

# Water Sustainability in MERCOSUR: Legal Integration and Regional Governance towards the Changes Arisen from the Industrial Revolutions

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## Abstract

This study, having the transformations imposed by the Industrial Revolutions as a background, aims to analyze the potential of MERCOSUR as an economic, legal and political bloc to promote the implementation of public policies and regulatory actions that promote water sustainability at regional levels. Initially, the impact of the Industrial Revolutions on the excessive consumption and degradation of water resources will be addressed, with a special focus on the unsustainable exploitation of water, an essential resource for human life and economic development. Next, an analysis will be made of the normative evolution of environmental rights in the MERCOSUR member countries, with emphasis on the constitutional and infra-constitutional provisions that seek to regulate and ensure the sustainability of natural resources, particularly water resources. Finally, the study examines the capacity of MERCOSUR, as an international legal entity, to promote legislative integration and intergovernmental cooperation, with a view to the effective sustainable management of water, through collective legal mechanisms and harmonized regulations. The methodology applied is descriptive-interpretative in nature, based on doctrinal sources, national and international legislation and MERCOSUR legal mechanisms, with the aim of evaluating the bloc's role in implementing sustainable governance of water resources.

## Keywords

Water Resources, Sustainability, Industrial Revolution, MERCOSUR

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## 1. Introduction

In 2010, water, an essential resource for life, was recognized as a fundamental Human Right by the United Nations (UN), despite still not being accessible to millions of people around the world. According to the UN, around 2.2 billion people lack access to safely managed drinking water. The total volume of water on the planet is approximately 1.4 billion cubic kilometers, but only 2.5% of this water is fresh, and only about 0.007% is accessible for human consumption. A huge amount of freshwater is stored on polar caps and underground aquifers, making the access to drinking water even more difficult, especially before the populational growth and climate changes. Locally speaking, South America contains, approximately, 26% of the freshwater on the planet, but this does not guarantee equitable and sustainable access for its population.

Water scarcity and pollution bring forth consequences for human health, food security, economic development and social peace. The UN warns that by 2025, approximately 1.8 billion people could suffer from water scarcity due to climate change, population growth, pollution and waste. In this context, the UN Sustainable Development Goal (SDG) No. 6 ensures availability and sustainable management of water and sanitation for all, aiming to guarantee universal access to drinking water, the improvement of its quality and the integrated management of water resources.

Brazil has made significant progress in expanding access to drinking water and basic sanitation. The implementation of alternative technologies, such as the use of cisterns to capture and make use of rainwater in regions where water supply is irregular, has proved to be an effective strategy for guaranteeing water supply for millions of people and enabling access to certain sanitation services. According to diagnostics from the National Sanitation Information System, between 2014 and 2020, drinking water coverage in the country rose from 83.5% to 92.5%, almost reaching the global average set by SDG 6, which is 92.7%.

However, challenges keep happening in the sewage sector. In the same period, sewage collection rose from 81.1% to 85.4%, but still remains far from the global average of 71.8%. The percentage of treated sewage also showed growth, rising from 51.9% in 2014 to 55.7% in 2020, despite still being below the global benchmark of 62.8%. Despite the progress, the universalization of basic sanitation remains a challenge. The approval of the 2020 Legal Sanitation Framework represents a significant step forward by establishing guidelines so that universal access to drinking water and basic sanitation is guaranteed by 2033. However, in order to achieve the goals of SDG 6, it will be essential to strengthen governance, increase investment in the sector and ensure more effective participation by civil society in the formulation and implementation of public policies aimed at the sustainable management of water resources.

Given what has been said, it should be noted that the Industrial Revolutions have profoundly impacted the use and degradation of water resources. During the First Industrial Revolution, water was used as an energy source in the textile and

milling industries, but this intense exploitation resulted in serious environmental problems, such as river pollution and the depletion of water sources. The aggravated water exploitation carries on to this day, demanding innovative approaches to its management in order to ensure the preservation and responsible use.

Within MERCOSUR, the economic and legal bloc has made progress, albeit slowly, especially when compared to the pace observed within the European Union, in implementing public policies that integrate water sustainability into its regional agenda. Legislative cooperation and revision of environmental policies amongst member countries are essential to address the challenges of water scarcity and degradation. Joint effort is required to promote an efficient and equitable use of water, aiming for its preservation and the needs, focusing on actions that ensure compliance with the SDGs, especially regarding the sustainable management of water resources.

This study aims to analyze the correlation between water and the transformations arising from the Industrial Revolutions, highlighting the impacts of debatable water exploitation and the urgency for innovative solutions to mitigate the water crisis. The work will also explore the evolution of environmental laws in MERCOSUR countries, with an emphasis on incorporated water management policies, examining MERCOSUR's role in legal integration and the promotion of sustainable water administration, focused on the protection of shared water resources, to ensure universal access to drinking water and sanitation for all, in accordance with the UN Sustainable Development Goals.

## 2. Water Resources and the Industrial Revolutions

Water is an essential resource for life, and it played a crucial role in the industrial revolutions, which have transformed the global economy and deeply changed the relationship between man and nature. The Fourth Industrial Revolution, marked by the convergence of physical, digital and biological technologies, offers new opportunities, but also presents challenges for sustainable water management and environmental preservation.

As highlighted by Klaus Schwab (2019: p. 35):

The Fourth Industrial Revolution is a new chapter in human development, on par with the first, second and third Industrial Revolutions, and once again driven by the increasing availability and interaction of a set of extraordinary technologies.

Understanding the origins of these changes is essential to think of solutions that gather economic development with environmental preservation, seeking a balance in the relationship between society and nature. This analysis focuses on water as a resource that was both intensively used and disrespected throughout the industrialization process, leading to a series of environmental issues that require an integrated approach to ensure its preservation and sustainable management.

## 2.1. Water in the First Industrial Revolutions: Unsustainable Use and Exploitation

### 2.1.1. The First Industrial Revolution: The Role of Water in Electricity Generation and Production

The First Industrial Revolution, which emerged at the end of the 18th century and was consolidated throughout the 19th century, represents a crucial milestone in human history. This period not only transformed the means of production, that is, the replacement of manual work by factories, but also profoundly altered the relationship between man and nature. The introduction of new technologies, such as the steam engines, railroads, mechanical production and the use of fertilizers, changed the way natural resources were exploited and used, intensifying human activities on the environment. Water has played a key role as a renewable resource, especially in the textile and milling industries, where it was used to move machinery (Hughes, 2000: pp. 34-42).

Science's improvement was crucial to the technological developments of that time. Discoveries and innovations have allowed man to expand his ability to transform the environment for his own benefit. However, the science of the period was mainly focused on increasing productivity, often disregarding the limits imposed by nature. The man-nature relationship became increasingly utilitarian, with nature being seen as an unlimited resource to be exploited. Therefore, this transformation was accompanied by environmental consequences that continue to influence contemporary debates about sustainability.

The steam engine was the driving force of the First Industrial Revolution. This technological innovation has ushered into a new era of large-scale production, reducing dependence on human and animal power. However, the steam engine also marked the beginning of an intense exploitation of natural resources, especially coal, whose reserves began to be extracted at a rapid pace, and of water, resulting in environmental impacts that would become more evident over time. The industrial use of water, without consideration for environmental impacts, has initiated a continuous cycle of degradation of aquatic ecosystems, which has lasted until the present moment.

The introduction of railways revolutionized transportation, connecting urban and industrial centers in unprecedented ways. This expansion enabled the flow of commodities and people, accelerating the urbanization process. However, railroads also required large amounts of natural resources for their construction, such as iron and wood, in addition to significantly altering natural landscapes.

Mechanical production transformed manufacturing, gradually replacing manual labor with organized manufacturing systems. This advance was accompanied by a significant increase in urbanization, as workers migrated from the countryside to the cities in search of jobs in the factories. Cities grew rapidly, often without planning, resulting in drastic changes in land use and man's relationship with nature. Natural space was replaced by urban structures. Air and water pollution became their new reality.

In the countryside, the introduction of agricultural machinery such as mechanical

plows and harvesters increased production efficiency. This development, combined with the use of chemical fertilizers, brought significant growth to agricultural productivity. However, this intensification resulted in a more aggressive exploitation of the soil and contamination of watercourses, initiating a cycle of environmental degradation that persists to this day.

Hydroelectric energy also played an important role during the First Industrial Revolution, especially in the textile industry, where it was used to move machinery around rivers.

During this period, the use of water to generate energy, despite being a beneficial innovation for production, impacted the environment, especially because of the pollution of rivers, where industrial waste was thrown without proper treatment. Industrial rivers, such as the Thames in England, have been affected by rapid industrialization. This process brought to light the first signs that water could not be seen only as an unlimited resource for economic growth, becoming a critical environmental issue in the early 19th century, with direct impacts on public health and water quality.

This was the beginning of an unsustainable exploitation of water resources, without concern for depletion or recovery of water quality. This use of renewable energy sources, although less impactful in terms of emissions, has altered the dynamics of aquatic ecosystems, with the construction of dams and diversions of watercourses. Thus, the intensification of water exploitation, and the pollution generated, resulted in an imbalance in aquatic ecosystems, with the contamination of water sources and the depletion of natural resources.

### **2.1.2. The Second Industrial Revolution: Intensifying Water Demand**

The Second Industrial Revolution, which took place between the end of the 19th century and the beginning of the 20th century, transformed man's relationship with nature by intensifying the exploitation of resources and reshaping the natural and social environment through mass production, the assembly line, electricity, and the use of fossil fuels. Despite providing significant advances, reflecting on the impacts of this period is essential to create a new model of development that respects the world's limits, and promotes a fair distribution of the benefits of progress.

One of the major milestones of the Second Industrial Revolution was the introduction of mass production and the assembly line, popularized by the automotive industry. However, despite reducing costs and making commodities more accessible to a larger part of society, the unrelenting search for efficiency intensified the need for natural resources, such as metal and fossil fuels, both essential for the maintenance of mass consumption. Raw material extraction intensified, with significant environmental impacts, such as soil degradation, deforestation and pollution of bodies of water.

Concerning the division of labor, mass production redefined the relationship between man and labor, reducing the worker's connection with the final product, making the work more automatic and often alienating, reinforcing a fragmented

view of the relationship between society and the environment. Production came to be seen in a sectoral way, with little consideration for the cumulative impacts on the ecosystem. This separation accentuated the perception that natural resources were infinite and available for unrestricted exploitation.

Moreover, the Second Industrial Revolution was leveraged by the advent of electricity, and brought with it a greater dependence on fossil fuels, such as coal and oil, for electricity generation and the operation of machines and vehicles. The intensive exploitation of these fuels caused irreversible changes in ecosystems and contributed to air pollution, problems that would become even more evident with the industrial growth of the 20th century.

During this period, water continued to be essential, both for human consumption in growing cities and for industrial production, particularly in the chemical industry and in the steel industry.

However, water use intensified further, especially in new factories and hydroelectric plants. During this period, water began to be used not only for urban and industrial supply, but also intensively in the cooling of machines and in production processes.

Cities began to grow rapidly, which increased the demand for clean water and sanitation systems, which often did not keep pace with urban growth. In addition, industrial effluents contaminated rivers and bodies of water, affecting water quality and generating public health problems, which became one of the biggest challenges in industrial cities. In this period, the Hudson River, located in the United States, became one of the greatest examples of industrial pollution, with a massive amount of waste being dumped into it. In the following decades, this phenomenon led to the creation of laws on pollution control.

Rapid population growth and the intensification of industrial activities made evident the need for more careful water management, with the construction of supply and sewage systems, and the regulation of water use. However, these initiatives were still incipient and often insufficient to cope with the volumes of water needed to sustain the booming industrial cities.

## **2.2. Water and the Digital Revolution: Contemporary Challenges and the Issue of Water Sustainability**

### **2.2.1. The Third Industrial Revolution: Technologies and Increasing Pressure on Water Resources**

The Third Industrial Revolution, also known as Digital Revolution, began in the second half of the 20th century and continues to shape economic, social and environmental relations.

This revolution, marked by the advent of the internet, the automation, and the ICTs (Information and Communication Technology), generated a greater efficiency in production, while enabling global connections; however, it has also expanded environmental and social challenges related to resource extraction, electronic waste, and water sustainability.

The Digital Revolution introduced a new paradigm of production and con-

sumption, characterized by the dematerialization of many economic activities. However, while digitalization has brought efficiency and connectivity, reducing the need for physical resources in some sectors, it has also increased the environmental impact caused by humanity, creating a complex and ambivalent relationship with nature.

Although the dependence on water in industries has decreased in some areas due to the development of more efficient processes, new challenges have arisen. The accelerated growth of urban areas, driven by globalization and digitalization, has increased the pressure on water resources. Water remained essential for food production, energy and industry in general, but at the same time, the issues of water scarcity and pollution became even more urgent.

The growing demand for drinking water and its crisis in several regions of the world show the urgent need to reformulate water management models. Nowadays, we face the paradox of water abundance and scarcity: while some regions deal with floodings, others suffer from extreme droughts. These phenomena were driven by industrial activities since the beginning of the Industrial Revolutions.

Water scarcity, worsened by pollution and overconsumption, has become a global issue. Fast urban growth, driven by globalization and digitalization, has increased pressure on water resources, creating a paradox between water abundance and scarcity. Excessive water use, especially in dry and semi-arid regions such as Brazil and Argentina, has generated a significant increase in competition for this vital resource.

Regarding technological innovation, a characteristic of the Third Industrial Revolution, it is important to highlight its potential to bring solutions to water management. The use of technologies such as reverse osmosis systems, wastewater reuse and efficient management of water resources through sensors and big data are some of the tools that offer hope for water preservation in the future. The digital revolution has the potential to transform water management, making it more efficient and sustainable. Smart irrigation technologies have begun to be implemented, particularly in agriculture, using sensors and big data to reduce water consumption and improve resource efficiency. These systems are an attempt to adapt water use to the new needs of globalized agriculture.

Global connectivity, amplified by the use of ICTs, which includes devices such as smartphones, computers and internet networks, has reduced geographical barriers, enabling the instant exchange of information and the creation of a more integrated economy. Nevertheless, while dematerialization promised a lower environmental impact, it created new environmental risks, bringing other significant challenges, such as the increasing demand for electronic devices, which depend on rare metals, like lithium and cobalt, and have high environmental costs of production and disposal. The extraction of these resources involves the degradation of natural habitats and, often, precarious conditions of human work. In addition, the growing volume of e-waste has become a global problem, with many developing countries being the receiver of toxic waste from wealthier nations.

While the Third Industrial Revolution has enabled innovations that can contribute

to sustainability, such as environmental monitoring technologies and circular economy models, the infrastructure that underpins the internet and digital systems, such as servers and data centers, consumes huge amounts of energy, often from non-renewable sources. Concerning the perception of the relationship with the environment, the internet and computers created the perception that work and consumption could occur without a direct connection with the physical environment. However, this “dematerialization” masked humanity’s fundamental dependence on natural resources to maintain digital infrastructure.

In addition, industrial automation, driven by digital technologies, has optimized production processes, allowing large-scale manufacturing with less human intervention. However, automation has intensified the use of natural resources to produce machines, control systems and robots, as well as expanding the production of consumer goods. The availability of cheaper and more abundant products has stimulated hyperconsumption, deepening the pressure on natural ecosystems, especially water resources, and generating increasing volumes of waste.

### **2.2.2. The Fourth Industrial Revolution and Sustainable Water Management**

The Fourth Industrial Revolution is characterized by the combination of the physical and digital world, using sensors and devices to integrate and control production processes. Among the main technological innovations that cover numerous areas are artificial intelligence, robotics, internet, autonomous vehicles, 3D printing, nanotechnology, biotechnology, materials science, energy storage and quantum computing, to name just a few. The Fourth Industrial Revolution stands out from the others because of its exponential speed; its breadth and depth; and its systemic and multifaceted impact, generating changes in the economy, in business, in governments and countries, in society and in individuals (Schwab, 2016: p. 13).

By creating a complex interdependence between the human and natural domain, the Fourth Industrial Revolution, changes the boundaries of environmental exploration, preservation, and regeneration. Emerging technologies promise to mitigate environmental impacts and restore degraded ecosystems, but they also amplify the risks associated with technological dependence and resource-intensive exploitation. This revolution not only transforms the way natural resources are exploited, but also creates opportunities to monitor and ease environmental impacts more efficiently, while presenting unprecedented ethical and ecological challenges. Technologies such as environmental sensors, big data and artificial intelligence can provide innovative solutions for the efficient management of water resources.

Artificial intelligence plays a central role in the Fourth Industrial Revolution, enabling the creation of smarter and more sustainable systems, but also increasing reliance on technologies that demand rare metals and resource-intensive production processes.

In addition, the Internet of Things (IoTs), in the context of the human-nature

relationship, allows the creation of “smart cities” that monitor the use of energy, transport and water, reducing waste and improving efficiency in water consumption. Environmental sensors connected to the IoTs are also used to monitor air quality, biodiversity, and pollution levels. The Internet of Things (IoT), for example, can be used to monitor water use and identify leaks, optimizing its consumption. However, despite its benefits, IoT increases the energy demands and technological infrastructure, creating new challenges related to the extraction of materials and the disposal of electronic devices. Therefore, the growing pressure on natural resources, allied to digitization and automation, generates complex challenges for water sustainability associated with technological dependence.

Autonomous vehicles have the potential to transform urban and rural mobility by decreasing carbon emissions through route optimization and better energy efficiency. When combined with electrical technologies and shared transport systems, they can generate significant reduction in environmental impact. However, the production of these vehicles requires developed technological components, such as lithium batteries and semiconductors, whose extraction and disposal lead to big environmental problems. Moreover, the infrastructure necessary to enable the operation of autonomous vehicles, including data networks and sensors, intensifies the pressure on natural resources.

Additive manufacturing, represented by 3D printers, reduces the need for transport and, consequently, greenhouse gas emissions by allowing the creation of objects directly at the place of use. Technology allows the use of recyclable materials and the customization of products, reducing waste. However, widespread access to 3D printers creates new consumption and production flows, which generates greater demand for specific materials and increases the amount of plastic and chemical waste.

Nanotechnology offers innovative solutions to environmental problems, such as the creation of advanced filters to purify water and the development of lighter and stronger materials, which reduce resource consumption; however, nanomaterials raise concerns about their toxicity and potential impacts on ecosystems and living organisms.

For its part, biotechnology allows advances such as genetic engineering to improve agricultural crops, increasing productivity and reducing the use of pesticides; it also enables the creation of biofuels and biodegradable materials, promoting other sustainable alternatives. However, these innovations raise ethical and ecological issues, such as the impact of genetically modified organisms on the natural balance.

In this regard, the speed and depth of these transformations require a reevaluation of the economic models and public policies to ensure that the technological advances are utilized in a sustainable and equitable manner, avoiding the expansion of inequality and irreversible environmental impacts.

It should also be kept in mind that in the contemporary world, sustainable water management is one of the greatest challenges faced by industrial societies. With increasing pressure on water resources and climate change, water-related

issues such as scarcity, water quality and resource management are urgent and global. Water scarcity affects an estimated 1.8 billion people worldwide, and access to safe drinking water remains a critical concern in many regions, particularly in developing countries.

Sustainability in water use requires a balance between consumption needs, and the preservation of aquatic environments and social justice. The industrial practices should be well thought out to reduce water waste, promote water reuse and ensure equitable access to water, especially to those in vulnerable situations. Moreover, the preservation of water resources and the proper treatment of industrial effluents should be prioritized to avoid the pollution of the bodies of water, ensuring water quality.

Regarding the economy, it is important to highlight that although the Fourth Industrial Revolution brings benefits, it also creates new challenges, especially regarding the increase in inequality. The benefits to consumers are unquestionable, since the creation of new products and services upgrade the efficiency of our lives; however, on the supply side, there is a substitution of labor for capital, due to the progress of innovations. On top of that, there is the fact that the concentration of advantages and values in capital holders is also aggravated by the platform effect. Developing, labor-intensive countries are the most vulnerable when talking about the migration of global manufacturers to advanced economies.

In this context, there are three main challenges to be faced so that the benefits of the Fourth Industrial Revolution can be optimised, be it in distributing benefits, managing externalities and ensuring a human-centered future.

The first challenge is to ensure that the benefits of the Fourth Industrial Revolution are distributed fairly, since people may not be able to enjoy the benefits generated for several reasons, including: 1) because they are unavailable, unaffordable or irrelevant; 2) because those systems are biased in overt or subtle ways; 3) because the operations of institutions that tend to privatize profits and concentrate wealth and opportunities (Schwab, 2019: p. 43).

The second challenge refers to externalities given the uncertainty as to their long-term impacts arising from the Fourth Industrial Revolution in complex social and environmental systems. Regarding the labor market, new technologies will cause changes in the nature of work in all sectors and occupations. This scenario is more worrying in developing countries whose manpower is more intense when talking about the production process, considering the migration of global manufacturers to capital-intensive developed countries. Thus, efforts must be made to enable the workforce to operate with increasingly capable, connected and smart machines. From this perspective, technological advances must be directed to significantly increase our capacity to solve negative externalities and increase the potential economic growth.<sup>1</sup>

<sup>1</sup>As said by Schwab, Klaus: Rapid technological advances in renewable energy, fuel efficiency and energy storage mean that investments in these areas are becoming increasingly profitable, boosting GDP growth and also helping to mitigate climate change, one of today's main global challenges (Schwab, 2019: p. 29).

The third challenge consists of ensuring that the decisions are led by and for humans, as Fourth Industrial Revolution technologies have the potential to evaluate and make decisions based on processing a large amount of incomprehensible or extremely complex data that is hard to be processed manually by humans.

Ending poverty, democratic politics, peacemaking, climate actions, resilience, diminishing inequalities, and economic growth should lead the Fourth Industrial Revolution, creating technologies and systems capable of promoting the distribution of economic and social benefits, such as income and autonomy for all.

In these circumstances, it appears that the relationship between humans and the environment, especially water resources, has always been characterized by an interdependence. However, with the advancement of humanity and the increase of its technological potential, nature, which once seemed abundant and immune to human impacts, has become vulnerable. This vulnerability is one of the major issues that spark debates on sustainability, since natural resources, essential for human survival, are being consumed in a fast and irresponsible way.

The relationship between water and industrial revolutions is complex and marked by a growing intensification in the consumption and exploitation of water resources, with significant impacts on the environment and society. Each phase of industrialization has brought with it both technological advances and environmental challenges that need to be addressed urgently.

However, technological innovation, which boosted industrial revolutions, could also be the key to a more sustainable future. The effective use of water, the rise of water purification and reuse, and adequate management of water resources are essential to meet the growing demand for water, without compromising the ecosystems' capacity of keeping its balance.

Past lessons, especially those that have negatively impacted the use of water on the industrial revolutions and environment, should guide future actions. Water is not only a natural resource, but a fundamental human right, and the pursuit of sustainability must be the main goal to all industrial, economic and political operations in the 21st century.

### **3. Water Resources in the Face of Human Potential and Their Protection within the Scope of Mercosur**

This topic addresses the vulnerability of nature to human potential and the urgent need for environmental protection, within the context of MERCOSUR, a bloc that, throughout its trajectory, has strived to integrate environmental issues into its regional policies.

Despite being the only planet known to have adequate conditions for human life, earth faces an unprecedented crisis implying a great responsibility, since it's the only planet that allows the development of life as we know it.

The relationship between nature and human potential is one of the main challenges of modernity, especially when the pressure on natural resources, like water, is growing due to economic development and the ever-growing world population.

The biggest challenge faced by humanity is to learn how to cohabitate, in a balanced way, with nature, respecting its limits and ensuring a sustainable world for future generations.

The concept of sustainable development involves the responsible management of natural resources, ensuring that they are used rationally, so that they can be renewed and available in the future.

However, there must be a global understanding about the urgency of this problem, especially in MERCOSUR, where different countries face various challenges related to the preservation of water resources. Sustainable development and environmental protection, especially water, are challenges that require an integrated approach and cooperation amongst the bloc's countries.

Within this context, it should be noted that although MERCOSUR bodies' decisions are made by consensus and with the presence of all the member states, the implementation of environmental regulations depends on their internalization in the legal systems of the member countries. Therefore, in order to effectively consolidate environmental rights in MERCOSUR, it is essential that national legislation is aligned, in order to strengthen environmental protection and boost sustainable development in the region. Therefore, sustainable development and environmental protection, especially regarding water, are challenges that require an integrated approach and cooperation between the bloc's member countries. MERCOSUR recognizes water as an essential resource, and member countries have sought to integrate environmental policies, creating regulations that seek efficient and sustainable water management.

Despite the efforts made within MERCOSUR, there is still a significant way to go for the bloc to achieve a level of water governance comparable to that of the European Union. While European countries are structured under a highly integrated regulatory framework, with effective enforcement mechanisms and strong links to economic policies, MERCOSUR still faces substantial challenges, such as legislative fragmentation, the absence of a coercive system for enforcing environmental standards and limited coordination to sustainable economic guidelines.

The European bloc stands out for having a unified regulatory framework, consolidated through the Water Framework Directive (2000), which establishes normative guidelines for the management and protection of water resources throughout the community. This instrument gives uniformity to the regulation of the sustainable use of water, ensuring water quality standards and promoting strong environmental governance. In addition, the countries that make up this structure adopt a centralized governance model, in which the European Environment Agency and the Court of Justice of the European Union play a fundamental role in overseeing and standardizing regulatory application, ensuring the effectiveness of environmental standards in all member states. The management of transboundary water resources is another point of distinction between the blocs. The European model implements advanced practices of integrated river basin governance, as in the case of the Danube River, whose regulation is based on binding

guidelines and coordinated decision-making mechanisms at multiple levels. This approach ensures more efficient control of shared water resources and promotes greater legal certainty when dealing with international waters. The intersection between environmental and economic policies also stands out as a strategic differentiator. Environmental goals are incorporated into agricultural and industrial policies, fostering the adoption of sustainable practices and encouraging the rational use of water resources in the productive sector. In addition, this group of countries operates under a standardized monitoring system, which obliges member states to submit periodic reports on water quality and availability. This information supports the establishment of public policies, promotes administrative transparency and strengthens environmental monitoring mechanisms.

In the context of MERCOSUR, it is essential to highlight that the participation of local communities, indigenous peoples and non-governmental organizations (NGOs) in the governance of water resources within MERCOSUR is gaining relevance, despite facing considerable obstacles. In the regional context, the Social Summits are instances of political dialogue that bring together representatives of social movements and government authorities from the States Parties, with the aim of strengthening the social dimension of integration and broadening citizen participation. However, the capacity of these initiatives to substantially influence decisions on water management is still limited.

In this context, in order for MERCOSUR to improve its water governance and consolidate a sustainable model for managing water resources, it is essential to strengthen regulatory integration between the member countries, create stricter inspection and monitoring mechanisms, establish economic incentives aimed at the sustainability of water resources and strengthen the Social Summits in the economic bloc's decision-making. The adoption of such measures would allow a greater alignment with international normative standards and would contribute to the consolidation of a safer and more efficient water regime in the region.

Moreover, sustainability is not only about preserving natural resources, but also about meeting essential human needs, which include clean water, food, sanitation, housing, energy, health care, education, democracy, security, and freedom. The way these needs are met are inherently connected to the government and society's capacity to manage their resources in a reasonable and balanced manner, without compromising the environment.

### **3.1. Environmental Law in Mercosur Member Countries with Emphasis on Water Resources**

Regarding environmental protection, it should be noted that in the 1980s and 1990s, its constitutionalization became a priority in the MERCOSUR States Parties.

In Brazil, the 1988 Constitution was a pioneer in recognizing, through the main section of article 225, the ecologically balanced environment as a fundamental right, entrusting both the government and society with the responsibility of

protecting it, for current and future generations. In addition, the sixth clause of article 170 of the Constitution established environmental protection as a general principle of the country's economic order, whose objective is to ensure a dignified existence with social justice for all. In addition to these, other articles related to the environment are found in the Brazilian Constitution, namely, articles 5, 20, 23, 24, 30, 91, 129, 174, 186, 200, 220 and article 231.

Regarding nonconstitutional legislation, as [Wellington Pacheco Barros \(2005\)](#) points out, on August 31, 1981, Federal Law No. 6.938/81 was enacted, which established the National Environmental Policy and created the National Environmental System (SINAMA), subordinated to the National Environmental Council (CONAMA). This council is responsible for defining norms and standards, among others, related to the control and preservation of environmental quality, in order to ensure the rational use of natural resources, especially water. This law recognizes water as an environmental resource that must be carefully planned, rationalized, inspected, protected and have its quality monitored.

The Federal Constitution of 1988 established new compositions regarding the water domain, having water resources under responsibility of the federal and state government. In addition, as established in the sixth item of the article 22 on the Federal Constitution, the legislative competence is exclusive to the Union, although there is the possibility of a complementary law authorizing the States to legislate on specific issues.

In January 1997, Law No. 9.433/97 was published, which established the National Water Resources Policy (PNRH), created the National Water Resources Management System and regulated the item 19 of article 21. According to [Ana Cláudia Bento Graff \(2000\)](#), this law represents a significant milestone, reflecting a profound change in the values related to the multiple uses of water, its priorities, its economic value, its finitude, and the populations' participation in management.

At the nonconstitutional level, it is also important to highlight the article 1291 of 2002's the Civil Code which states:

the owner of a superior property cannot pollute water that is essential to the lives of those who own inferior properties. If polluted, the water must be recovered compensating the damages suffered, if it is not possible to recover or divert the artificial course of the waters ([Brasil, 2002](#)).

Speaking of criminal law, the Penal Code provides in its articles 270 and 271, penalty for the actor who poisons drinking water, of common or private use, food or medicinal substance intended for consumption, and for the one who corrupts or pollutes drinking water, of common or private use, making it unfit for consumption or harmful to health.

In addition, these are some examples of relevant environmental legislation in Brazil: Law No. 12.651/2012—Brazilian Forest Code, Law No. 9.605/1998—Environmental Crimes Law, and Law No. 12.305/2010—National Policy on Solid Waste

and Law 9.966/2000, which provide the prevention, control, and inspection of pollution caused by oil spilling and other harmful substances in water under national jurisdiction. Besides those, several resolutions and regulations complement the legal framework, addressing specific issues and detailing operational aspects.

Despite the existence of an extensive regulatory set, the effective implementation of environmental laws in Brazil faces significant challenges. The scarcity of financial and human resources in the agencies responsible for inspection, in addition to corruption and impunity, result in an inefficient application of legislation. In addition, the participation of local communities, indigenous peoples and NGOs in environmental management, although essential, is often underestimated, which limits the effectiveness of public policies. The opposition of several economic sectors is another relevant obstacle, since they prioritize profits over environmental preservation, which requires a broader and more transparent debate over the priorities for a sustainable development.

In Paraguay, the 1936 Constitution also enshrined the right to a healthy and ecologically balanced environment, dedicating an entire section to its protection. The seventh article of the Paraguayan Constitution establishes the preservation and improvement of the environment as priority goals, connecting them to human development, and states in article 8 the prohibition of the import of toxic waste and the manufacture, possession and use of nuclear, chemical and biological weapons, in addition to demanding the obligation to repair environmental damage. The Paraguayan Constitution also provides for the environmental issue indirectly in articles 6, 37, 46, 114, 115 and 226.

Paraguay has adopted several policies for environmental protection over the years. In 1980, the National Environmental Sanitation Service (SENASA) was created, and began monitoring water, air and soil quality, in addition to establishing guidelines for the control of environmental contamination throughout the country. In 1989, the Undersecretary for Natural Resources and the Environment was founded by the Ministry of Agriculture and Livestock, with the goal of reducing deforestation, promoting reforestation, controlling wildlife trafficking and encouraging environmental education, in addition to promoting legislative reforms.

In 1994, Paraguay and Germany, signed the Technical Cooperation Agreement for the elaboration of the National Strategy for the Protection and Management of Natural Resources of Paraguay (ENAPRENA), whose main goal was to create an action plan to protect natural resources, controlling water, soil and air pollution. In 1997, with the enactment of Law No. 9.433/97, which established the National Water Resources Policy, there was a significant change in the management of water resources, with a more integrated and coordinated approach.

In the year 2000, Law No. 1.561/00, the National Environment System, was created, composed of the Secretariat of the Environment (SEAM) and the National Environment Council (CONAM). SEAM started the management and monitoring of water resources, replacing SENASA, and started to play a central role in the

formulation of environmental policies. Other legislations, such as the Sanitary Code and the Agrarian Statute, have also introduced penalties for environmental crimes.

Law No. 3239/2007, which establishes the protection of water resources in Paraguay, regulates the sustainable management of all waters in the national territory, regardless of their condition or physical state. Its goal is to ensure that water use is socially, economically and environmentally sustainable for the populations living in the Republic of Paraguay.

International cooperation has also been important, with Paraguay participating in agreements with Brazil and Argentina, such as the Río de la Plata Basin Treaty, and other protocols that deal with the conservation of water resources and aquatic fauna. In addition, the country requires environmental impact studies for projects that may affect the environment, such as deforestation and dam construction, seeking to ensure control over activities that impact ecosystems.

Although there are several operating environmental laws and policies, the lack of effectiveness emerges as a major challenge to be overcome.

Argentina, with its constitutional reform of 1994, in articles 41,75,121 to 124, recognized the right to a healthy and balanced environment for human development, imposing the rational use of natural resources, obligation to repair the damage caused and the prohibition of the entry of hazardous waste.

In Argentina, water is treated as a public domain asset, and Law No. 25,688, of December 30, 2002, establishes the Water Environmental Management Regime, with minimum guidelines for its conservation, and rational use. However, each province is responsible for the management of water resources, both surface and underground wise, including water beds, according to the scope determined by the Argentine Civil Code. This resulted in the non-adoption of the Water Law by the provinces, which prefer local laws, as they consider them more appropriate to the interests of local communities.

Based on this, José Hélio Ferreira Pes (2005: p. 64) says:

National legislation as well as provincial legislation prohibit throwing domestic and industrial waste into rivers without prior treatment. Both national and provincial legislation organize the supply of drinking water and establish limits for contamination control. Water protection standards in several provinces are more extensive than those issued by the nation.

The water law in Argentina is regulated provincially, so that there are several Water Codes, such as the Buenos Aires Water Codes—Law 12257/1999; Chaco—Law 555-R/1986, Chubut—Law XVII/53/1996, Córdoba—Law 5.589/1973, Corrientes—Decree Law 191/2001, Formosa—Law 1246/1997, Jujuy—Law 161/1950, La Pampa—Law 2.581/2010, La Rioja—Law 4.295/1983, Neuquén—Law 899/1975, Rio Negro—Law 2952/2009, Salta—Law 7017/1998, San Juan—Law 190-L/2014, San Luis—Law VI-0159-2004, Santiago del Estero—Law 4869/1980 and the following provincial laws, namely, the Catamarca Water Law—Law 2.577/1973, Caba

Water Environmental Management Law—Law 3295/2010, Between Rivers Law 9172/1998, Santa Cruz Waters Law—Law 1451/1982, Santa Fe Waters Law—13740/2017, integral Water Resources Management Law of Tierra del Fuego—Law 1126/2016 and Tucán Waters Law—7139/2001. In the context of Mendoza, in addition to the National Constitution and international treaties with a constitutional hierarchy, the Law of Minimum Assumption of Environmental Protection, the Civil and Commercial Code of the Nation of 2015, the Constitution of Mendoza of 1916, articles 186 to 196 of its Sixth Section, the Water Law of 1884 and the Law 4.035/1974—Subterranean Water Law, along with other provincial laws subsequent to the legal regime of the province's waters (Erice & Andean, 2024).

In Uruguay, the 1996 constitutional reform and the 2004 water reform reinforced environmental protection in their constitutional text, recognizing access to water and sanitation as fundamental human rights and establishing the sustainable management of water resources. The “Water Reform” introduced four new items in article 47, establishing the guidelines for the national water and sanitation policy: (i) the preservation and protection of the environment, as well as the restoration of ecosystems; (ii) the sustainable management of water resources to ensure their availability for current and future generations; (iii) the definition of regional priorities in water use; and (iv) the principle that the provision of services, restricted to public entities, should prioritize social aspects over economic interests. The Constitution of Uruguay also supports environmental protection through article 7, which ensures the right to life; article 32, which establishes the social function of property; and article 72, which guarantees, in addition to the explicit rights in the Constitution, those inherent to the dignity of the human person.

Uruguay has demonstrated a remarkable advance in its environmental legislation, with emphasis on the Fauna Protection Law—Law 9481/1935, law that regulates the commercialization of agrochemicals—Law 13640/1967, the Water Code—Decree 14.859/1978, the Soil Conservation Law—Decree—Law 15.239/1981, the Forest Law—Law 15.939/1987, the Environmental Impact Assessment and Prevention Law—Law 16.466/1994, the General Environmental Protection Law—Law 17.283/2000 and the Spatial Planning Law—Law 18.308/2008, National Water Policy Law—Law 18.610/2009, Law 19.829/2019—Integral Waste Management Law and Creation Law of the Ministry of the Environment—Law 19.889/2020.

Uruguay's environmental legislation has focused on and strengthened water resources management, especially in light of the water crisis faced by the country. The enactment of Law No. 17.283/2000, which created the National Water Resources Policy, established a framework for sustainable water management. The country has adopted integrated water resources management, emphasizing the preservation of water quality and the rational use of its resources. In addition, the Water Code was an important step in regulating the use of water resources, providing a legal framework for the conservation and sustainable use of water. In

response to water scarcity, projects such as Nepturno, which aims to promote the integrated and sustainable management of water resources, and Casupá, which seeks to recover watersheds and aquatic ecosystems, were implemented. These projects play an essential role in mitigating the effects of the water crisis, promoting environmental awareness and ensuring water supply in the country.

The 1999 Constitution of Venezuela also recognized ecological balance as a common heritage and guaranteed the right to development in an environment free from contamination, establishing in its article 127 requirements for the conservation of the environment. Moreover, activities that may cause damage to ecosystems must be preceded by environmental impact studies, prohibiting the entry of toxic and hazardous waste, as well as the manufacture and use of nuclear, chemical and biological weapons. The Constitution also requires that contracts involving natural resources include the obligation to preserve the ecological balance and restore the environment to its natural state whenever there are changes.

Venezuela's nonconstitutional environmental legislation, with an emphasis on water resources management, is governed by the 2007 Comprehensive Water Resources Management Law, which defines water resources as public domain assets essential for the country's sustainable development. The law aims to ensure the reasonable use of water, promotes its preservation and regulates the use of water bodies, focusing on the protection of aquatic ecosystems and the needs of the population. In addition, the 2014 Organic Environmental Law reinforces the State's responsibility to protect natural resources and create management instruments for the sustainable use of water. The country also participates in international agreements, such as the Treaty on the Orinoco River Basin, which aims to protect regional water resources.

Despite the solid legal framework, effective implementation faces challenges due to economic, political limitations and lack of adequate infrastructure.

### **3.2. Environmental Protection in Mercosur**

In this scenario, MERCOSUR, as an economic and political bloc, has been committed to including the environmental issue on its agenda, recognizing that environmental challenges transcend national borders and require a coordinated approach among member countries. Because, although local recognition of the importance of environmental preservation and the efficient use of available resources for economic development is fundamental, this recognition alone is not sufficient to mitigate existing transboundary socio-environmental conflicts.

States began to assume legal and environmental responsibility at an international level, while respect for national sovereignty was consolidated, with the provision of shared responsibilities for possible environmental damages.

The bloc has advanced in the creation of common policies aimed at environmental protection, understanding that the preservation of nature is fundamental, not only to guarantee social quality of life, but also to ensure the economic and social sustainability of the region.

Explicitly or not, the constitutions of MERCOSUR member countries enshrine several environmental principles. For example, Brazil, Argentina, Uruguay and Venezuela establish the principle of intergenerational solidarity to ensure the satisfaction of needs, highlighting the importance of environmental preservation for future generations.

When analyzing the historical construction of the MERCOSUR formation process, it can be seen that it dates back to 1960, when The Latin American Integration Association (ALADI) was created, with the goal of establishing a free trade area between the countries of the region. However, during this period, important treaties related to water governance emerged.

It should be noted that during the 1960s, the construction of hydroelectric dams and infrastructure projects was already being discussed, which brought to light the need for an agreement that would guarantee the coordinated and peaceful management of these resources. In this context, the Río de la Plata Basin Treaty, signed in 1969 between Argentina, Bolivia, Brazil, Paraguay and Uruguay, was a milestone in the successful integration of cross-border cooperation between the countries of the Río Plata region. The aim of the agreement was to establish cooperation for the rational and equitable use of water, environmental preservation and the promotion of regional development and serving as the basis for other hybrid cooperation agreements such as the Itaipu Treaty and the Guarani Aquifer Agreement.

The La Plata Basin Treaty also played a crucial role in avoiding direct conflicts between the countries of the basin, providing a platform to settle issues involving the use of water for consumption, navigation and energy generation. Through this cooperation agreement between the five states, areas of common interest were determined, making it possible to carry out studies, programs and projects, as well as drawing up operational guidelines and legal instruments for their implementation in order to promote assistance to navigation; guarantee the sustainable use of water resources through the regularization of watercourses and their equitable and multifunctional use; encourage the preservation and protection of fauna and flora; improving road, river, air, electricity and telecommunications interconnections; encouraging regional complementarity through the creation and strengthening of strategic industries for the development of the Basin; stimulating the economic integration of border areas; promoting mutual cooperation in education, health and the fight against diseases; developing initiatives of common interest, with an emphasis on surveying, evaluating and taking advantage of the region's natural resources and deepening knowledge about the entire La Plata Basin. Such initiatives reflect not only cooperation for the use and preservation of water, but also the central role of water resources in economic and environmental integration within MERCOSUR.

It is clear that since its creation, MERCOSUR has gradually incorporated the environmental issue to its agenda, understanding that environmental challenges transcend national borders and require a cooperative approach that aims the

correction of internal laws of the States Parties.

According to Samuel Guimarães Pinheiro, it is essential that they unite to boost economic growth, protect political sovereignty and value the cultural identity of their populations. Otherwise, they run the risk of becoming peripheries subordinated to the large regional blocs, remaining on the margins of the global economy and politics (Guimarães, 2014: p. 190).

The second MERCOSUR Presidential Summit, held in 1992, was a milestone in the formalization of environmental issues within the bloc, creating the Specialized Meeting on the Environment (REMA), through Resolution No. 22/92. REMA was established as a forum for cooperation between member countries, with the general objective of formulating recommendations to the Common Market Group (CMG) aimed at ensuring the effective and coordinated protection of the environment in the regional integration process, and with the specific objective of contributing to the creation of adequate conditions in the environmental field, in order to guarantee a fair competitiveness between the States Parties, as well as an adequate external competitiveness of products originating from MERCOSUR.

Soon after, in 1995, Working Subgroup No. 6 (SGT. No. 6) was created, through MERCOSUR Resolution GMC/38/95, which focused on environmental management, with the goal of promoting sustainable development, implementing actions that ensure the integration of environmental issues in the regional union process, promoting environmental measures that are effective, economically feasible and socially equitable. SGT. No. 6 has become the central body for the implementation of environmental policies in MERCOSUR, working closely with the environment ministers of the member countries and international organizations.

As Paulo Affonso Leme Machado (2004: p. 28) discusses:

In 1992, MERCOSUR member countries met in Las Leñas (Argentina) and defined the goals to be achieved and the deadlines for their achievement, and many of them dealt with environmental issues. Subgroup No. 6 was structured to deal specifically with the Environment, through the Taranco declaration, at a meeting of the Ministers and Secretaries of the Environment of the four countries mentioned, held in Uruguay in 1995. And through Resolution 38/95, the Common Market Group approved the elaboration of an additional environmental protocol in the agenda of Subgroup No. 6.

MERCOSUR SGT. No. 6, the main environmental management agent, covers several specific areas, which are of great importance for the local sustainability agenda, namely:

- Environmental Waste Management and Post-Consumer Responsibility: MERCOSUR has been working to implement common waste management systems and promote post-consumer responsibility, addressing issues such as recycling and proper management of products at the end of their life cycle.
- Competitiveness and Sustainable Production and Consumption: In accordance with Decision No. 26/2007, which deals with the promotion of a green economy, MERCOSUR has encouraged policies that promote sustainable

production and responsible consumption, with the goal of reducing the negative environmental impacts of economic activity.

- **Fight against desertification and drought:** Given the significant impact of desertification and drought in several MERCOSUR regions, especially Argentina and Brazil, the bloc has developed joint strategies to mitigate these phenomena.
- **Environmental Goods and Services:** The protection of environmental goods and services, such as water resources and forests, is one of MERCOSUR's priorities, with initiatives to promote the sustainable management of these resources.
- **Biodiversity:** The preservation of biodiversity is one of the most critical fields in MERCOSUR. In 2006, the environment ministers approved the MERCOSUR's Biodiversity Strategy, focusing on protecting and promoting the sustainable use of local biodiversity.
- **Air quality:** MERCOSUR has been committed to reducing air pollution through the implementation of air quality policies and pollution monitoring.
- **Environmental Management of Substances and Chemicals:** In 2004, SGT. No. 6 prepared an action plan for the management of hazardous substances and chemicals in MERCOSUR, aiming to minimize the risks associated with the use and disposal of these products.
- **MERCOSUR Environmental Information System (SIAM):** It is an essential technological innovation for environmental governance in the bloc. This advanced platform makes it possible to share and monitor environmental data, promoting the integration of information between the States Parties and enabling more accurate regional diagnoses. Its implementation strengthens the articulation of environmental policies and increases the capacity of MERCOSUR countries to face water challenges in a coordinated and efficient manner. By consolidating information on actions, projects and the results of environmental initiatives, SIAM improves the transparency of decisions and facilitates access to strategic data, ensuring greater dissemination of knowledge among governments and society. This tool gives decision-makers and policy-makers access to fundamental information for more efficient management of water resources. The platform enables detailed monitoring of crucial indicators such as water quality, pollution levels, water consumption patterns and actions aimed at environmental conservation. Through this analytical capacity, SIAM makes it possible to draw up more effective strategies for water sustainability, contributing directly to mitigating environmental impacts and promoting the rational use of natural resources in the regional bloc.

In 2001, the MERCOSUR Framework Agreement on the Environment (CMC/DEC No. 02/01) was adopted, one of the main legal instruments aimed at implementing common environmental policies among member countries, trying to promote cooperation on transnational environmental issues, strengthen the sustainable management of natural resources, and ensure the protection of the

environment, especially in areas such as the preservation of biodiversity, the fight against desertification and waste management.

In addition, the Framework Agreement establishes guidelines for MERCOSUR countries to share information and best practices regarding sustainability, and also provides a framework for the negotiation and implementation of environmental commitments within the bloc. The Framework Agreement also coordinates with international commitments, such as the Convention on Biological Diversity and the Paris Agreement, reflecting MERCOSUR's engagement with global environmental issues.

Within this context, it is important to highlight that the Olivos Protocol, signed in 2002, attributed to the MERCOSUR Dispute Settlement System the qualification to deal with issues related to socio-environmental issues at the local level.

In the following years, the 2006 MERCOSUR Biodiversity Strategy and the Promotion and Cooperation Policy in Sustainable Production and Consumption in Mercosur of 2007 stood out in the Environmental Policy Agenda.

In 2009, through Resolution No. 41/09, the MERCOSUR Support Program for the Advancement of the Economic Integration and Sustainable Development Process integrated cooperation initiatives between MERCOSUR and the European Union, with the purpose of aligning cross-cutting strategies of the States Parties with consistent and applicable regional guidelines.

In August 2010, in order to promote greater cooperation in scientific knowledge and responsible management of water resources, the Guarani Aquifer Agreement, one of the largest groundwater reservoirs in the world, was signed between Argentina, Brazil, Paraguay and Uruguay. According to [Pilar Carolina Villar \(2015: p. 236\)](#), this was the first instrument to be signed after the adoption of AGNU Resolution 63/124, being influenced by an approach to International Freshwater Law. Its signature, despite the slow pace of its ratification, is an example of successful water integration in MERCOSUR, due to its magnitude and regional representation, strengthening the environmental issue in the integration process of the bloc, by intensifying cooperation and promoting discussion on transboundary waters, generally benefiting the Río de la Plata Basin System. Articles 3, 4, 6 and 7 of the Agreement on the Guarani Aquifer, when addressing issues related to the environmental protection and conservation of this system, state that the signatory countries must guarantee the rational, sustainable and fair use of water resources, promoting the multiple use of these resources. In addition, the Agreement states that any activities or projects aimed at exploiting the aquifer in the territories of the countries involved must implement appropriate measures to avoid significant impacts on the other parties or on the environment. However, despite the importance of the Agreement on the Guarani Aquifer, the management of aquifer's groundwater is still lacking, being the subject to regulatory instruments of each of the states that share it. Given the strategic importance of the aquifer and the possible conflicts related to its management in transboundary areas, it is essential to implement mechanisms for integrated and cooperative management. In addition,

it is essential to advance in research and monitoring of the resource, especially after the Agreement signing in 2010, considered the most significant in the region with regard to the governance of transboundary aquifers.

On April 21, 2012, the Additional Protocol to the MERCOSUR Framework Agreement on the Environment came into effect at the international level, in order to prevent, mitigate, respond immediately and promote recovery in situations of environmental emergencies, through agile, effective and predictable procedures.

In addition, it should be noted that the Meeting of Ministers of the Environment of Mercosur (RMMA), which is held periodically, is another central element of the bloc's environmental agenda. In 2003, the environment ministers of the MERCOSUR member countries met to propose advances in cooperation and environmental protection and in the coordination of policies aimed at sustainable development in the region. In 2024, the XXXI RMMA, held in Paraguay, continued to be an important platform to promote environmental cooperation and address regional sustainability challenges.

The meetings have been essential in aligning member countries' environmental policies and establishing a joint action plan for the implementation of green initiatives. RMMA also serves as a mechanism to discuss and coordinate MERCOSUR's response to environmental emergencies and to promote the integration of environmental issues into other aspects of local policies.

The main topics should also be highlighted, since they have been approached in a specific way at the MERCOSUR's environmental agenda, with the implementation of decisions and action plans aimed at the environment's protection and, the promotion of sustainability, to wit:

- Sustainable Production and Consumption (Decision No. 26/2007): MERCOSUR has adopted policies that encourage sustainable production and consumption practices, with the objective of reducing the environmental impact on the region. Decision No. 26/2007 is a milestone in promoting a more sustainable economy and encouraging the efficient use of natural resources.
- Waste (Action Plan for the Management of Hazardous Substances and Chemicals): MERCOSUR has been working on the execution of an action plan for waste management, with a special focus on hazardous chemicals. The plan covers 10 work areas, including the reduction, reuse and recycling of waste and the proper management of toxic substances.
- Environmental Emergencies (Decision CMC/DEC No. 14/04): In 2004, MERCOSUR adopted Decision CMC/DEC No. 14/04, which establishes guidelines for coping with environmental emergencies, such as natural disasters and accidents with chemicals, in order to minimize their impacts on the region.
- Biodiversity (Mercosur Biodiversity Strategy): The Mercosur Biodiversity Strategy, approved in 2006, seeks to promote the conservation and sustainable use of regional biodiversity, with a focus on protecting vital ecosystems such as the Amazon and Chaco. This strategy is essential to preserve South America's

rich ecosystems, which play a crucial role in the global ecological balance.

Despite the efforts undertaken, legal asymmetries between State Parties reduce the effectiveness of regional environmental protection standards.

As [Aline Beltrame Moura \(2018\)](#) says:

The absence of minimum harmony between national laws can cause a dangerous situation of uncertainty, since a certain MERCOSUR standard could be repealed in a member state and be fully in force in another country. (...) And this situation corroborates the low rate of incorporation of MERCOSUR rules by the legal systems of the member states and, consequently, the non-compliance with the rules aimed at consolidating and advancing this process of Latin American integration.

On December 6, 2024, the conclusion of the negotiations of the Partnership Agreement between MERCOSUR and the European Union was announced, after 25 years of discussions, which makes it now possible the elaboration of texts for the Agreement, and its future signature and ratification. This agreement establishes one of the largest free trade areas in the world, encompassing economies of approximately \$22 trillion and about 718 million people. In the environmental field, the agreement focuses on integrating trade with sustainability, promoting the adoption of strict climate and environmental standards, and includes commitments in areas such as fishing and sustainable forest management. In addition, it provides for the resolution of environmental disputes, preventing the use of trade-damaging protectionist measures and ensuring the protection of MERCOSUR countries' exports, especially in the face of European regulations.

In view of the above, it appears that MERCOSUR's environmental agenda has advanced significantly since the creation of REMA and Working Subgroup No. 6. However, challenges still exist, especially with regard to the implementation of common policies, the financing of environmental initiatives and the harmonization of local legislation. Despite this, MERCOSUR has demonstrated a growing commitment to environmental protection, promoting cooperation amongst member countries and developing policies that seek to balance economic development with environmental sustainability. Ongoing collaboration between member countries, civil society and international organizations will be key to consolidating a sustainable future for South America.

#### **4. Conclusion**

The Industrial Revolutions had a big impact on the way water was used and exploited over time, especially in the early stages of industrialization, when water was seen as a virtually unlimited resource for power generation and mass production. The First Industrial Revolution used water as a driving force in the textile and milling industries, driving economic growth, but also generating significant environmental side effects, such as river pollution and depletion of water resources. In subsequent revolutions, the intensification of the exploitation of natural resources,

including water, accompanied by increasing urbanization and industrialization, accentuated environmental problems, creating the urgent need to rethink the relationship between development and environmental preservation. The Fourth Industrial Revolution, with its technological and digital innovations, offers new opportunities to optimize water use, but also brings challenges related to increased consumption and pressure on ecosystems, requiring a more integrated and sustainable approach.

In this context, MERCOSUR has a fundamental role in the management of water resources in South America. The bloc has promoted cooperation among its member countries, seeking to integrate environmental policies to address the challenges of water scarcity and ensure water sustainability in the region. The creation of important agreements, such as the Silver Basin Treaty and the Guarani Aquifer Agreement, reflects MERCOSUR's commitment to jointly manage shared water resources and protect aquatic ecosystems. However, Mercosur still faces challenges, such as the lack of full legislative harmonization among member states and the implementation of effective environmental policies. Overcoming these barriers is essential to ensure that water is managed sustainably and that countries in the bloc are prepared to deal with the impacts of climate change.

In addition, the environmental law of MERCOSUR member countries has evolved to recognize the importance of water as a fundamental right and a collective good to be protected. In Brazil, for example, the 1988 Constitution and Law No. 9.433/97 established a national water resource management system, recognizing water as a scarce resource that must be used efficiently and sustainably. Likewise, countries such as Argentina, Uruguay, Paraguay and Venezuela have adopted specific legislation for the protection of water resources, in line with the principles of sustainable development and integrated water management. However, the implementation of these legislations still faces obstacles, such as the lack of resources, the resistance of economic sectors and the difficulty of coordination between national and regional policies.

In order for MERCOSUR to fulfill its role in the protection and sustainable management of water, it is essential that its member countries strengthen legislative integration and the application of common environmental policies, ensuring a more sustainable future for the region.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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