory of Vojvodina; 69.01% do not have their sewage purified; 14.28% get it purified as a part of public sewage; 16.7% apply primary purification method

of sewage. (Faculty of Science, Chemistry Department, 2010, p. 72)

However, the fact that merely 36.88% ES on the territory of the Province is covered by sewage purification, 35.53% being industrial and the rest 64.47% public sewage (JP "Vode Vojvodine", 2010), represents a problem for water protection and for integrated water management.

Public utility companies, owned by local government, as operators of the system, carry out the drainage and purification of sewage.

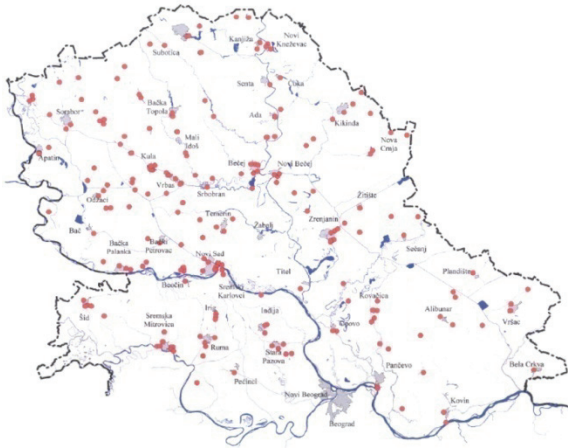


Fig. 1 Spatial distribution of pollution sources (Dalmacija, 2008)

2.2. Sewage Purification Business Processes – Barriers and Objectives

The existing utility companies represent traditionally functional organizations of vertical management; managers are focused on their own sectors and parts of the organization business, while the organization as a whole is neglected.

In spite of the fact that the idea of business organization through business process management has not been of a recent date, utility companies have not set to work on implementation of initiatives for improving business through business process development.

At the very start the philosophy of utility companies' adjustment seems to have been repellent justified by the imprudence of local government, but objectively it was due to the unwillingness of the legislator and the fear of changes.

Instead of defining and promoting business processes justifications related to profitability, vague definitions, unreal expectations, wrongly defined goals, management support failures were sought. In the 1990s, however, when the process approach became, once again, an essential issue, information technologies were not advanced

enough to provide optimal support to the approach.

Long-standing inappropriate legal framework, ownership structure, inefficient services provision, fragmented competence of governmental bodies at different levels of jurisdiction, the absence of broadened knowledge about the way these companies should be organized and managed, lack of investment, poverty, and inappropriate selection of employees represent the major obstacles for the transformation of these organizations into financially sustainable, market-oriented companies providing quality service to their users.

Quality management system demands the organization to analyze the requirements of the service users, to define the processes that contribute to the achievement of products and services acceptable for both users and the founder of the organization, and to hold these processes under control. Through constant improvement, the possibility of satisfying users and other interested parties increases, providing confidence of users in the quality consistency of utility products and services.

The most relevant advantage of this approach is reflected in the need to adjust to changes through process approach that will make interventions on the process possible that will provide visible results in a short time. The real deficiency of ISO standard is the fact that all the processes were recorded on paper, resulting in the possibility of making mistakes and losing data, as well as the consumed time represented difficulties in meeting quality standards.

However, the greatest deficiency is the permanent adjustment to market changes, the impossibility of keeping key business data up-to-date and providing timely information. Business processes management¹ represent business initiative supporting PDCA² approach that enables quick adoption of business process changes and thus establishes direct possibilities of controlling not only the business processes, but the business of the utility company as well.

2.3. Sewage Purification BPM

Due to different approaches of numerous authors in defining the term of business process for the purposes of this paper ISO standard definition will be used – 'Every activity or a set of activities that receives input elements and converts them into

¹ Hereinafter referred to as BPM

² Deming's methodology: Plan-Do-Check-Act

output elements can be considered as a process.' (Standardization Institute of Serbia, 2007)

The defined processes consist of mutually connected activities of the organization so that some of the organizational goals could be realized. They have their proprietor, limits and users adding them value, and are related to parts of business and cross-functional businesses of the organization. These are:

1. The primary business process is the drainage and purification of utilized water in order to perform the mission and achieve the major goals of the organization directly affecting the provision of a utility service and protection of the environment.
2. Management processes are planning, resource management, reassessment and control carried out at top management level by allocation of resources. BPM is to result in constant improvement of performance covering the interests of all interested parties.
3. Process support involves defined roles and tasks, human resources, infrastructure, organizational structure, technology, policy, rules and regulations. They are cross-functional in character and provide successful realization of primary business functions.

The process of sewage purification in Vojvodina is not performed institutionally. There are few companies using sewage treatment facilities before disposing of their waste water into public sewage networks; there are only 22 municipal facilities for purification of industrial and communal sewage.

2.4. Sewage Quality Standard Issue

Sustainable development of water resources is contained and depends on economic, institutional, and water management instruments and principles - WHO/UNEP (1997).

Regardless of the fact that the state is the founder and the owner of public sewage networks, sewage purification operators and water resources companies running the recipient reservoirs, the regulatory role of the competent authority is imposed in connection with adopting rules regulating this domain, defining standards for performing this work, and establishing a regulatory body for the sewage domain.

In addition, the application of economic principles does not exclude the application of regulatory instruments not adjusted to those of EU. Public functions and competence are shared between the central government (defining principles and water management measures) and the regional water resources management organizations (defining water quality flowing into public waterways and the level of pollutants).

Unlike communal sewage characterized by a constant composition resulting from the standard and the way of living in the region, the sewage quality of the other polluters is heterogeneous and demands the application of appropriate pre-treatment of each type of pollution.

Local authority bodies have the discretionary right to stipulate the quality level of sewage disposed into the municipal sewage network, or – in agreement with the local sewage purification operator – to determine the obligation for building a sewage pre-treatment facility to purify sewage to due quality level, depending on each polluter's business.

Having adopted BAT (Environmental Protection Agency (EPA), n.d.) concepts, the best available technique of environmental protection, such conditions should be created that lessen the environmental impact of some production or activity. In cases of sewage purification, a comprehensive solution involves identification of sites where sewage comes from, collection and transport of sewage, purification of sewage, transport of purified water to recipients, re-use of purified sewage and the recipient.

Sewage purification BPM primarily depends on the quality of unprocessed sewage and, in relation to the quality of purified water, it is conditioned by the characteristics of the recipient. If the choice of the process were made according to service flow and according to the type of order of the user, in conformity with the matrix of the process characteristics (Schroeder, 1993, p. 178), sewage purification would have the quality of linear service flow to order.

2.5. Business Processes Organization Issues

If the organization establishes, documents, and carries out QMS, it can reach its full potentials on the condition that BPM has been implemented on the level of the entire organization, which then requires the establishment of process focused organization. Comprehensiveness of business processes is achieved by orienting and motivating employees to improve business processes.

"Every company is a collection of activities performed with the goal of designing, producing, marketing, supplying, and supporting its products. The value chain of a company and the way it carries out certain activities reflect its history, strategy, strategy implementation approach, and the economy of these activities themselves." (Porter, 1985, p. 55)

During organization design, the management must define business processes and sub-processes so as to provide optimal functioning of the business system using efficient and effective management and respecting organization theory rules, and the experience gained in this or similar activities.

The managers of BPM organization prove their adherence to development and constant improvement of efficiency by focusing on users, defining quality policy, determining quantifiable quality goals, authorizations and responsibilities, and human resources management. They also define, provide, and maintain the necessary infrastructure.

After sewage purification business process and sub-processes have been identified, process lists and process line diagram determined, it is necessary to describe formally the process elements: technical and technologic lines, purposes, goals and volume, input, ownership, management, and output so that the process elements are clearly understood.

2.6. Investment Issues

Strategic goals of the company are: higher level of collected sewage, purification quality, lowering purification costs, attaining leadership in technology, creating opportunity for growing and developing, achieving sustainable development of the local community.

If the company focuses on a long-range performance sewage purification, investment activities may have two aspects:

- financial, and
- organizational.

The financial aspect of investment implies earmarking financial and other resources by which the quantity of all engaged resources (necessary for building the lacking facilities, equipment, and installation to raise the existing purification to higher technical and technologic level) is changed.³

Organizational aspects of investments begin with the need to break up close systems tending to

maintain the existing state. Knowledge, the key production resource, highlights the features of modern economy reflected in promotion of creativity, innovations, organization management that eliminate obstacles to cognizance and limited human resources, and also encourages the creation of environment leading to changes. All these things are feasible if the BPM capacities are provided with innovation infrastructure, adequate administrative capacities, and long-range financial means.

3. Information Systems in Function of BPM

The support of information and communication technologies⁴ is considered one of the preconditions for successful functioning of an organization. An integrated information system is a coherent program solution that covers the whole model of the company's business, supports and integrates the work of all services and functions connecting all business processes within the organization, but also the external ones the organization is performing with its business partners. (Vukšić, Hernaus, & Kovačić, 2008, p. 128) Unlike the available information technologies of the 1970s and 1980s, when the availability of data was in the main focus (van der Aalst, ter Hofstede, & Weske, n.d.), the present software systems are designed for business processes management.

"Modern organizations - rich in knowledge and built on firm ITC foundations, have three different forms and are entirely (Tisen, Andriesen, & Depre, 1999, p. 166):

- process based
- team-work based o
- virtual community based

BPM has reached full potential by being implemented on the entire level of the organization (JP "Vode Vojvodine", 2010). This was achieved using specialized software for the application of eCert standard, an electronic system for sewage purification BPM, a network application with adjusted, process befitting modules. Its functions are reflected in the production of documents, business process management, approval of realization activities and their monitoring. The electronic system for business process management is a customized module design enabling management by internet.

³ The subject is not treated in this paper

⁴ Hereinafter referred to as ICT

Table 1 BPM eCert applications

MANAGEMENT ELECTRONIC SYSTEM , ISO 9001:2008

<i>Business processes</i>	<i>Sub-processes</i>
Documentation	- documents inspection, mail, requests, subject matters, effective regulations
Management	- Planning: work schedule, monthly programme, work activities assessment, approval of actions, assignments
Resources	- Human resource: systematization, employees, medical examination, sanitary examination, protective equipment
Product and service realization	- Infrastructure: machinery, maintenance, reporting and elimination of breakdowns
	- Jaroš: wells, equipment, chlorine containers, drinking water supply network
Measuring, improvement analysis	- UPOV: sewers, pre-treatment, equipment
Purchase	- field laboratory work, sampling, calibration, relevant institution's report, faulty samples report
Administration	- plan, purchase request, accepted offers, terminated process
	- departments, sectors, producers, suppliers, document classes, wells, programme, examination type

"The following advantages are achieved by implementing standards: exclusion of paper documentation, effective monitoring of the whole management system, as well as permanent, fast and accurate access to information for authorized subjects from any location. It also enables the monitoring of the realization of tasks of each employee according to defined criteria; economic external checking; efficient documentation management; connecting the business processes of the system; business controlling system, and an easier management of resources." (Lukić, Vodokanal – 50 godina u službi korisnika, 2011, p. 131)

Reference models can be paired with best available practical knowledge. It is also possible to compare alternative processes (to benchmark

them) or to conduct simulation or quality evaluation studies. (Scheer & Nüttgens, n.d.)

Implementing this sewage purification process requires know-how, as well as the technology, organizational procedures and rules both of the benchmarking partner and the individual knowledge of each employee.

4. Achieving Improvement of Sewage Purification Business Processes

For proper assessment of the organization's goals achievement, it is necessary to estimate performances from different aspects of gauging instruments, list of balanced measurement being the most renowned. (Kaplan & Norton, 1996)

The indicators related to the organization depend upon existing strategy and critical factors of success. They cover all aspects of business, but it is necessary to establish target performances, simple process measurement, dedicated management, and created organizational culture.

The available information about achieved performance is used in decision making and in business promotion actions . Measures represent information and motivation instruments both for individuals and teams.

Information system should contain information about *what is to be done* and *what digressions from* defined procedures of the business process *emerged* when the process was performed. These and other types of information are used for constant improvement of sewage purification business process. The best practice of recent cases and available new technologies enable adjustment and application of benchmarking process.

"By analyzing the obtained results of the best organizations knowledge about one's own technical and technological advances, about work organization, and motivation of the workers is gained. On the basis of thus acquired experience, development programmes can be designed with the aim of improving the observed deficiencies, decreasing difference in quality and business effectiveness, and defining prospects for top level results." (Lukić, 2008, p. 10)

If the gap is eliminated after the conducted benchmarking process and improvement is achieved by adjusting purification BPM, resources should be diverted so that another process could be improved in relation to its competitive area.

After the benchmarking process has been conducted, it is necessary to form a data base to be used in the further implementation of improvement. A continuous process implies

information updating; the ending of one process is the beginning of another.

5. Conclusion

The fact that only 36.88% ES on the territory of Autonomous Province of Vojvodina is covered by sewage purification confirms the existing problem of water protection and integral water management.

As Serbia is getting closer to European Union, EU regulations on water should be taken in account. The new European policy comprises directives on water brought by European Parliament and Council of Europe and refers to the activities of the Union in the domain of water and has been in force since December 22, 2000. The directives demand rational use and protection of water.

The paper points out the need for the implementation of BPM promotion initiatives in sewage purification by business processes development. Sewage quality standard and business processes organization issues have also been specified.

Financial and organizational aspects of investments present a particular problem. Illustration and the practical example of BPM in sewage purification – public water utility company JKP "Vodokanal" Sombor.

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