

THE FINANCIAL AND ECONOMIC RISKS IN THE RISK ASSESSMENT MODEL MADE FOR WASTEWATER TREATMENT PLANT

Jovana Topalić¹ [0000-0001-7854-3257], Vladimir Mučenski² [0000-0001-9830-4747],
Andrea Ivanišević³ [0000-0003-3342-7257]

Abstract

This paper analyses the financial and economic risks in the risk assessment model made for wastewater treatment plants. This group of risks was identified during the doctoral research conducted with the Delphi method. In the risk assessment model, six groups of risks are identified and evaluated within a team of the Delphi method: legal, financial and economic, logistics, environmental protection, management, and design risks. The financial and economic risk group has five identified risks. These risks are specified after the literature review and previous project experiences. The importance of identification of these risks is making the adequate risk response.

Key words: risk, financial, economic, Delphi method

1. Introduction

The risk assessment model for the construction process of wastewater treatment plants was developed as a part of a doctoral thesis. It is a unique model made after detailed literature research, which included a review of journals, legal acts, and books and collected information about operational plants (Topalić Marković et al., 2020). The risks in the model are organized into categories, and each of them individually can lead to delays in work and issues in exploitation, thus directly affecting economic and financial losses. There are 37 risks in the model divided into six risk groups.

The research involved the expert's group using the Delphi method. One of the risk groups that is important for the planning and design phase of construction is the legal group of risks, and the other groups include financial and economic risks,

¹ University of Novi Sad, Faculty of Technical Sciences, Serbia, jovanatopalic90@uns.ac.rs

² University of Novi Sad, Faculty of Technical Sciences, Serbia, mucenskiv@uns.ac.rs

³ University of Novi Sad, Faculty of Technical Sciences, Serbia, andrea@uns.ac.rs

logistics risks, ecological risks, management risks, and design risks (Topalić Marković, 2022).

The model itself is a part of project risk management. Risk management identifies, approaches, and prioritizes risk, followed by coordinated actions that reduce, monitor, and control the possibility and impact of adverse events. Risk management aims to reduce the possibility of uncertainties preventing the achievement of the project objectives (Bowers, 2016).

The importance of risk management in the construction process of wastewater treatment facilities is increasing. This is because the population has increased, and the need for an engineered system for wastewater management in large cities has become more evident (Riffat, 2012). The construction of a wastewater treatment plant is a complex and extensive project, sometimes taking several years. Plants represent multi-million investments due to their complexity, equipment, and many people involved in all parts of the project. Risk analysis and risk management are important parts of the decision-making process in the construction industry. After analyzing different articles, guidelines, and projects of wastewater treatment plants, it can be concluded that the construction industry does not focus enough on project risk analysis and assessment in this area (Walewski et al., 2006; Renault & Agumba, 2016; Ogunsanmi, 2011).

Over the years, the management of wastewater treatment systems has been characterized by a stepwise progression from solving sanitation problems (this was the main focus in the early phases of the 20th Century) to avoiding eutrophication in receiving water bodies and nutrient recovery/recycling (has been emphasized over the past 10 years) (Bowers, 2016).

Uncertainties and risks in the field of wastewater treatment are considered according to the design guidelines. Historically, the design itself is based on the requirements of the institutions, design standards accepted by the industry or legal regulations (industry standards tailored to specific requirements with individual amendments) (Jaroslav Černi Institute for the Development of Water Resources, 2015).

The risk model, which was developed as a part of the doctoral thesis is different from the standard guidelines because it includes 37 risks strictly connected to the civil engineering aspects of projects. This model is essential in the initial phases and design phases, when poor decisions can subsequently lead to poor efficiency and financial losses. For Serbia, it is crucial to know how to manage the risks, because there will be many future projects for wastewater treatment plants required for Serbia's EU accession (Topalić Marković & Mučenski, 2022).

This topic is important for Serbia and has the potential for implementation in practice, especially because Serbia is awaiting a big step ahead, and this is the process of entering the European Union. There is a norm for wastewater treatment plants that every settlement with more than 2000 inhabitants must oblige (Jaroslav Černi Institute for the Development of Water Resources, 2015). The capital of Serbia, Belgrade, and some larger cities do not have wastewater treatment plants (WWTP).

So, this model can be important and implemented in earlier stages of the project to reduce economic and financial losses.

2. Results

The identification of risks in the planning phase of a project and the arrangement of impact values has become a fundamental basis of today's various construction projects (Yucelgazi & Yitmen, 2019).

The commonly used terms of economic and financial risk are usually vaguely defined. Narrowing down the economic risk to only lending transactions or equity investments, which is often done, is considerably narrowing down the term (Turlajs & Jurenoks, 2006). In this research financial risk describes any risk that could impact project finances. Economic risks are financial risks that affect the overall economy.

For the first time, risks identified in this model are combined in this way, and it is important to note that they are used for the Delphi method. These risks are connected to the risks in the initial and design phases of the project. All risks presented are rated by the experts who participated in the Delphi method. After two rounds, the respondents reached a consensus, confirmed by descriptive statistics.

The economic and financial risks are defined after a detailed literature analysis, laws and bylaws, and projects. This group of risks comprises five risks. Evidence for every risk can be found in the literature. These risks are the following [10]:

1. Inadequate budget (lack of funds) for building modern plants (CEDEF, 2015)
2. Uncontrolled cash flow in some phases of the project (Kishan et al., 2014; Wideman, 1992)
3. Inflation and unexpected price change (Kishan et al., 2014; Wideman, 1992)
4. Unfinished and incorrect estimation of financial benefits (Walewski et al., 2006)
5. Unfinished and incorrect estimation of economic benefits (Walewski et al., 2006)

These risks are explained and defined for the risk assessment model (Topalić Marković, 2022):

1. Inadequate budget (lack of funds) for building modern plants
This risk is identified in (CEDEF, 2015)
Risk explanation: The big problem is caused by insufficient funds for modern plant construction. There may not be money to buy quality equipment for the wastewater treatment facilities, which can endanger the treatment process and the water quality. Also, an unrealistic budget refuses a serious bidder.
2. Uncontrolled cash flow in some phases of the project
This risk is identified in (Kishan et al., 2014; Wideman, 1992)

Risk explanation: If the investor does not provide high-quality supervision on the project over the expenditure of funds approved for the project contractor, it may happen that do not use the money for the intended purposes.

3. Inflation and unexpected price change

This risk is identified (Kishan et al., 2014; Wideman, 1992)

Risk explanation: Inflation, that is, price disturbances that can potentially occur increase the price of works during building construction, which are not foreseen in the design phase when the designer forms construction costs, can cause serious consequences for the project.

4. Unfinished and incorrect estimation of financial benefits

This risk is identified in (Walewski et al., 2006)

Risk explanation: If financial assessments remain incomplete or have incorrect benefits, there is a possibility that the project will have a deficit of money. Financial benefits refer to the owner of the infrastructure. For example, when planning return income loans, the main problem is the incorrect assessment of the income of the facilities based on estimates of the amount of purified water. If the loan installment burdens the price of water, there can be a significant drop in water consumption (water consumption is reduced), and by itself, therefore, the inflow of money for loan installments decreases.

5. Unfinished and incorrect estimation of economic benefits

This risk is identified in (Walewski et al., 2006)

Risk explanation: If economic assessments remain incomplete or have incorrect benefits, the project may contain omissions regarding its importance for the region and the entire society. This may lead to a reconsideration of the project or optional significant changes.

This research was conducted to fully meet the needs of the project managers when planning risk management. Therefore, it is important that everything is available with information on whether and how project managers create management plan risks. If they create plans, this model will help them go through the definition more easily and create an adequate risk response.

The main significance of the created model is a better understanding of risk factors, which can lead to reduced financial losses and better project sustainability. The limitations of the research are a small number of experts with managerial experience in the Delphi team and that experts participating in this research were from only two countries, Serbia and Bosnia and Herzegovina.

3. Conclusions

This paper presents the financial and economic risks in the risk assessment model for wastewater treatment plants. This group of risks was identified during doctoral research conducted with the Delphi method. Risks in the risk assessment model are identified and evaluated within a team of the Delphi method: legal, financial and economic, logistics, environmental protection, management, and design risks. The financial and economic risk group has five identified risks. The importance of identification of these risks is making the adequate risk response. For Serbia, it is crucial to know how to manage the risks, because there will be many future projects for wastewater treatment plants required for Serbia's EU accession.

Acknowledgments

This research has been supported by the Ministry of Science, Technological Development and Innovation (Contract No. 451-03-65/2024-03/200156) and the Faculty of Technical Sciences, University of Novi Sad through project "Scientific and Artistic Research Work of Researchers in Teaching and Associate Positions at the Faculty of Technical Sciences, University of Novi Sad" (No. 01-3394/1).

REFERENCES

- [1] Bowers, D. (2016). *Risk Management: Past, Present and Future Directions*. Nova Science Publisher.
- [2] Kishan, P., Bhatt, R., & Bhavsar, J. J. (2014). A Study of Risk Factors Affecting Building Construction Projects. *International Journal of Engineering, Research & Technology*, 3(12), 831–835. <https://www.ijert.org/a-study-of-risk-factorsaffecting-building-construction-projects>
- [3] CEDEF (2015). Use and treatment of municipal and industrial wastewater in the Republic of Serbia[pdf]. CEDEF and the Provincial Secretariat for Urbanism, Construction and Environmental Protection, Novi Sad, Serbia <https://drive.google.com/file/d/0B5otVVm41sb5S2tSVERFOERON3c/view> (in Serbian)
- [4] Jaroslav Černi Institute for the Development of Water Resources (2015). Strategy of Water Management in the Republic of Serbia. <http://www.rdvode.gov.rs/doc/Strategija%20upravljanja%20vodama.pdf> (in Serbian)
- [5] Marković, J. T., Mučenski, V., Savić, D., Velkovski, T., Peško, I., & Tomaš, L. (2021). Risk assessment model for planning and design processes of wastewater treatment plants. *Periodica Polytechnica Civil Engineering*, 65(1), 181-190.
- [6] Ogunsanmi, O. E., Salako, O. A., & Ajai, O. M. (2011). Risk Classification Model for Design and Build Projects. *Journal of Engineering, Project, and Production Management*, 1(1), 46–60. <http://doi.org/10.32738/JEPPM.201107.0006>

- [7] Renault, B. Y., & Agumba, J. N. (2016). Risk management in the construction industry: A new literature review. In *MATEC web of conferences* (Vol. 66, p. 00008). EDP Sciences. <https://doi.org/10.1051/mateconf/20166600008>
- [8] Riffat, R. (2012). *Fundamentals of Wastewater Treatment and Engineering*. CRC Press.
- [9] Topalić Marković J. (2022). Model preliminarne procjene rizika za proces građenja postrojenja za prečišćavanja otpadnih voda [Doctoral dissertation, Juniversity of Novi Sad, Faculty of Technical Sciences, Novi Sad].
- [10] Topalić Marković J., & Mučenski V. (2022). Legal aspects of the risk assessment model created for Wastewater treatment plants. In V. Nikolić & E. Stojiljković (Eds.), *Proceedings of the 19th International Conference "Man and Working Environment" – OESEM* (pp. 133–136). University of Niš, Faculty of Occupational Safety
- [11] Turlajs G., & Jurenoks V. (2006). Economic and financial risk and its classification. *Management and sustainable development 1-2/2006* (14).
- [12] Walewski, J. A., Gibson, Jr., G. E., & Vines, E. F. (2006). Risk identification and assessment for international construction projects. In: *Global project management handbook*, 2nd ed. (pp. 1–17). McGraw-Hill.
<http://www.icoste.org/Slovenia2006Papers/icecFinal00033.pdf>
- [13] Wideman, R. M. (ed.). (1992). *Project and Program Risk Management: A guide to managing project risks and opportunities*. Project Management Institute.
- [14] Yucelgazi, F., & Yitmen, I. (2019, February). Risk Assessment for Large-Scale Transport Infrastructure Projects. In *IOP Conference Series: Materials Science and Engineering* (Vol. 471, No. 2, p. 022005). IOP Publishing.



© 2024 Authors. Published by the University of Novi Sad, Faculty of Technical Sciences, Department of Industrial Engineering and Management. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>).