

# How Can AI Technologies Be Used To Ethically Provide Clean Drinking Water?

By Susan V. Ricker

Artificial intelligence (AI) describes an ever-evolving cyber tool which can be used to assist in many different business applications, including the water industry. Due to the fast implementation of this methodology, there are unknowns which create challenges in establishing protocols. AI technologies can be used ethically to provide clean drinking water by applying concepts that incorporate transparent business profitability models, utilitarian-based ethics, a focus on faults in human abilities versus machine learning, and justice-based ethics.



## Advancing Business Profitability

AI tools have advanced business processes ethically in the water treatment industry. The development of AI on the business profitability side of water treatment and environmental sciences explains how its incorporation can make the water treatment process more efficient and cost-effective. Benefits of blockchain trading of energy resources and Water as a Service (WaaS) subscription-based business models offer a positive financial impact to customers, businesses, and society. Blockchain creates a marketplace for water utilities to sell to consumers within their communities to promote fair pricing based on usage which is tracked by AI. Pricing mechanisms can encourage price savings by monitoring usage and offering incentives to reduce consumer costs (Soori, et al., 2024). AI algorithms also analyze transparently and in real-time, which leads to improved honest resource management and allows consumers to make informed decisions about their water usage and economic choices to pay for the cost of it.

New multi-dimensional bidding datasets are available to water equipment manufacturers due to AI that was not available 10 years ago. AI search engines can layer criteria for an AI automated metering system called smart water technologies. These partnerships and projects could divulge competitors' involvement as well as market intelligence to help identify the best opportunities to pursue for the bidding company. This would put them at the forefront of the bidding process and eliminate wasting efforts if they had a higher chance of winning the project. The debate is whether it is ethical to have this type of advantage (Mohindroo, 2022).

## Utilitarian Ethics

An article by Vredevoogd (2024) analyzed how utilitarian ethics can be used as the best decision process when deciding to use AI technology to lead the monitoring and treatment of creating clean drinking water. The implementation of AI will produce the best impact on society for the common good. Gaining an understanding of this form of moral reasoning to produce the greatest balance of good over harm in this industry raises the ethical question. Current methodologies in harnessing AI create hurdles in municipal water treatment management. Lack of trust in a developing technology could cause issues with employee retention, operational growth lags, and unforeseen financial costs. Introducing the topic of a community's support and acceptance to a successful launch of emerging AI technologies highlights where ethics are a factor.

## AI vs. Human Challenges

### Ethical Dilemma

There is an ethical question presented of when to use AI instead of actual humans and their thought processes. An article by Li and colleagues (2021) compares human knowledge of the steps in monitoring the treatment process versus the wealth of data used to make split second decisions to predict crises and issues within the plant before they happen. It is a valid risk management point to define what a water treatment plant's challenges are in operations and how human operators can make data entry and analysis mistakes or make crisis-based decisions with emotions. How AI proposes to fix these issues is by perfecting the usefulness and developing a process for understanding big data and establishing a crisis protocol. This is pivotal in defining ethics of AI versus Human.

### Societal Benefit

The cost of upgrading water treatment technologies results in societal benefits, Nishant (2020) discusses a community's acceptance of emerging AI technologies. There is a positive value for keeping the gauge monitoring, repetitive, and time-consuming tasks assigned to AI. This replaces human workers' role but permits them to focus on higher value work and creates a time-saving benefit. Also, AI overcomes the bias of human emotions which is a factor that stymies the efficiency of data-driven information. This creates harmony in the workplace.

## Better Data

An article by Newton (2024), regarding better decision-making in water utilities, discusses the advantages of improving water treatment's data-driven culture. Manually inputting data risks corrupting it and making it unusable due to basic human error, therefore additional training is needed to reduce the likelihood of errors. If smart metering and automated meter reading (AMR) is implemented, it changes the culture to accurate AI data read electronically from the source instead of human inputs with possible errors. The benefit of smart metering creates efficiency with little training in a data-driven culture.

## Justice Ethics

Another point is to discuss justice ethics for the common good. If clean water is a right and necessity for human survival, then supplying it efficiently and cost effectively makes sense. AI is the direction of the future, and its efficiency has been proven. It is important to understand ethics are reasoned rationales and not reactionary decisions based on feelings (Kidder, 2006). When doing the right thing humans have the capacity to feel a certain way when making a choice bad, good, or even uncomfortable (Nagle, 2024). Right vs. Right is the ethical dilemma, and those choices can be difficult as they are not quantitative problems which involve data, moral problems based on governance, generally accepted values, or common moral principles as stated by Markkula Center (Velasques & et al., 2021). To understand the ethics of either continuing to use humans or using technology-based decisions to claim the fate of the viability of a precious environmental resource is a dilemma. There are two paths to follow, to reach the same outcome; choosing to implement AI is efficient and appears to be the best choice for sustainability of life.

## Research Gaps

The concept of connecting AI ethics and water treatment into one answer requires exploring across different disciplines and gaining an understanding of how water treatment systems work, how AI tools work, and synthesizing the information from a justice ethics for a greater good approach. There are strengths in the study of AI ethics and in the study of use of AI in water treatment processes, and discussions from a profitability and policy standard that showed in favor of AI.

A counter point reading by Munn (2023) suggests that the use and development of AI tools and technologies are not fair to all groups of people for moral principles and governance because ethical guidance is still vague with recent technologies. Munn explains there is a lack of transparency and a lack of consequences for not treating all groups of people fairly (2023). As technologies advance by hyper-speed, the legislative arena is lagging behind, creating an imbalance of technology and governance.

The weakness in this research combines and disseminates information of ethics in the water treatment industries. Most ethical research explains the need for sustainability and solving the water crisis. I explored talking to professionals from different water associations based in the United States and water and wastewater equipment manufacturers. I received valuable feedback from a boots-on-the-ground perspective. This is a gap, but oral communication helped synthesize the research.

The next step is for future research in ethics in the water industry for using advanced AI business processes to solve the identified gap. The significance of this could advance understanding in the field because it would link moral values of an AI decision-based system to whether its use is beneficial for creation of potable water in the treatment facilities. Future research could contribute an understanding to the fields of AI, Ethics, and Sustainability and describe how water treatment and sustainability are related then link it to how this subject is needed to understand societal needs for human survival.

## What Does This All Mean?

Explaining challenges of AI that impact business models in water treatment helps gain an understanding of the ethical dilemmas that are faced by water industry businesses and their served communities regarding the necessity to incorporate rapidly emerging AI technologies as best practice. It is ethically understood we cannot take water for granted and it will continue to be a needed commodity. Careful consideration is made to address business profitability over the expense of human capital or the lives of recipients. Since access to clean water is a resource that should be available to all people, solving the ethical dilemma within an AI infrastructure is a stymie if it is not fully understood. Employing AI to build stronger relationships among manufacturers creates partnerships with each other beginning with the cycle of bidding jobs and then within internal staffing; in the ability to make positive strides in accuracy and efficiency at the steps in a treatment plant level; and to use new models and data to drive decisions. These conclusions describe how ethics can be used when treating drinking water with tools from AI.

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