



**REcovery and REcycling of nutrients TURNing wasteWATER into added-value products for a circular economy in agriculture**

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## List of abbreviations

W2R	Water2REturn
WP	Work Package
D	Deliverable
EU	The European Union
EC	European Commission
EASME	European Agency for Small and Medium Enterprises
H2020	Horizon 2020

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# 1. Executive Summary

The European Union is faced with many challenges, with food insecurity and water scarcity amongst the most pressing. In recognition of these issues, the Water2Return project was created, which seeks to increase clean water supply, increase fertilizer supply, protect EU interests, and improve farming. While there are other projects that individually look at clean water, or creating nutrients, the Water2Return project works on an entire circular economy.

The Water2Return project was tasked with writing a policy brief and roadmap to foster EU implementation of nutrient recovery from industrial wastewater stream. The following document will serve as a Policy brief and roadmap to foster EU implementation of nutrient recovery from industrial wastewater stream.

This document includes what is known as a PEST (Political, Economic, Social, Technological) analysis and takes a look at the benefits and risks of each of those four aspects.

Among the Political Benefits are that the project is timely, well-suited, and that there are a large number of receptive members of the EU government that support projects that provide environmental improvements. Risks are that the topic is complicated and must be presented clearly to ensure that it is well understood. The Economic Benefits include increased water supply and reduced wastewater. Social benefits are mostly indirect, but include increased employment. Technological benefits include improved water technology and water safety measures.

## 2. Introduction

Nutrient recovery from water systems is one of the most important issues facing the EU today. It affects numerous aspects, including climate change, water scarcity, international trade dependence to name just a few. In the course of the development of this project, it was discovered that there was a necessity for clean water as well as a safer and healthier environment. The Water2REturn project recognized this need and thus formulated a plan to purify water, and turn the traditionally negative byproducts into beneficial products.

## 3. PEST analysis

### 3.1 Political

#### Political Benefits

The Water2REturn project is well-timed in its development. The European Union has become more and more cognizant of the necessity for clean water and resource safety, though it has recognized the vital importance of wastewater treatment since at least as far back as 1991, with council directive 91/271/EEC defining terms and setting up goals all the way through 2027.

In terms of water reuse, as recently as 2019, the agricultural committee of the European Parliament has written new legislation regarding the reuse of wastewater. This legislation includes Article 5 of the Water Framework Directive which analyses the pressures on water bodies. Excessive abstraction from both surface and groundwater bodies. These problems are amplified by both increased climate change and water scarcity issues. Water reuse is also important for the management of water quality, with additional information on this available in CSI guidelines from 2016 which provide information on water reuse, water planning and management within the Water Framework Directive.

Additionally, this project will help work to solve the issues of water scarcity and droughts, highlighted by the Commission in 2007 when they noted that at least 11 percent of Europe's population had been affected by drought at that time. It will also help increase the volume of water in the water system. This project will also be careful to note the water hierarchy under which water sources can be used for which purposes. It's important to note that water reuse can help improve local water quality issues.

Furthermore, the Blueprint for Safeguarding European Waters addresses many of the key points of water reuse that are reflected in Water2REturn. Their guidelines are key factors to follow when planning W2R water usage:

- 1. Reuse in integrated water planning and management: guidelines have been developed with Member States and stakeholders to help considering water reuse more systematically when implementing EU water legislation. The guidelines contain recommendations on how to better integrate water reuse into water planning and management within the EU policy framework while taking into account underlying environmental and socio-economic benefits<sup>20</sup>;*
- 2. Setting minimum quality requirements for reused water for agricultural irrigation and groundwater recharge (i.e. the focus of this study is to support the Commission's impact assessment on this action);*
- 3. Integration of water reuse provisions into the BAT reference documents (BREFs) under the Industrial Emissions Directive;*
- 4. Support for research and innovation; and*
- 5. Better access to EU funding for water reuse infrastructure.*

In terms of nutrient recovery, there is also likely going to be political support. There has been a growing push for green policies in the European Parliament. Most recently, in mid-July 2019, a tentative agreement for reducing emissions by 55% in just 10 years was agreed upon with many seeking a 65% reduction. With such a clear mandate, it is likely that there will be continued support for nutrient recovery.

Another key note is to make sure to connect to the right EU MEPs that are best suited for this project. An MEP recently led in the creation of legislation for wastewater in 2018/2019 in Strasburg. Similarly, a European Commissioner of Environment, Maritime Affairs and Fisheries presented a proposal for regulation on minimum requirements for water reuse on the 28th of May 2018.

In general, there are large numbers of MEPs that we should interact with this project and we need to make sure we're speaking to the right people. Several of our partner organizations have met with these MEPs in question previously and we should maintain these connections.

### Political Risks

As with any project, the product and plan need to be clearly explained to the necessary parties of interest. If misinformation is spread about the project, it could create a snowball effect. The 2006 Australian case study (explained under social), shows how if the message is not presented properly and with the correct support, then the project would end up unsuccessful.

It is also important to ensure that the fertilizers and nutrients are approved by the necessary political bodies. In November 2018, the European Union finally updated the rules for organic and recycled fertilizer for the first time since 2003. This better allows organic and other unique fertilizer methods (such as Water2REturn) to enter the market. However, it is important to ensure that the methods used by this project follow the guidelines.

Similar to the political benefits, there are risks in whom we ally with on the project. It will be a delicate tightrope to explain that this project has benefits both for the environment as well as from the economy.

## 3.2 Economic

### Economic Benefits

An economic benefit of water, is of course the fact that it's a resource. Adding more water to the water table would increase the supply, which would in turn be better able to respond to demand. It would also increase the value of land nearby as that land would become less stressed and better able to be developed or used for agriculture. Finally, there would be increased irrigation that would help the development of agriculture.

An economic benefit to nutrient recovery is the additional amount of nutrients and fertilizer available will decrease the cost of fertilizers in general. It will also decrease the amount needed to import from non-EU countries (a point also addressed in the political analysis).

In addition, this takes a liability, wastewater, and turns it into multiple assets, including water, energy, and nutrients. Each of these assets has a value and thus can create revenues and even profits.

Other important facts to note is that the wastewater market has seen an impressive 10% increase per annum. This level of growth is incredible and suggests that there is room in the market for Water2REturn.

Furthermore, there is a massive economic benefit for the slaughterhouses in general. Presently, the purification of wastewater is a cost. With the addition of this procedure, the current liability becomes

an asset. Instead of having to spend capital to remove the “waste”, they are instead able to profit off the “waste” as it now becomes the previously mentioned dual assets of fertilizers and water.

### Economic Risks

An economic challenge of water reuse is that it is more expensive than simply pulling water from lakes or rivers. With that noted, it's important to recognize that clean water is a limited commodity. Water reuse will not be cheaper than reservoir water for a long time but it is important to make sure that it is priced competitively against other forms of water usage, such as desalination. Currently, many alternate forms of water removal and usage are being subsidized, either directly or indirectly. Without any form of subsidy, or continued subsidies given to competing water sources, Water2REturn would be at a competitive disadvantage. It is also important to figure out the actual costs of the project, which will wait for the completion of successful operation of the facility being built.

Economic risks of nutrient recovery once again focus on making sure that the costs of the recovery are comparable to other means of creating fertilizer. If Water2REturn's nutrient recovery method is too expensive, then it will have a difficult time competing with other.

Essentially, the economic value is based on the costs vs revenue. If the costs are too high, then the project and its resulting products will be seen as a failure. If the costs are lower than the revenue, then the project will be considered a success.

## 3.3 Social

### Social Benefits

Water reuse has many positive indirect social benefits. One major benefit is employment. This is due mainly to the large amount of cheaper water. With less expensive water, businesses can hire more employees and make more profits. Golf courses, parks, and hotels would all be greatly assisted, as these locations use large amounts of non-drinking water. Additionally, water creates increased food security, due to, obviously, an increased amount of water in the water chain. Finally, with more water available, drinking water will increase as wastewater can be used for more and more purposes.

Currently, Cyprus and Malta already reuse more than 90% and 60% of their wastewater respectively, while Greece, Italy and Spain reuse between 5 and 12% of their effluents, clearly indicating a huge potential for further uptake.

Nutrient recovery also has many positive indirect social benefits. Like water reuse, the increased amount of economic prosperity and increased hiring caused by water, these same advantages can be seen from the decreased prices and increased usage of fertilizer created by nutrient recovery.

### Social Risks

In some countries, the public perception of water reuse can be negative and there may be a distrust of water reuse practices. There is a concern that organic farmers might react negatively to the use of wastewater from slaughter houses. Although it is difficult to view the thoughts and perspective of every organic farmer, there was, fortunately, a questionnaire provided to a large number of organic farmers in 6 EU member states.



This questionnaire analysed different types of phosphorus sources, including “products or by-products of animal origin” such as blood, hoof, horn and bone.” On the other hand, manure and liquid excrement from factory farming is forbidden under organic crop production legislation. Part of how this project is received is how the product and specimens are created and defined.

In terms of actual statistics, over 70 percent of participants in the conference supported both the use of conventional cattle manure as well as meat and bone meal. However, these are likely supporting the use of products from non-factory farms. Additionally, it is important to note that the participants in this project are well-educated and knowledgeable about the specifics of organic farming. The average “organic” farmer will have less of an understanding of what is involved, and may be more hesitant.

Similarly, the public, with even less knowledge of organic farming may be easily frightened and confused by the procedure if not educated properly. A larger study of 2,000 respondents in the United States found “that while 49% were willing to try recycled wastewater, 13% refused, and the rest weren't sure. For some people, no matter how much you tell them the water is safe to drink, the feeling of disgust is too much to overcome – even in the direst of situations.” Although much of the water will be used for agricultural purposes instead of drinking, there's definitely the human element to take note of.

As to the social risks for nutrient retrieval, the focus once again rests with organic farmers. Although the benefits of using nutrients from this process are recognized by the experts, a layperson might be hesitant to use the new products without being properly informed as to its benefits.

Additionally, some farmers are hesitant to use a product that was previously called “waste” as it may reflect poorly on their product. With the modern focus on “clean”, the term “waste” has negative connotations that need to be addressed.

The project needs to also note who the stakeholders are, and address the project towards these people and with these people in mind. Each of these stakeholders will have different goals and we need to ensure that they're all addressed.

## 3.4 Technological

### Technological Benefits

This will be a new method of both water reuse and nutrient recovery. As such, the lessons learned and innovations discovered during the Water2REturn project will help develop new and improved technologies across the board. A note on the technological side, is that the project is not complete yet, so there may be undiscovered benefits that will be determined by the implementation of the process.

This innovation will also help the EU be more likely to reach its environmental goals, resource safety goals, security goals, and many others.

Another technological benefit is that each location has its own advantages. For example, in the South, there is less power required for the plants, while in the north, the sunlike helps the algae grow faster, meaning that each area has its own technological benefit to its location.

### Technological Risks

As with any new technology, there are always inherent risks. Water2REturn deals with waste products, biologicals, and numerous other parts that may have diseases or contamination. It is important to make sure that all risks and dangers are minimized in every step of the process. Although there has been great research on the project, the fact that it is not yet complete suggests there could be unknowns that are still to be discovered and resolved.

Water2REturn has been careful to minimize all risks so far and has been extremely careful in its processes. It has safeguards in place, well-trained expert staff, and follows all EU and other regulatory guidelines.

Another key risk is that the process works best in warmer countries. Currently the process is being tested in Spain, however if the process is used in the United Kingdom or Scandinavian countries, the process works but is less effective and more costly.

Additionally, the process will not get the pathogen level down to zero (though it will get it within acceptable ranges for many water reuse purposes).

## 4. Conclusions

In conclusion, this project is an important step forward to the future of not just the European Union, but the world. As population increases and resources become more scarce, it will require innovative programs and plans. This analysis shows that there are a few risks involved, however the risks are mostly easily mitigable and the benefits far outweigh the potential risks.

Politically, this is an excellent time to go forward with this project. There are numerous forward thinking members of the EU government who support clean water and other environmental causes. Economically, this project is viable and will help increase the amount of cheap, clean water. Socially, the people of Europe understand that we are in desperate times, and that a reasonable, well-planned project like this is necessary. Technologically, this project introduces replicable plans that can help advance the ecological state of the world.

All these factors explain that there is no time like the present to go forward with this project and help support the environment so that the children and grand-children of the European Union will have clean water and greenery.

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