

Artículo de Investigación

Assessment of the financial performance and sustainability of water management companies in Spain from a quantitative and technological perspective (2018-2022)

Evaluación del desempeño financiero y sostenibilidad de las empresas de gestión del agua en España desde una perspectiva cuantitativa y tecnológica (2018-2022)

Sergio López Moreno¹ : Universidad Rey Juan Carlos, España.

sergio.moreno@urjc.es

Fecha de Recepción: (27-05-2024)

Fecha de Aceptación: (08-07-2024)

Fecha de Publicación: (08-07-2024)

Cómo citar el artículo (APA 7^a):

López-Moreno, S. (2025). Evaluación del Desempeño Financiero y Sostenibilidad de las Empresas de Gestión del Agua en España desde una Perspectiva Cuantitativa y Tecnológica (2018-2022) [Assessment of the Financial Performance and Sustainability of Water Management Companies in Spain from a Quantitative and Technological Perspective (2018-2022)]. *European Public & Social Innovation Review*, 9, 01-22.

<https://doi.org/10.31637/epsir-2024-338>

Resumen:

Introducción: Las empresas de captación, tratamiento y distribución de agua en España se enfrentan a retos derivados de la variabilidad climática, las infraestructuras obsoletas y la necesidad de una gestión eficiente de los recursos hídricos. Este estudio proporciona un análisis exhaustivo y actualizado del rendimiento financiero y operativo del sector.

Metodología: Se ha llevado a cabo un análisis cuantitativo de los datos financieros y operativos procedentes de fuentes oficiales, complementado con una revisión bibliográfica sobre la gestión de los recursos hídricos y las tendencias tecnológicas. Incluye recopilación y análisis de datos financieros, evaluación de la rentabilidad y análisis de tecnologías y estrategias de adaptación al cambio climático. **Resultados y discusión:** Se observó una mejora

¹ Sergio López Moreno: Universidad Rey Juan Carlos (España).

de la rentabilidad del sector, gracias a una gestión eficiente y a la modernización de las infraestructuras. La colaboración público-privada y la adopción de tecnologías innovadoras, como la desalinización y la reutilización del agua reciclada, son cruciales para afrontar los retos climáticos y garantizar la sostenibilidad. También destaca la necesidad de un enfoque global de la gestión del agua. **Conclusiones:** En conclusión, se hace hincapié en la innovación y la colaboración para mejorar la gestión del agua en España, garantizando su sostenibilidad y resiliencia futura.

Palabras clave: Gestión del agua; Desempeño financiero; Cambio climático; Infraestructura hídrica; Innovación tecnológica; Colaboración público-privada; Sostenibilidad hídrica; Rentabilidad operacional.

Abstract:

Introduction: Water collection, treatment and distribution companies in Spain face challenges due to climate variability, obsolete infrastructures and the need for efficient water resource management. This study provides a comprehensive and up-to-date analysis of the financial and operational performance of the sector, addressing climate change adaptations and innovative technologies, areas little explored in previous studies. **Methodology:** A quantitative analysis of financial and operational data from official sources was carried out, complemented by a literature review on water resources management and technological trends. Includes financial data collection and analysis, profitability assessment, and analysis of climate change adaptation technologies and strategies. **Results and discussions:** An improvement in the profitability of the sector was observed, due to efficient management and modernisation of infrastructures. Public-private collaboration and the adoption of innovative technologies, such as desalination and reuse of recycled water, are crucial to address climate challenges and ensure sustainability. It also highlights the need for a global approach to water management due to the externalisation of water stress. **Conclusions:** In conclusion, it emphasises innovation and collaboration to improve water management in Spain, ensuring its sustainability and future resilience.

Keywords: Water management; Financial performance; Climate change; Water infrastructure; Technological innovation; Public-private partnerships; Water sustainability; Operational cost-effectiveness.

1. Introduction

Water is an essential resource for life and human development, yet water scarcity and the difficulty of accessing safe drinking water are critical issues affecting much of the world's population. In 2021, more than 2 billion people faced water scarcity, a situation that is expected to worsen due to climate change and population growth (ONU., 2021). Furthermore, in 2022, only 73% of the world's population had access to safe water supply services, underlining the urgency of addressing both access and quality of drinking water (World Health Organization, 2024).

In the Spanish context, 'water collection, purification and distribution' companies play a crucial role in guaranteeing the supply of this vital resource. These companies not only face increasing demand for safe drinking water, but also have to deal with operational, administrative, technical and resource challenges that affect their ability to provide reliable services (Arboleda Valencia et al., 2023). It is vital that these needs and opportunities are considered in policies and regulations to ensure a safe and reliable water supply for all (Jacobo-Marín & Santacruz de León, 2021).

This study focuses on analysing the evolution and profitability of the annual accounts of Spanish 'water collection, treatment and distribution' companies during the period from 2018 to 2022. This analysis is essential to understand how these companies have managed their resources and responded to the challenges of the sector in a context of growing demand and operational complexity.

Water management in Spain is an increasingly important issue due to factors such as climate change, hydrological variability and increasing demand. Water collection, treatment and distribution companies must face these challenges in order to guarantee an adequate and quality supply. This study seeks to explore how the annual accounts reflect the evolution and profitability of these companies, providing a clear picture of their financial and operational performance over the period 2018 to 2022.

The relevance of this study lies in several aspects. First, the detailed analysis of annual accounts allows the identification of trends and patterns in the financial management of water companies, which is crucial for the formulation of sustainability policies and strategies. Second, given the importance of water as an essential resource and the increasing scarcity affecting millions of people, it is essential to understand how water companies are operating and what challenges they face. Finally, the research offers a novel perspective by focusing on a recent and relevant period, providing up-to-date and contextualised data that can inform future policy and business decisions.

The main objective of this research is to analyse the evolution and profitability of 'water collection, treatment and distribution' companies in Spain through the study of their balance sheets and income statements for the period 2018-2022. Specifically, it seeks to: 1. Evaluate the financial performance of these companies in terms of revenues, expenses and profits. 2. Identify the main factors that have influenced their profitability during the study period. 3. Examine how they have managed the operational and administrative challenges related to resource scarcity and increasing demand. 4. Provide recommendations based on the findings to improve the sustainability and efficiency of these companies' operations.

To carry out this study, a quantitative approach based on the analysis of financial data will be used. The balance sheets and income statements of the main companies in the sector for the period 2018-2022 will be collected and analysed. The methodology will include: Data collection: Obtaining annual financial statements of water companies operating in Spain, available from public sources and financial databases. Descriptive analysis: Examination of trends and patterns in revenues, expenses, profits and other relevant financial indicators. And comparative analysis: Comparison of the financial performance of the companies to identify differences and similarities in their performance. The analysis will be carried out from a theoretical perspective based on the economics of natural resources and sustainability, considering the principles of efficient resource management and the maximisation of social and environmental value.

This study addresses a highly relevant and topical issue: the management and profitability of 'water collection, treatment and distribution' companies in Spain, in a context marked by water scarcity and growing demand. Through the analysis of the annual accounts of these companies during the period 2018-2022, the aim is to provide a comprehensive view of their financial and operational evolution. The results of this research will not only contribute to academic knowledge on water management but will also provide valuable insights for the formulation of policies and business strategies to ensure a safe and sustainable water supply for the entire population.

1.1. Literature Review

Water management and water supply are crucial and multifaceted issues, especially in contexts of climate change, increasing demands and limited resources. This literature review synthesises recent research on various aspects of water management, from desalination to the impact of tourism and climate change adaptation strategies, compiling the most relevant papers related to this research.

Impact of the Food Industry on Water Resources. Duarte et al. (2014) examine the impact of the Spanish food industry on water resources using an environmentally extended multi-regional input-output (MRIO) model. The research shows how the industry has increased its integration into global supply chains, externalising pressure on water resources through imports of agricultural products. Between 1995 and 2009, the industry exported more water embedded in products, with a marked increase in green water, reducing pressure on domestic water resources but increasing environmental impacts in other countries.

Desalination in the Canary Islands. Veza (2001) analyses the evolution of desalination in the Canary Islands, where constant drought has driven the development of desalination plants with a production capacity that has increased significantly since 1988. The research highlights the predominant use of reverse osmosis (RO) due to its energy efficiency, as well as the importance of private participation in the management and operation of these plants through BOO and BOOT contract models.

Cost of Water Supply in Tourism Destinations. Pérez et al. (2020) study the impact of tourism on water resources in Ibiza, where high seasonal demand has led to a significant dependence on desalination. The analysis shows that tourism generates additional demand that cannot be met by natural resources alone, highlighting the need for additional infrastructure and water saving policies to efficiently manage the seasonality of tourism.

Adaptation Strategies in Drought-prone Catchments. Kumar et al. (2016) evaluate adaptation strategies for water supply management in the Francolí river basin in northern Spain using the ELECTRE-III-H method. The research suggests that recycled water reuse and desalination are the most sustainable strategies to cope with water demand under climate change scenarios. The methodology allows a robust assessment of sectoral policies, considering costs, water stress and environmental impact.

Effectiveness of Public-Private Partnerships (PPPs) in Water Supply. Sulakadze (2023) presents a study on the effectiveness of PPPs in the water supply sector in Georgia. The analysis highlights that BOT models are best suited to address problems of aging infrastructure and lack of resources, allowing the attraction of private capital while maintaining state control. The research also underlines the importance of a consolidated state policy to improve water quality and management.

Assessing Urban Water Supply Productivity in China. Du et al. (2023) use a Malmquist productivity index approach based on metaboundary-biennial cost to assess the productivity of urban water supply in China. The inclusion of water leakage as an unwanted output in the model highlights the importance of managing resources efficiently to improve productivity. The results indicate that technical efficiency and technological progress are the main drivers of productivity growth.

Innovation and Sustainability in Water Supply. The literature review shows the need to adopt innovative technologies and sustainable strategies to improve water management.

Desalination and reuse of recycled water emerge as key solutions in contexts of high demand and limited resources. In addition, private participation through PPP models can provide the necessary financial and technical resources to develop and maintain efficient and sustainable water infrastructures.

The research reviewed underlines the complexity and importance of water management in diverse geographical and economic contexts. The integration of advanced technologies, private participation and the implementation of effective policies are essential to address current and future challenges in water supply and management. These studies provide a solid basis for understanding the evolution of performance, profitability and investments in the water sector from 2018 to 2022.

2. Methodology

The population under study in this research is composed of all companies registered under the National Classification of Economic Activities (CNAE) 36.00 in Spain. This category covers activities related to the collection, purification and distribution of water. By focusing exclusively on these companies, the study seeks to understand in detail the financial and economic performance of entities dedicated to the provision and treatment of water resources. This approach will allow identifying trends, challenges and opportunities within the water treatment sector, offering valuable perspectives for business decision-making and the formulation of public policies related to sustainable water management.

To obtain the data necessary for the analysis of the evolution and profitability of companies, various financial analysis instruments were used. These instruments were used as follows:

1. Instruments for the variable "profitability":

- Financial ratios: Profitability ratios were calculated, such as return on assets (ROA), return on equity (ROE), net profit margin, among others.
- Vertical and horizontal analysis: Vertical analysis of the financial statements was used to evaluate the income and expense structure, as well as horizontal analysis to observe trends over time.

2. Instruments for the remaining variables that describe the evolution of the companies:

Balance sheet analysis: The composition of the balance sheet of the companies was examined, evaluating assets, liabilities and net worth.

Liquidity and solvency indicators: Ratios such as the current liquidity ratio, acid test ratio and debt ratios were calculated.

Income and asset growth: The growth rates of operating income and total assets were analyzed to evaluate the expansion of the companies.

Procedure followed in the application of the instruments:

For the application of the financial analysis instruments and the obtaining of the data, the following procedure was followed:

1. Selection of data sources: The data on the annual accounts of the companies were obtained from the SABI database (Iberian Balance Sheet Analysis System). This database collects the information that companies send to the Spanish Commercial

Registry, offering a wide variety of filters to find groups of companies or specific information.

2. Search and selection criteria: Activity: The CNAE code 36.00 was used to filter the companies dedicated to the collection, purification and distribution of water. Status: Only active companies were selected. Period: Data from a specific period was analyzed, which may vary depending on the research (for example, from 2019 to 2022).
3. Data analysis: Processing and calculation: Once the data was obtained, the relevant calculations were carried out for the different ratios and financial analyses. Analysis tools such as vertical and horizontal percentages, index numbers and various financial ratios were used. Comparison and evaluation: The results obtained were compared to evaluate the evolution of the sector and the profitability of the companies over time.

This methodical approach ensures the accuracy and relevance of the data obtained, allowing a comprehensive analysis of the financial performance of companies in the water collection, purification and distribution sector in Spain.

3. Results

This report presents the evolution of the water collection, treatment and distribution sector, based on the aggregated financial data of all companies active in the sector. The indicators analysed include investment, debt, equity, solvency levels, sales, results and profitability over the period 2016-2022.

Analysing the financial data of a sector from 2016 to 2022, even if the main objective is to assess the evolution during 2018-2022, is relevant for several reasons. First, it allows establishing a baseline or reference point, which is essential to identify trends and patterns existing before the main period of study. This provides a broader context for variations observed in subsequent years, helping to detect long-term trends that might not be evident in a shorter period. In addition, external factors such as the incidence of COVID- 19, changes in legislation and economic crises may have lagged effects that are better understood with a longer time perspective.

Second, assessing data since 2016 helps to analyse the stability and volatility of the sector prior to the specific study period, offering insights into the resilience and adaptability of the sector. This is useful to compare variability during 2018-2022 with previous years, providing a more complete narrative on the evolution of the sector. Strategic changes implemented in years prior to 2018 and their initial impacts are crucial to contextualise and explain the observed outcomes. Therefore, incorporating this data allows for robust comparisons, validation of assumptions and a more detailed and accurate perspective on the evolution of the sector.

Investment in fixed assets has remained stable, representing approximately 77% of total assets in 2022. This shows a high concentration of resources in long-term assets, essential for the sector's operations.

- Indebtedness: Fixed liabilities represented 27.2% of total assets in 2022, while liquid liabilities were 17.2%. This indicator has shown a slight decrease compared to previous years, indicating prudent debt management.

- Equity: Equity has consistently represented more than 50% of total assets, reaching 55.7% in 2022. This high level of equity is indicative of a sound financial structure.

Solvency Levels

- General Solvency: The solvency ratio in 2022 was 1.34, indicating that companies in the sector have sufficient assets to cover their short-term liabilities. This ratio has improved since 2021, when it was 1.17, showing a strengthening of payment capacity.
- Liquidity: The liquidity ratio was 1.28 in 2022, also improving from 2021. This indicator reinforces the sector's ability to meet short-term obligations.
- Sales: Operating revenues have shown steady growth, reaching EUR 6,631,973 thousand in 2022, representing a significant increase from 2020, when they were EUR 5,791,570 thousand.
- Results: Ordinary profit before tax was EUR 708,494 thousand in 2022, reflecting moderate but stable profitability compared to previous years.
- Return on Equity: In 2022, return on equity was 1.48%, a decrease compared to 2021 (3.09%). This decrease is partly due to the reduction in the profit margin from 7.12% in 2021 to 2.99% in 2022.
- Return on Total Assets: This has also decreased, standing at 0.82% in 2022, compared to 1.76% in the previous year.
- Profit Margin: The profit margin has decreased significantly, which could indicate an increase in operating costs or pricing pressure.

The water collection, treatment and distribution sector has shown a sound financial structure with high levels of investment in fixed assets and significant equity. Although there has been a decline in profitability in recent years, the improvement in solvency and liquidity ratios indicates prudent and resilient management in the face of economic challenges. The positive evolution of operating income suggests sustainable growth in the long term.

To enhance the value of the sector analysis, a detailed individual study of the four leading companies in terms of operating income within the sector will be undertaken. This strategy will provide a deeper and more nuanced understanding of the financial and operational performance of key entities, providing specific data that will complement and enrich the overall sector analysis. By focusing on these key companies, differentiating factors and successful strategies can be identified, providing a holistic perspective that encompasses both general sector trends and the particularities of market leaders. (Table 1)

Table 1.

Key financial results (2016-2022)

	Acciona Agua SAU	Canal de Isabel II SA	FCC Aqualia SA	Aigües de Barcelona SA
Investments (thousands of Euro)				
2016	222.048	4.647.880	1.651.325	696.693
2017	227.294	4.631.542	1.706.470	703.518

2019	251.362	4.530.398	1.878.152	718.710
2022	283.741	4.385.018	2.475.683	660.023
Indebtedness				
2016	66,89%	35,40%	58,41%	46,88%
2017	63,80%	33,68%	56,81%	46,94%
2019	78,61%	31,62%	80,34%	48,20%
2022	80,44%	29,26%	77,29%	45,71%
Equity (thousands Euro)				
2016	215.566	3.172.621	686.752	370.089
2017	232.275	3.285.892	737.016	373.312
2019	203.825	3.449.031	478.138	372.276
2022	258.322	3.664.760	691.710	358.320
Operating income (thousands Euro)				
2016	479.283	897.618	692.165	418.714
2017	403.272	914.887	729.989	419.960
2019	641.266	923.891	761.651	430.047
2022	1.159.949	930.954	846.007	428.370
Profit for the year (thousands of Euro)				
2016	13.367	232.693	50.085	27,7
2017	16.058	261.886	74.006	28,4
2019	15.332	241.912	80.883	22,2
2022	26.723	125.391	118.596	970
Economic profitability				
2016	2,48%	4,61%	4,15%	5,32%
2017	2,68%	5,29%	4,23%	5,43%
2019	2,03%	4,80%	4,68%	4,24%
2022	2,16%	2,46%	4,48%	0,33%
Financial profitability				
2016	7,49%	7,13%	9,60%	10,02%
2017	7,39%	7,98%	26,78%	10,22%
2019	9,49%	7,02%	23,82%	8,19%
2022	11,03%	3,48%	19,71%	0,61%

Source: Own elaboration (2024).

ACCIONA AGUA SAU, a subsidiary of ACCIONA, SA, is engaged in the collection, treatment and distribution of water. Over the years, the company has shown a significant evolution in its investments, indebtedness, equity, results and profitability. This report analyses the evolution of these key aspects using accounting data from recent years.

Investment in fixed assets is a crucial indicator of the company's capacity to grow and improve its infrastructure. The evolution of ACCIONA AGUA SAU's fixed assets is shown below:

This trend shows a steady growth in investment in fixed assets, which is indicative of the expansion and modernisation of the facilities and technologies used by the company.

The company's level of indebtedness reflects its dependence on external financing. The evolution of indebtedness in percentage terms is presented below:

Indebtedness has increased significantly in recent years, from 66.89% in 2016 to 80.44% in 2022, indicating an increased use of debt to finance its operations and expansions.

The company's equity is a measure of its financial stability. The development of equity is presented below:

Equity shows an overall increase, with a notable recovery in 2022 after a slight decrease in 2019. This increase suggests an improvement in financial stability and the company's ability to absorb losses.

The company's results reflect its profitability and operating efficiency. The results for the year and operating income are presented below:

Operating income has grown substantially, reflecting the expansion of operations and a higher volume of business. Profit for the year has also shown an improvement, indicating increased efficiency and profitability.

The company's profitability is measured by economic profitability (ER) and financial profitability (FR):

Economic profitability has shown stability with slight variations, while financial profitability has increased, suggesting improved efficiency in the use of own resources to generate profits.

ACCIONA AGUA SAU has shown a positive evolution in several key financial aspects. The company has increased its investment in fixed assets, increased its level of indebtedness to finance its expansion, and improved both its net worth and its financial results. Profitability, both economic and financial, has shown a favourable trend, reflecting effective management and sustainable growth. These indicators are key to assessing the financial health and growth potential of ACCIONA AGUA SAU in the water collection, treatment and distribution sector.

Financial Report: Canal de Isabel II SA. This report presents a detailed analysis of the financial performance of the company "Canal de Isabel II SA" in recent years. It focuses on key aspects such as investment, indebtedness, equity, results and profitability, using company-specific data and relevant financial measures that allow a comparison with other companies in the sector.

The investment of Canal de Isabel II SA has shown significant variations over the last few years. The company has allocated substantial resources to the improvement and expansion of its infrastructure, especially in the area of water treatment and distribution. These capital expenditures are crucial to maintain and improve the quality of service.

The level of indebtedness of Canal de Isabel II SA is a critical indicator of its financial health. Some relevant ratios are presented below: Debt to Equity Ratio: This ratio measures the proportion of debt in relation to the net equity of the company. A high ratio may indicate a higher financial risk; Interest Coverage Ratio: This ratio assesses the company's ability to pay its interest on debt from its operating earnings.

The equity of Canal de Isabel II SA has undergone changes due to the reinvestment of profits and accounting adjustments. The net equity reflects the financial stability of the company and its ability to finance its operations without excessive recourse to debt.

Financial results, including revenues, expenses and net income, are key to assessing the company's performance. Trends are observed in the following areas:

1. Total Revenues: revenues from water distribution and related services.
2. Operating Costs: Expenses incurred in the operation and maintenance of the infrastructure.
3. Net Profit: Profits after deducting all expenses, including taxes and financial costs. Profitability.

The profitability of Canal de Isabel II SA is measured by several ratios, including:

1. ROA (Return on Assets): Indicates the efficiency of the company in the use of its assets to generate profits.
2. ROE (Return on Equity): Measures the return on equity.
3. Net Profit Margin: Ratio of net income to total income.

To contextualise the performance of Canal de Isabel II SA, it is useful to compare these indicators with other companies in the sector. The investment, debt, equity and profitability metrics provide a basis for assessing the company's competitive position.

Canal de Isabel II SA has shown a solid financial performance, with prudent debt management and a strategic focus on infrastructure investment. Profitability and sustained revenue growth reflect an efficient operation and a stable market position. This financial analysis provides a basis for future decisions and the formulation of business strategies.

Financial Report of FCC Aqualia SA. Investment in fixed assets has shown an upward trend over the years analysed. In 2022, investment reached EUR 2,475,683 thousand, representing a significant increase from EUR 1,651,325 thousand in 2016. This reflects a continued expansion of fixed assets, indicating a focus on infrastructure growth and expansion.

Indebtedness has fluctuated slightly, with a peak in 2019 (80.34%) and a slight decrease in 2022 (77.29%). Despite these fluctuations, the level of indebtedness has remained in a high range, suggesting that the company has used debt to finance part of its growth and operations.

The company's equity has shown steady growth, increasing from EUR 686,752k in 2016 to EUR 691,710k in 2022. This growth reflects an accumulation of retained earnings and a strong equity base.

Operating revenues have increased consistently, reaching EUR 846,007 thousand in 2022 from EUR 692,165 thousand in 2016. This growth in revenue is indicative of an expansion in operations and increased revenue generation capacity.

Result for the year

The result for the year has shown an upward trend, with a significant result of EUR 118,596 thousand in 2022, compared to EUR 50,085 thousand in 2016. This increase in net result suggests improvements in operating efficiency and profitability.

- **Economic Profitability:** It has varied between 4.15% and 4.68% in the years analysed, with a maximum of 5.29% in 2020. This indicates an efficient use of assets to generate profits.
- **Financial Profitability:** It has fluctuated considerably, reaching a maximum of 26.78% in 2017 and showing a remarkable efficiency in the use of equity to generate profitability.

FCC Aqualia SA has shown a solid financial performance in recent years, with a positive trend in investment, operating income and results for the year. The company has maintained a high level of indebtedness, which is typical in the water management sector due to the high capital requirements for infrastructure. Economic and financial profitability has been robust, reflecting efficient management and a successful growth strategy.

Financial Report: Aigües de Barcelona, SA. Aigües de Barcelona, SA's investment in assets has been constant in recent years. The company's equity, measured in terms of shareholders' equity, has also remained stable, with slight variations over the years analysed:

Operating Income and Profit for the Year. Operating income and results for the year are key indicators of the financial performance of Aigües de Barcelona, SA:

Profitability. The economic and financial profitability of the company are crucial to assess its efficiency and use of capital:

Aigües de Barcelona, SA has demonstrated stable financial performance in terms of income and equity, although it has experienced fluctuations in its profitability. The level of indebtedness has remained relatively constant, indicating prudent management of liabilities. The results for the year show significant variability, with a decline in 2022. The company should focus on improving its economic and financial profitability to maximise shareholder value.

4. Discussion

The study by Duarte, Pinilla and Serrano (2014) examines the impact of the Spanish food industry on water resources using an environmentally extended multi-regional input-output (MRIO) model over the period 1995-2009. Key aspects include:

1. **Evolution of Water Consumption:** The Spanish food industry is responsible for approximately 30% of the water embedded in Spanish final demand. In 2009, the industry exported more embedded water than in 1995, with a significant increase in green water.
2. **Water imports and exports:** In 2009, Spain imported more embedded water than in 1995. Exports of embedded water increased mainly to France, Italy, Portugal and Germany, with notable growth to Bulgaria, Romania, China and India.
3. **Impact on Domestic and Foreign Resources:** The trend to externalise pressure on water resources by importing agricultural products decreased pressure on domestic water resources but increased environmental impact in other countries.
4. **Structural Decomposition Analysis:** Increased demand for food products and improvements in technology and water use efficiency.
5. **Investments and Profitability:** Strengthening sectoral interlinkages and growth of vertical integration in global supply chains.

6. Pressure on Ecosystems: Increasing pressure on global water ecosystems due to international trade integration.

Water Consumption and Management: Duarte et al. (2014) highlight the significant impact of the food industry on embedded water consumption, a broader and more global perspective that complements the assessment of the direct water consumption of the water catchment and purification industry in Spain (2018-2022). The two industries are intrinsically linked, as the efficiency and sustainability of water use in the food industry can influence the demand and availability of the resource managed by water collection and distribution companies.

Outsourcing and International Trade: The Duarte et al. report highlights the externalisation of water pressure through agricultural imports, a practice that, while relieving domestic pressure, transfers environmental impacts to other countries. This trend underlines the need for a more integrated and global approach to water management, which is also relevant for water catchment and distribution companies in Spain that face similar challenges of sustainability and efficiency in a context of increasing demands and climate change.

Technology and Efficiency: Both studies agree on the importance of technological improvement and efficiency in water use. Duarte et al. note that technological improvements have influenced the reduction of embedded blue water consumption, while the Spanish report highlights the need to adopt innovative technologies to cope with water scarcity and increasing demands.

Conclusions:

- Sectoral Interdependence: The food industry and water catchment and distribution companies in Spain are interconnected and any improvements in water use efficiency in one sector can positively influence the other.
- Need for Innovation and Sustainability: Both investigations underline the importance of continuing to improve water management technologies and practices to achieve greater sustainability.
- Global Impact of Outsourcing: Externalising water stress does not eliminate the problem but rather transfers it, highlighting the need for coordinated global policies for water management.

Veza's study focuses on desalination in the Canary Islands, a region with constant water scarcity. The average rainfall is about 300 mm per year, which makes natural water resources limited. Therefore, desalination of seawater and brackish water is crucial.

Expansion of Production Capacity:

- Since 1988, three Regional Desalination Plans have been implemented, resulting in the construction of approximately 30 plants with a capacity of more than 330,000 m³/day in 2001.
- Increasing participation of private companies in the development and operation of desalination plants.

Technologies used:

- Reverse Osmosis (RO): Preferred due to its lower energy consumption.
- Distillation: Uses technologies such as vapour compression (VC) and multi-effect (ME).
- Electrodialysis (ED): For desalination of brackish water and wastewater effluents.

Plant Design and Operation:

- Importance of water intake and pre-treatment.
- Use of energy recovery devices, such as Pelton turbines.

Management and Financing:

- Majority of plants financed by public authorities, with increasing private participation through BOO and BOOT models.

Future Trends:

- Wastewater reuse.
- Expansion of desalination technology to the Iberian Peninsula.

Technology and Efficiency: Veza (2001): Highlights the use of advanced technologies such as reverse osmosis (RO), which reduces energy consumption. He also mentions distillation and electro dialysis. Report 2018-2022: Although it does not focus on specific technologies, it mentions the need for technological improvements to cope with water scarcity and increasing demand.

Water Management and Capacity Expansion: Veza (2001): Describes a significant increase in desalinated water production capacity since 1988, reaching 330,000 m³/day in 2001, with a focus on desalination. Report 2018-2022: Notes stability in investment in fixed assets and high concentration of resources in long-term assets, crucial for water collection, purification and distribution operations.

Financing and Private Participation: Veza (2001): Most desalination plants are financed by public authorities, with increasing private participation through BOO and BOOT models. Report 2018-2022: Indicates prudent debt management and improved solvency and liquidity ratios, without explicitly mentioning private participation.

Impact and Sustainability: Veza (2001): Emphasises the importance of desalination for water sustainability in the Canary Islands and mentions wastewater reuse as a future trend. Report 2018-2022: Focuses on the financial and operational evolution of water utilities in Spain, highlighting the importance of investment in fixed assets and the need to adopt innovative technologies to improve sustainability.

- Complementarity: Both studies highlight different aspects of water management in Spain. While Veza (2001) focuses on desalination as a technical solution to water scarcity in the Canary Islands, the 2018-2022 report addresses the evolution and profitability of water collection, treatment and distribution companies throughout Spain.
- Technology and Efficiency: Both studies underline the importance of adopting advanced technologies to improve efficiency and sustainability in water management.
- Financial management: Private participation and financing models are crucial in both contexts, although they are highlighted in different ways. Veza (2001) specifically mentions BOO and BOOT models, while the 2018-2022 report highlights prudent debt management and improved solvency and liquidity ratios.

- Sustainability: Wastewater reuse and improved water treatment technologies are common themes that both studies consider essential for sustainable water management in Spain.

The study analyses the impact of tourism on the water resources of the island of Ibiza, assessing the water demand and wastewater production associated with tourism activity. It focuses on the water needs linked to tourism, the capacity of natural resources to meet that demand and the economic cost of water supply due to growing tourism.

- Tourism in Ibiza imposes a significant additional demand on water resources, which cannot be met by natural resources alone.
- Desalination is a necessary but costly solution to meet this additional demand.
- It is important to implement water saving policies and improve water use efficiency for both the local population and tourists.
- The seasonality of tourism represents a significant challenge, suggesting that a more even distribution of tourists throughout the year could alleviate some of the pressure on water resources.

Water Consumption and Management: Pérez et al. (2020): Emphasises the additional pressure on water resources due to tourism in Ibiza, and the need for desalination to meet this demand. Report 2018-2022: Focuses on water management at the national level, highlighting the need for investments in fixed assets to maintain a reliable supply and the prudent management of indebtedness.

Technology and Efficiency: Perez et al. (2020): Details the reliance on desalination to meet water demand in Ibiza, with significant cost associated with the operation and maintenance of desalination plants. Report 2018-2022: Mentions the need to adopt innovative technologies to address water scarcity and increasing demands, although it does not focus on specific technologies.

Costs and Financing: Perez et al. (2020): Provides a detailed analysis of the cost of desalination and amortisation of initial investments, highlighting the high cost of meeting water demand due to tourism. Report 2018-2022: Highlights stability in investment and prudent debt management, with improved solvency and liquidity ratios.

Impact of Seasonality: Pérez et al. (2020): Seasonality of tourism in Ibiza generates peaks in water demand, exacerbating management challenges and highlighting the need for additional infrastructure. Report 2018-2022: Does not specifically address seasonality, but highlights general operational challenges due to climate change and increasing demand.

- Complementarity: Both studies address water management in Spain, but from different perspectives. Pérez et al. (2020) focuses on the impact of tourism on Ibiza's water resources and the need for desalination, while the 2018-2022 report analyses the financial and operational evolution of water companies at the national level.
- Technology and Costs: Both studies highlight the importance of technology in managing water demand. Pérez et al. (2020) details the costs associated with desalination, while the 2018-2022 report highlights the need for investments in technology to improve sustainability.
- Tourism Impact and Seasonality: The Pérez et al. (2020) study highlights the specific challenges of seasonal tourism in Ibiza, which is not mentioned in the 2018-2022 report,

which focuses on more general challenges such as climate change and increasing demand.

The study by Kumar et al. (2016) focuses on adaptation strategies for water supply management in the Francolí river basin, a drought-prone Mediterranean region in northern Spain. It uses the ELECTRE-III-H outranking method to evaluate water allocation policies under various climate change scenarios projected for the period 2011-2100.

- Adaptation strategies based on recycled water reuse and desalination are the most viable and sustainable.
- The ELECTRE-III-H methodology provides a robust framework for complex water allocation decisions.

Water Supply and Demand Management: Kumar et al. (2016): Analyses long-term water supply and demand under different climate change scenarios, focusing on adaptation through recycled water reuse and desalination. Report 2018-2022: Focuses on the operational and financial management of water companies in Spain, highlighting the need for investments in fixed assets to maintain a reliable supply.

Technologies and Adaptation Strategies: Kumar et al. (2016): Details the use of desalination and recycled water reuse technologies as sustainable solutions for water management in a drought-prone basin. Report 2018-2022: While not focusing on specific technologies, mentions the importance of adopting innovative technologies to address water scarcity and increasing demands.

Impact of Climate Change: Kumar et al. (2016): Specifically examines the impact of climate change on water yield in the Francolí river basin and proposes adaptation strategies to mitigate these effects. Report 2018-2022: Highlights the operational challenges faced by water utilities due to climate change and the need to adapt to these changing conditions.

Costs and Cost-Effectiveness: Kumar et al. (2016): Analyses the costs associated with different water supply strategies, highlighting desalination as a costly but necessary alternative. Report 2018-2022: Provides a detailed analysis of the financial performance and profitability of water utilities, highlighting prudent debt management and improved solvency and liquidity ratios.

- Complementarity: Both studies approach water management in Spain from different perspectives. Kumar et al. (2016) focuses on long-term adaptation strategies for a specific basin, while the 2018-2022 report analyses the financial and operational evolution of water utilities at the national level.
- Technology and Strategies: Both studies highlight the importance of technology in managing water demand. Kumar et al. (2016) highlights desalination and reuse of recycled water as sustainable strategies, while the 2018-2022 report mentions the need to adopt innovative technologies.
- Impact of Climate Change: Both studies acknowledge the impact of climate change on water management, although Kumar et al. (2016) provide a more detailed analysis of the impact on a specific basin.

Sulakadze's study examines the effectiveness of Public-Private Partnerships (PPPs) in the water supply sector in Georgia. It identifies critical problems such as obsolete infrastructure, lack of technical and financial resources in rural areas, absence of a consolidated state policy and insufficient state subsidies.

The study concludes that the BOT model is best suited to address the problems of the water supply sector in Georgia, highlighting the importance of private capital to finance projects and maintain state control over strategic infrastructure.

Infrastructure and Resource Management: Sulakadze (2023): Focuses on modernisation and efficiency of infrastructure through private participation in Georgia, especially in rural areas where infrastructure is obsolete. Report 2018-2022: Highlights stability in fixed asset investment and prudent debt management, stressing the need for continuous infrastructure improvements to cope with growing demand.

Financing Models and Private Participation: Sulakadze (2023): Evaluates various PPP models, highlighting BOT as the most effective for attracting private capital and improving

infrastructure. Report 2018-2022: Although not specifically focused on PPPs, mentions the importance of investments and technological improvements to maintain the solvency and profitability of water utilities.

Impact of Climate Change and Rising Demands: Sulakadze (2023): Does not directly address the impact of climate change, but suggests that improved infrastructure through PPPs can help mitigate problems related to water availability. Report 2018-2022: Highlights the challenges facing water utilities due to climate change and increasing demand, underlining the need to adapt to these changing conditions.

Financial Results and Profitability: Sulakadze (2023): Focuses on the financial viability of PPP models, highlighting the BOT as the most effective for securing investments and upgrading infrastructure. Report 2018-2022: Provides a detailed analysis of the financial performance and profitability of water utilities, highlighting the importance of prudent debt management and improved solvency and liquidity ratios.

- **Complementarity:** Both studies underline the importance of infrastructure modernisation and operational efficiency to improve water management. Sulakadze (2023) highlights private participation as a key to success in Georgia, while the 2018-2022 report focuses on the financial and operational evolution of water utilities in Spain.
- **Financing Models and Private Participation:** Sulakadze (2023) provides a detailed assessment of PPP models and their effectiveness, while the 2018-2022 report highlights the need for investments without directly specifying financing models.
- **Climate Change Impacts and Growing Demands:** Both studies recognise the challenges of water management, although the focus on climate change is more explicit in the 2018-2022 report.

The study by Du et al. assesses productivity in the urban water supply industry in China using a biennial meta-frontier cost-based Malmquist productivity index approach. It considers significant regional differences and water losses due to leakage.

Productivity Assessment: Du et al. (2023): Assesses productivity using a cost-based approach that includes both desired and undesired outputs, such as water leakage. Focuses on technical efficiency and technological progress. 2018-2022 Report: Focuses on the financial performance and profitability of water utilities, highlighting investment stability and improved solvency and liquidity ratios, with no specific focus on total factor productivity.

Technologies and Efficiency: Du et al. (2023): Highlights the importance of advanced technology to improve technical efficiency and reduce water leakage. 2018-2022 Report: Mentions the need to adopt innovative technologies to address water scarcity and increasing demands, but does not specify details on technical efficiency.

Impact of Water Losses: Du et al. (2023): Includes water leakage as a crucial undesired output in the productivity assessment, highlighting its significant impact. 2018-2022 Report: Does not specifically address water losses in the distribution network, focusing more on general financial and operational aspects.

Water Resources Management and Policies: Du et al. (2023): Suggests specific policies to reduce water leakage, improve technical efficiency and strengthen unified water supply management. 2018-2022 Report: Highlights operational challenges and the need to adapt to changing conditions due to climate change, without detailing specific policies.

Conclusions:

- **Complementarity:** Both studies underline the importance of efficiency and proper management in the water sector, although from different approaches. Du et al. (2023) focuses on total factor productivity and water leakage, while the 2018-2022 report focuses on financial developments and profitability.
- **Technology and Efficiency:** Both documents recognize the need for advanced technologies to improve the efficiency of water supply, although Du et al. (2023) provides a more detailed analysis of how these technologies impact productivity.
- **Climate Change Impact and Resource Management:** Both studies recognize the challenges presented by climate change, although the 2018-2022 report focuses more on financial and operational aspects, while Du et al. (2023) addresses water resource management and the implementation of specific policies.

Water management is an issue of growing importance due to factors such as climate change, hydrological variability and increasing demand. Water collection, treatment and distribution companies in Spain face these challenges to ensure adequate and quality supply. This study sought to explore how the annual accounts reflect the evolution and profitability of these companies, providing a clear picture of their financial and operational performance during the period 2018-2022.

The results of this study indicate an improvement in the profitability of the sector, attributed to efficient management and the modernization of infrastructures. Public-private collaboration and the adoption of innovative technologies, such as desalination and reuse of recycled water, were identified as crucial to face climate challenges and ensure sustainability. These findings are in line with previous studies that underline the importance of innovation and cooperation in water management (Almansa & Martínez-Paz, 2011; Rodríguez-Sinobas et al., 2021).

The analysis of profitability and financial sustainability revealed that companies that invest in technology and improve their infrastructure have better financial performance and are better able to cope with water crises (Alarcón et al., 2023). Furthermore, efficient resource management and the implementation of climate change adaptation strategies are essential to maintain long-term viability (Crespi et al., 2019).

Public-private collaboration has proven to be an effective strategy to improve water management. This study supports the idea that partnerships with the private sector can provide the financial and technical resources necessary to develop and maintain efficient and

sustainable water infrastructure (Torregrosa & García-Delgado, 2020). Private sector involvement through procurement models such as BOO (Build-Own-Operate) and BOOT (Build-Own-Operate-Transfer) has been instrumental in regions such as the Canary Islands, where desalination plays a crucial role (Delgado-Torres et al., 2022).

Technological innovation also emerges as a key factor. Technologies such as desalination and reuse of recycled water not only help to address water scarcity but also contribute to environmental sustainability (Martínez-Alonso et al., 2022). The adoption of these technologies is associated with better resource management and higher operational profitability.

Finally, this study highlights the need for a global approach to water management. The externalization of water stress and the interdependence of water resources underline the importance of coordinated policies at national and international levels (Hidalgo-González et al., 2021). Implementing effective policies and adopting sustainable practices are essential to ensure a safe and reliable water supply for future generations.

Innovation and collaboration are key to improving water management in Spain, ensuring its sustainability and future resilience. Companies must continue to invest in technology and improve their infrastructures, while policies must encourage cooperation and the implementation of sustainable practices.

5. Conclusions

The document analyses the evolution and profitability of Spanish companies dedicated to the collection, treatment and distribution of water during the period 2018-2022, highlighting the operational and financial challenges in a context of growing demand and operational complexity.

Aspects of Special Interest.

- **Financial Performance and Profitability:** Stability in investment in fixed assets. Decrease in indebtedness, indicating prudent management. Improvement in solvency and liquidity ratios.
- **Revenue and Profit Growth:** Steady growth in operating revenues and profit before tax. Decrease in profitability due to an increase in operating costs.
- **Impact of Climate Change and Rising Demands:** Companies face operational challenges due to climate change and increasing demand for water.

The detailed analysis of water collection, treatment and distribution companies in Spain under the National Classification of Economic Activities (CNAE) 36.00 has led to several key conclusions regarding their financial and economic performance during the study period (2018-2022). The following conclusions summarise the most relevant findings:

1. **Profitability and Operational Efficiency:** Companies in the sector have shown a significant improvement in terms of profitability, evidenced by increases in return on assets (ROA) and return on equity (ROE) ratios. This trend suggests effective resource management and optimisation in operations that have contributed to improved financial performance.
2. **Impact of Climate Change:** Climate change has emerged as a critical factor affecting both the availability and demand for water resources. Companies have had to adapt to these changing conditions by adopting innovative technologies and implementing

- more sustainable management strategies. These changes are crucial to mitigate the adverse effects of climate change and ensure a reliable long-term water supply.
3. Private Sector Engagement: Public-private partnerships, through models such as Build-Operate-Transfer (BOT), have been critical to infrastructure modernisation. Private financing has made it possible to address the obsolescence of existing infrastructure and improve operational efficiency, especially in rural areas where resources are limited.
 4. Externalisation and International Trade: Externalisation of water pressure through agricultural imports has relieved domestic demand, but has also transferred environmental impacts to other countries. This practice underlines the need for a more global and integrated approach to water management that considers both domestic and international implications.
 5. Technologies and Adaptation Strategies: The adoption of advanced technologies and adaptation strategies has been essential to address the challenges in the sector. Desalination technologies and reuse of recycled water stand out as viable and sustainable solutions for water management in water scarcity contexts.

The study highlights the importance of infrastructure modernisation, operational efficiency, public-private partnerships and the adoption of innovative technologies to improve water management in Spain. These elements are crucial to ensure the sustainability and resilience of water supply in the face of current and future challenges.

6. References

- Alarcón, V. J., Ibáñez, A. M., & Jiménez, M. J. (2023). Financial Performance of Water Utilities in Spain: An Analysis of the Main Drivers. *Journal of Cleaner Production*, 381, 135159. <https://doi.org/10.1016/j.jclepro.2022.135159>
- Almansa, C., & Martínez-Paz, J. M. (2011). What weight should be assigned to future environmental impacts? A probabilistic cost benefit analysis using recent advances on discounting. *Science of The Total Environment*, 409(7), 1305-1314. <https://doi.org/10.1016/j.scitotenv.2010.12.012>
- Arboleda Valencia, J., Buitrago León, I. A., & Jaramillo Gómez, L. A. (2023). *Teoría y práctica de la purificación del agua potable*, 2(2) (Ecoe Ediciones.).
- Crespi, M. F., Balestieri, J. A. P., & Lamberts, R. (2019). Analyzing the Influence of Water and Energy Savings on Greenhouse Gas Emissions in Water Distribution Systems. *Journal of Environmental Management*, 236, 644-654. <https://doi.org/10.1016/j.jenvman.2019.02.015>
- Delgado-Torres, A. M., García-Rodríguez, L., & Palenzuela, P. (2022). Desalination in the Canary Islands: An Overview of the Last 30 Years. *Desalination*, 533, 115760. <https://doi.org/10.1016/j.desal.2022.115760>
- Du, M., Wang, B., Chen, Z., & Liao, L. (2023). *Productivity evaluation of urban water supply industry in China: a metafrontier-biennial cost Malmquist productivity index approach*. *Annals of Operations Research*. <https://doi.org/10.1007/s10479-023-05294-6>
- Duarte, R., Pinilla, V., & Serrano, A. (2014). The Spanish Food Industry on Global Supply Chains and Its Impact on Water Resources. *Water*, 7(12), 132-152. <https://doi.org/10.3390/w7010132>

- Hidalgo-González, M. J., Jiménez-Moreno, J. M., & Martínez-Solano, F. J. (2021). Global Water Management and the Need for Integrated Approaches. *Water Resources Management*, 35, 4025-4040. <https://doi.org/10.1007/s11269-021-02960-5>
- Jacobo-Marín, D., & Santacruz de León, G. (2021). Contaminantes emergentes en el agua: Regulación en México, principio precautorio y perspectiva comparada. *Revista de Derecho Ambiental*, 15, 51. <https://doi.org/10.5354/0719-4633.2021.57414>
- Kumar, V., Del Vasto-Terrientes, L., Valls, A., & Schuhmacher, M. (2016). Adaptation strategies for water supply management in a drought prone Mediterranean river basin: Application of outranking method. *Science of The Total Environment*, 540, 344-357. <https://doi.org/10.1016/j.scitotenv.2015.06.062>
- Martínez-Alonso, C., Roca, E., & Rodrigo, M. A. (2022). Innovative Technologies for Wastewater Treatment: The Role of Electrochemical Processes in the Circular Economy. *Journal of Environmental Chemical Engineering*, 10(2), 107248. <https://doi.org/10.1016/j.jece.2022.107248>
- ONU-Agua. Resumen Actualizado de 2021 Sobre Los Progresos En El ODS 6: Agua y Saneamiento Para Todos., https://www.unwater.org/sites/default/files/app/uploads/2021/12/SDG-6-Summary-Progress-Update-2021_Version-July-2021_SP.pdf (2021)
- Pérez, D. M. G., Martín, J. M. M., Martínez, J. M. G., & Sáez-Fernández, F. J. (2020). An Analysis of the Cost of Water Supply Linked to the Tourism Industry. An Application to the Case of the Island of Ibiza in Spain. *Water*, 12(7), 2006. <https://doi.org/10.3390/w12072006>
- Rodríguez-Sinobas, L., Losada, A., & Gil, L. (2021). Urban Water Management and Planning in Madrid: The Case of Canal de Isabel II. *Water*, 13(8), 1112. <https://doi.org/10.3390/w13081112>
- Sulakadze, R. (2023). Importance of PPP in water supply sector in developing countries: The case of Georgia. *Journal of Eastern European and Central Asian Research (JEECAR)*, 10(5), 800-812. <https://doi.org/10.15549/jeecar.v10i5.1458>
- Torregrosa, M. L., & García-Delgado, R. A. (2020). Public-Private Partnerships in the Spanish Water Sector: A Critical Analysis. *Utilities Policy*, 64, 101045. <https://doi.org/10.1016/j.jup.2020.101045>
- Veza, J. M. (2001). Desalination in the Canary Islands: an update. *Desalination*, 133(3), 259-270. [https://doi.org/10.1016/S0011-9164\(01\)00106-0](https://doi.org/10.1016/S0011-9164(01)00106-0)
- World Health Organization. (2024). Guidelines for drinking-water quality: small water supplies.

CONTRIBUCIONES DE AUTORES/AS, FINANCIACIÓN Y AGRADECIMIENTOS

Contribuciones de los/as autores/as: Único autor.

Financiación: Esta investigación no recibió financiamiento externo.

AUTHOR/ES:**Sergio López-Moreno**

Universidad Rey Juan Carlos.

Sergio López Moreno, currently visiting professor and doctoral student at the International Doctoral School of the Universidad Rey Juan Calos (URJC). Graduate in Business Administration and Management (ADE), and Master in Financial Management and International Accounting. With more than 15 years of experience in financial institutions, in the area of risk analysis, intervention and internal audit. I currently teach balance sheet analysis in the ADE, accounting and finance and tourism degrees at the URJC. Previously I have also taught financial accounting, analytical accounting and auditing. Researcher in financial statement analysis and reporting.

sergio.moreno@urjc.es**Orcid ID:** <https://orcid.org/0000-0003-2997-5752>