

# Circular Water Value Concept: Assessing Its Impact on Designing and Implementing Circular Water Initiatives - A Study on Coal Mines in Poland

K. Panteleaki – Tourkodimitri<sup>\*1</sup>, D.Xevgenos<sup>1,2</sup>, M. Mortou<sup>2</sup>, K. Mitko<sup>3</sup>,

<sup>\*1</sup> SEALEAU, the Netherlands

<sup>2</sup> Faculty of Technology, Policy and Management, Delft University of Technology, Delft, the Netherlands

<sup>3</sup> Silesian University of Technology, Poland

## Introduction

The concept of "Circular Water Value" defined by D. Xevgenos et al. (Xevgenos et al., 2024) introduces a novel metric for assessing the economic potential of resource recovery from wastewater within a circular economy framework. By assigning a monetary value to the recovered resources per unit of wastewater, the circular water value helps quantify the benefits of implementing circular water solutions, making it a practical tool for decision-makers and stakeholders in both the coal mine sector and the broader wastewater sector. This study expands on the initial concept tested with data from two coal mines in Poland, aiming to increase the validity of the novel circular water solution by extending research within the coal mine sector. Recognizing the need for comprehensive validation and improvement, this research integrates additional case studies.

Furthermore, through stakeholder interviews, insights are given to enhance the robustness and applicability of the proposed solution. However, the primary challenge lies in building trust and consensus among various stakeholders. This raises the research problem of how to objectively and transparently identify and assess the different intellectual assets of the contributing parties, ensuring acceptance by all involved stakeholders. Consequently, this study aims to support the consensus-building process for the collaborative exploitation of innovative water technologies developed within research projects.

## Materials and methods

Data are collected from a larger number of coal mines in Poland to ensure a more comprehensive and representative analysis. The methodology employed a robust combination of quantitative and qualitative research techniques. Quantitative data analysis involved detailed examination of wastewater effluent compositions, treatment costs, and the economic potential of resource recovery.

This is supplemented by qualitative insights gathered from structured interviews and interactive meetings with key stakeholders, including mine operators, technology providers, environmental experts, and policy makers. These interactions provided critical perspectives on the practical challenges and operational dynamics associated with implementing circular water solutions as well as on how to align the interests of different stakeholders to joint exploitation opportunities. Currently, the members of LIFE BRINE-MINING project define their intellectual assets, including information about proprietary knowledge, patents/copyrights, partnerships, customer database, software and experience, as well as physical assets (e.g. manufacturing facilities, vehicles, distribution network), human assets (experienced researchers, skilled sales force) and financial assets (financial guarantees, cash, lines of credit, stock option pool, access to funding). An Intellectual Asset Management methodology is being used to develop and apply a knowledge management approach for better collaboration between the partners.

## Conclusion

The findings from this extensive research will demonstrate a significant potential for the wider application of the "circular water value" concept across various sectors. The analysis could reveal specific areas where the solution could be enhanced and adapted to better meet the diverse needs of different industries. Key stakeholders provided invaluable insights into the factors that influence the successful implementation and scalability of the solution. These factors include the availability of technology, regulatory frameworks, economic incentives, and the willingness of industries to adopt circular water innovative practices. These implications are particularly significant for policymakers and project developers, as they underscore the potential of circular water solutions

to contribute to the sustainable transition of the coal mining industry and other sectors reliant on water-intensive processes.

Furthermore, our paper introduces a tool designed to facilitate consensus-building for the collaborative exploitation of innovative technologies. These technologies, often developed within research projects, tend to compete and create fragmented markets, hindering widespread adoption. This work contributes to the development of sustainability-oriented business models and Circular Business Modelling theory and practice. It demonstrates how a framework, based on assessing intellectual assets, can be applied in collaborative projects to commercialize and exploit project outcomes through new venture creation.

### **Acknowledgment**

This project has received funding from the European financial instrument for the Environment (LIFE+) of the LIFE BRINE-MINING project (LIFE18 ENV/ GR/000019) (<https://brinemining.eu/en/home/>).

### **References**

Xevgenos, D., Tourkodimitri, K. P., Mortou, M., Mitko, K., Sapoutzi, D., Stroutza, D., ... & van Loosdrecht, M. C. M. (2024). The concept of circular water value and its role in the design and implementation of circular desalination projects. The case of coal mines in Poland. *Desalination*, 579, 117501.