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ENHANCING CIRCULARITY IN THE WATER SECTOR: A CONSUMER PREFERENCE ANALYSIS FOR SAFETY CERTIFICATION PROGRAMMES FOR WASTEWATER REUSE IN AGRICULTURE

Action IV.5 on Green topics

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To my father,

endless love.

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1. Background:

1.1 Water in agriculture and climate change challenges

Water shortage and quality degradation rank among the most critical global issues. The rapid growth of the population has intensified demand within industrial and agricultural sectors, resulting in the excessive exploitation of water resources (UNESCO, 2021). On a global scale, freshwater constitutes less than 3% of the Earth's total water volume, with the vast majority being seawater. Of this limited freshwater supply, only a small portion is directly accessible: approximately 20% is groundwater, which requires energy for extraction, while around 79% is contained within glacial ice (Abou-Shady et al., 2023). According to the Food and Agriculture Organization (FAO) of United Nations, between 1995 and 2000, freshwater withdrawals worldwide steadily increased, from 3,790 cubic kilometres to 4,430 cubic kilometres, and by 2025, they are expected to reach 5,240 cubic kilometres (Lazarova, 2013). Furthermore, the extreme weather events (e.g. floods, droughts, and high temperatures) resulting from climate change, combined with pollution, pose risks to water quality and availability, impacting water uses and the environment (EEA, 2024). According to the World Health Organization, about 40% of people globally do not have access to clean drinking water and over 4 billion people suffer from water scarcity for at least one month out of the year (WHO, 2011).

At the European level, the State of Water Report of 2024 also highlights that water stress impacts an average of 20% of the land area and 30% of its population each year (EEA, 2024). Additionally, as the European Environment Agency (EEA) points out, water stress is particularly severe in southern Europe, where pressures on water resources are exacerbated by energy production, agricultural irrigation, and the demands of domestic water supply

(EEA, 2021). At the same time, climate change is also expected to worsen water scarcity in other European countries, such as Belgium, Bulgaria, France, Germany, Poland, and Romania, resulting in significant adverse impacts for European economies and societies (Bisselink et al., 2020). In many arid and semi-arid regions, dependence on rain-fed agriculture, combined with limited access to irrigation for millions of smallholder farmers limits their productive capacity, compromises livelihoods, weakens resilience to environmental shocks, and jeopardises local food security. Over the past three decades, the demand for food production has more than doubled globally. The Food and Agriculture Organization of the United Nations (FAO) estimates that by 2050, food production will need to increase by about 50% from 2012 to meet the necessities of a growing world population and changing food preferences (FAO, 2018).

It is worth noting that irrigation is a key factor in the transition from subsistence farming to commercial agriculture, which drives economic growth. By stabilizing production, irrigation helps to reduce the risk of crop failure while increasing profitability. In the last decades, the benefits of irrigation for agriculture have been largely studied. Young & Loomis (2014) demonstrated that irrigation value significantly increases land value. This increase is the result of the increased productivity of the land (Ruberto et al., 2021) and a wide range of potential uses of land input (Gioia et al., 2012) thanks to the presence of water resources. However, it is not only the possibility of accessing water resources that determines a higher land value, but also the reliability of irrigation water services greatly influences this value. Indeed, Tauro et al. (2024) pointed out that the self-supplied services, rather than the collective ones (such as the service provided by the irrigation and reclamation consortia), resulted in a higher market value of the land due to its higher reliability. In this regard, Giannoccaro et al. (2019) highlighted that in Apulia (a region of Italy), between 2001 and 2016, a shortage in irrigation water conveyed by collective services resulted in substantial economic impacts, with losses in gross agricultural product by 30%.

According to Mesa-Jurado et al. (2012), Spanish farmers derive not only direct use value but also non-market value linked to greater guarantees for irrigation services. Moreover, the lack of effective water governance increases the risk of water shortages, further aggravated by the challenges posed by high industrialization and climate change (Berbel et al., 2023).

1.2 The reuse of reclaimed wastewater: a challenging solution

As traditional water resources become increasingly insufficient to meet the demands of agriculture, industry, and domestic use, the exploration and use of alternative solutions are no longer optional, but an essential step to ensure sustainable water management and to meet the challenges of a changing climate. Governments have adopted different strategies to tackle the issue of water scarcity. According to Grey et al. (2013), such approaches involve changing water governance structures rather than imposing water use restrictions, establishing water pricing policies, and implementing wastewater reuse and recycling systems. Wastewater reuse has been practiced for thousands of years. The earliest known cases of water reuse date back to the Bronze Age (3200-1100 B.C.), when societies such as Egypt, Mesopotamia, and Crete used domestic wastewater for irrigation (Abou-Shady et al., 2023). Afterward, the Greek and Roman societies, in particular Athens and Rome, implemented water reuse systems in urban areas between 1000 B.C. and 330 A.D. (Ait-Mouheb et al., 2020). The idea of reusing potable water is now supported worldwide, with about 60 nations currently recycling water for agricultural purposes; among these, Israel is the largest “re-user”, with

86% of its recovered water (400 million m^3/year) reused for agricultural irrigation (Faria et al., 2020; Sapkota, 2019).

Wessels (2023) highlights the complexity of identifying the form of wastewater reuse in agriculture, typically categorized into four distinct reuse types: direct treated, direct untreated, indirect treated, and indirect untreated. As stated by the author, direct reuse involves applying treated or untreated wastewater directly to agricultural activities, while indirect reuse occurs when wastewater is discharged into a natural water body and subsequently utilized downstream. Moreover, planned wastewater reuse is most associated with the direct use of treated wastewater, characterized by strict regulations and a high degree of formal recognition. Such planned schemes are designed to maximize the productive and economic potential of wastewater as a resource, steering away from its perception as mere waste by adopting terms like “reclaimed” or “recycled” water (Wessels, 2023). This semantic shift has been shown to improve public acceptance by mitigating perceived risks associated with wastewater reuse (McClaran et al., 2020; Mikhailovich, 2009).

The recycling of wastewater for agricultural purposes has been demonstrated to generate many quantifiable benefits, including improvements in public health, as well as environmental and economic advantages (Jaramillo & Restrepo, 2017). Recently, the recycling of urban wastewater has emerged as a viable solution, aligning with both the principles of the circular economy and the European Green Deal (European Commission, 2019). Since the agricultural sector uses 70% of fresh water, the first and most important benefit is the development of alternative resources in areas where conventional water is scarce (Winpenny et al., 2017). Additionally, the high nutrient content of reclaimed water increases crop productivity, benefiting farmers and the environment by reducing the need for external nutrient inputs, which typically involve fossil fuel use and increase greenhouse gas emissions (Berbel et al., 2023). Indeed, wastewater may contain macro and micronutrients (Drechsel et al., 2010), which could increase crop yield and decrease fertilizer use in agriculture (Liu & Haynes, 2011). The practice of utilising wastewater for irrigation purposes offers several economic advantages, including reduced energy consumption, which can lead to significant cost savings (Cruz, 2009; Verlicchi et al., 2012).

A further assessment of wastewater reuse has been conducted from an environmental standpoint. Several scholars have analysed the non-market benefits of wastewater reuse, particularly in the context of the Water Framework Directive (WFD) and its objective of achieving good ecological status for all European waters. The first has been Birol et al. (2010) who estimated the non-market value of recharging an aquifer with treated wastewater in Cyprus. Similarly, Alcon et al. (2010) and Alcon et al. (2012) have assessed the non-market value of the use of recycled water for agricultural purposes in Spain, identifying significant environmental benefits associated with the reuse of wastewater for irrigation. In Puglia, southern Italy, Arena et al. (2020), in a comprehensive Cost-Benefit Analysis of an existing wastewater reuse scheme, identified several environmental benefits. Specifically, their study highlighted the enhancement of recreational value in the restored coastal areas, where wastewater discharge has been eliminated or managed in a way that considerably reduces marine pollution. Nevertheless, the practice of reusing wastewater can have deleterious consequences, including the potential contamination of soil (e.g. salts, heavy metals) and the possible leaching of nutrients when irrigation is applied incorrectly or in excessive quantities (Berbel et al., 2023). Moreover, the use of wastewater has been demonstrated to present a risk to human and animal health, due to the potential presence of pathogens, organic pollutants, or toxic substances (Yi et al., 2011). According to Khalid et al. (2018), if these chemicals and pathogens are not adequately removed through sanitisation, can exert deleterious effects on both agricultural workers and consumers. The ingestion of contaminated food or the inhalation of contaminated particles through the respiratory system can result in the introduction of pathogens and contaminants into the human body (Singh et al., 2012; Yi et al., 2011). In the absence of disinfection or advanced filtration within the treatment system, the presence of pathogens such as Salmonella spp., Escherichia coli, intestinal nematodes, and Legionella spp. in the treated wastewater remains a possibility (Ofori et al., 2021).

In the absence of robust and effective risk mitigation systems, the practice of wastewater irrigation has the potential to threaten public health. In line with this, the recently issued EU Regulation 2020/741 establishes minimum safety standards and the implementation of a risk management plan on an EU-wide basis. To this end, all stakeholders, including operators of wastewater treatment and reclaimed water facilities, as well as farmers, are required to adhere to established risk management systems to ensure the microbiological quality of irrigation water.

According to a recent review, in the European Union, 787 reuse schemes across 16 countries are operational (Water Reuse Europe,2018). This represents an increase of 437 schemes compared to the findings of the 2006 review of the European water reuse sector. About the geographical distribution, 250 water reuse schemes have been identified in Northern Europe, with France, Germany, and the Netherlands hosting 112, 36, and 28 schemes, respectively. Conversely, Southern Europe relies on 537 schemes, with Spain, Italy, and Greece contributing 361, 99, and 44 schemes, respectively. It is noteworthy that 62% of the 787 identified schemes are located along coastlines in water-scarce areas, such as Spain, where freshwater supplies are scarce and sharply impacted by drought and overwatering from agriculture and tourism. The identified schemes encompass both non-potable and indirect potable uses, covering a wide range of reuse purposes, from agricultural and landscape irrigation (including golf courses) to industrial applications and the enhancement of water supply resources. In Europe, reuse for agricultural purposes is the predominant application, accounting for 39% of the schemes, followed by industrial reuse at 15% and recreational reuse at 11%. Despite significant efforts to harmonize regulations and financial support within the strategic programs of the European Union, as well as the economic benefits and technological advancements achieved, the actual volume of reused water within the European Union remains very low compared to its potential (Pollice et al., 2016). Likewise, in the Puglia region, where out of 97 million m^3/year of treated wastewater could be technically and economically recoverable, less than 1 million m^3/year is reused (Giannoccaro, Arborea, et al., 2019)

1.3 The EU Regulation 2020/741: the new "Fit for Purpose Approach" and the "Risk Management Plan"

The European Union has long prioritized water conservation through legislative measures aimed at reducing excessive consumption and promoting efficient wastewater management. The Drinking Water Quality Directive (80/778/EEC) was the first comprehensive EU legislation on water reuse, establishing standards for controlling toxic substances and microorganisms in drinking water (Procházková et al., 2023). Council Directive (91/271/EEC) mandates for improving urban wastewater management, including secondary treatment to minimize environmental damage from untreated wastewater and encouraging the reuse of treated water when appropriate. In 1998, Directive 98/83/EEC set quality standards for drinking water, and in 2000, the Water Framework Directive (2000/60/EC) was introduced to establish an integrated strategy for protecting all water sources, implicitly recognizing water reuse as a means of enhancing water availability.

A step forward in wastewater regulation has been taken with the recent development of Regulation 2020/741 of the European Parliament. While previous regulations were primarily driven by health concerns and the environmental impacts of wastewater disposal into all water bodies (i.e. rivers, groundwater and seas), as argued in Berbel et al. (2023), the impetus behind the adoption of Regulation 2020/741 was to establish minimum requirements at the European level. This was particularly relevant given that only six Member States – Cyprus, Greece, Spain, France, Italy, and Portugal – had previously enacted national regulations for the reuse of reclaimed water. Regulation 2020/741 is specifically focused on wastewater reuse, with the aim of conserving water resources, reducing consumption, and ensuring that reused water is safe among other for food production. This contributes to the protection of the environment, human and animal health, and the promotion of the circular economy. In this regard, the strategic use of wastewater as a leverage to improve the sustainability of the agricultural sector is recognised in the Circular Economy Action Plan (EU, 2019), which emphasizes the need for the efficient use of water and nutrients in agricultural practices.

The last legislative measure is notable for overcoming a “fit-for-all” approach, a strategy that previously prevailed and was characterized by an emphasis on precaution without regard for practical utility or economic viability, towards a new “fit-for-purpose” approach. This change resulted in the adoption of more specific and consistent water quality standards and limits, tailored to different crop categories and based on risk analyses conducted at the local level (Vivaldi et al., 2022). Moreover, the regulation enables Member States to employ treated wastewater for a variety of purposes, including its reuse for agricultural irrigation, and civil, environmental, and industrial applications. To this end, the regulation stipulates the implementation of a Risk Management Plan (RMP) and a comprehensive monitoring plan, considering the site-specific conditions of the treatment facility, storage infrastructure, and distribution network, and engaging all stakeholders involved in the reuse process up to the end users.

In 2022 the Joint Research Centre of the European Commission proposed technical guidelines for the application of the key risk management principles for the assessment and management of health and environmental risks linked to a water reuse system. As highlighted in this technical report by Maffettone and Gawlik (2022), the Risk Management Plan (RMP) must encompass the identification and management of risks related to the use of reclaimed water of a specific quality, tailored to applications. The plan should adhere to the risk management elements outlined in Annex II of the Water Reuse Regulation, following a methodical approach. This encompasses a thorough examination of the water reuse system, the identification of potential hazards and hazardous events, the populations and environments at risk, and the associated exposure pathways. Furthermore, the plan should outline strategies to manage and mitigate the identified risks, incorporating existing or potential preventive measures and barriers. The establishment of mechanisms for communication and cooperation among the relevant stakeholders is also essential to ensure the timely implementation and communication of corrective actions.

As previously mentioned, the Water Reuse Regulation stipulates in Annex II that the RMP must be based on 11 key elements of the risk management plan (KRMs), to ensure that reclaimed water is used and managed safely in a manner that protects human and animal health, as well as the environment. These KRM elements are mapped into four modules:

1. **Module I - "Water Reuse System"**, which encompasses KRM1, "System description" (detailing the entire water reuse system from the entry point at the urban wastewater treatment plant to the point of use), and KRM2, "Parties, roles, and responsibilities" (which identifies all parties involved in the water reuse system).
2. **Module II – "Risk Assessment"**, covering KRM3, "Hazards identification" (pathogens, pollutants, or hazardous events such as treatment failures); KRM4, "Populations and environments at risk exposure routes"; KRM5, "Environmental and health risk assessment" (identifying potential risks linked to each previously identified hazard); KRM6, "Additional requirements"; and KRM7, "Preventive measures" (identifying preventive measures to be implemented, such as specific irrigation techniques or additional water treatments).
3. **Module III – "Monitoring"**, addressing KRM8, "Quality control system", and KRM9, "Environmental monitoring system" (assessing the release of identified pollutants into the exposed environmental receptors).
4. **Module IV – "Management and Communication"**, which includes KRM10, "Incidents and emergency systems" (for managing incidents and emergencies), and KRM11, "Coordination mechanisms" (related to the coordination and communication among the various actors involved in the water reuse system).

Focusing on the final Module IV, particularly regarding communication issues, the JRC Technical guidance emphasizes that "*the reuse of treated wastewater may raise public concerns. […] It is important to engage with the public and other stakeholders in the planning and introduction of systems for water reuse, preferably as early as possible*." As demonstrated in the DEMOWARE project, the absence of public trust in regulation and monitoring, the technical processes, the organisation of water reuse, and, more importantly, the uncertainty surrounding the quality and safety of reused water significantly influenced public acceptance or opposition to water reuse schemes (Brouwer et al., 2015).

Research shows that in many countries, while a significant amount of urban wastewater is treated, only a fraction of it is reused (Dolgen & Alpaslan, 2023; Florides et al., 2024; Mannina et al., 2022). As highlighted in the Laboratorio REF (2020) study, in Italy only 4% of the total volume of treated wastewater, around 200 Mm^3 at the national level, is intended for reuse (mainly for irrigation), although the total volume of wastewater potentially available for reuse is around 20% (ARERA, 2019) . The failure of many water reuse programs can be attributed to political, technological, economic, institutional, regulatory, and social barriers (Canaj & Mehmeti, 2024; Kirchherr et al., 2018; Voulvoulis, 2018). Among others, social barriers, such as public acceptance, are a crucial aspect of the success of wastewater reuse plans (Dolnicar et al., 2011; Doria, 2010; Fielding et al., 2015; Po et al., 2005; Price et al., 2015). The lack of confidence in the control procedures and the bodies that have adapted to them creates a barrier between policymakers and stakeholders, leading to biased perceptions of wastewater sources and a lack of information on wastewater quality and safety (Morris et al., 2021; Saliba et al., 2018). Moreover, the JRC technical guidance highlights that to reach a wide audience, a sufficient water reuse communication strategy is needed to provide complete and objective information through different communication channels (Maffettone & Gawlik, 2022). The provision of clear, comprehensive, and transparent information regarding the recycling process represents a well-founded and strategic approach to addressing public concerns (Dolnicar & Hurlimann, 2009). In this regard, Dolnicar et al. (2010) found that providing Australians with detailed information about the recycling process significantly increased their willingness to use recycled water, as compared to their willingness before receiving the information.

1.4 Objectives

The EU by issuing the Regulation (EU) 2020/741 follows a normative approach to deal with risk, build trust and ensure health safety across the EU. Furthermore, by adhering to a "fit for purpose" strategy, scientifically rigorous standards are established based on the objective risk exposure associated with various planned direct and indirect reuses. This approach is based on the classification of water quality into four distinct categories, which define both quality thresholds and monitoring frequencies for specific pollutants. These categories range from the most stringent, Class A, which applies to the irrigation of food crops consumed raw, to the least stringent, Class D, which is designated for the irrigation of non-food crops (European Parliament, 2020). In doing so, the goal is to prevent wastewater reuse projects from an excessive treatment cost in such cases where human risk is coherently very low. Moreover, the risk management plan aims to involve all stakeholders in the process of water purification and disinfection, as well as its reuse. Stakeholders include Water Authorities, water utilities (i.e., freshwater suppliers and wastewater treatment plants), collective irrigation services (i.e., responsible for distributing irrigation water) farmers, who are the final water users, and consumers. However, neither strict rules regarding consumer engagement nor a mechanism to ensure standard compliance guarantee are established by the regulation. As Field & Field (2002) noted, there is a natural tendency to think that the enactment of a law automatically leads to the rectification of the problem to which it is addressed. This tendency is obviously too simplistic, since the enactment of a policy is only one aspect of the regulatory process.

Information and communication campaigns are suggested as best practices to enhance public-wide acceptance. Nevertheless, the successful completion of the circular process of reuse depends also on the involvement of consumers, whose preferences for buying food produced with reclaimed water are paramount.

While the public acceptance of recycled water has been extensively studied (Fielding et al., 2018), there is a lack of research focused specifically on consumers perceptions of food irrigated with reclaimed wastewater. A few examples are from economic experiments conducted in the U.S., where consumers revealed a lower willingness to pay for wine produced from grapes irrigated with recycled water, as compared to grapes irrigated with conventional water (Li et al., 2018). Similarly, for fresh produce grown with recycled water (Savchenko et al., 2018).

A key challenge in enhancing public acceptance of wastewater reuse lies in fostering consumer confidence in these practices. Amfo et al. (2018) conducting a study in Ghana, revealed that consumers were willing to pay a premium for certified safe vegetables, as such certification mitigated concerns regarding health risks associated with wastewater irrigation. Similarly, in the United States, Savchenko et al. (2019), through a value-of-information analysis, inferred that an hypothetical labelling policy indicating wastewater reuse on both processed and fresh food would result in greater consumer welfare compared to the absence of such labelling.

Moreover, terminology can influence consumers' responses. For instance, Menegaki et al. (2009) found that Greek consumers preferred the term "recycled water" over "treated wastewater". Similarly, Rock et al. (2012) observed that consumers in Arizona responded more positively to terms such as water reuse, recycled water, repurified water, and reclaimed water, compared to terms like effluent, tertiary treated wastewater, and toilet-to-tap. Additionally, Ellis et al. (2019) discovered that U.S. consumers consistently favoured terms associated with the perceived quality of water (e.g., pure, fresh, natural) rather than the terminology commonly used by scientists and industry (e.g., reclaimed or treated).

The primary insights derived from economic experiments on consumer preferences originate from the U.S. and Ghana. While empirical research on the European context is scant, the effect of the new regulation enforced in June 2023 is still pending.

Building on this premise, the main objective of this research is to demonstrate that regulation alone is not sufficient to guarantee risk management, as it primarily addresses bureaucratic aspects while neglecting those related to compliance. In other words, legislation implicitly assumes its application and compliance, whereas a purposed process is needed to guarantee its effective enforcement. Furthermore, while regulations adopt a rational and empirical approach, it is widely acknowledged that risk perception varies subjectively from individual to individual. Furthermore, the use of specific terminology can influence consumers' perception of risk and rise concerns or feelings of disgust.

Grounded in the thesis that a normative approach alone is not enough to deal with consumers' risk perception and enhance acceptance of recycled water for food production, two broad hypotheses have been formulated:

- The first is that setting standards along with providing a Risk management plan, are not sufficient conditions to raise public acceptance, therefore, consumers will ask for a further guarantee of compliance with the law.
- The second hypothesis is that the terminology used to describe recycled water reuse can influence consumer decision-making, by shaping both their perception of and their preferences for food products irrigated with such water.

The starting point is the current Regulation (EU) 2020/741 which establishes minimum common rules for reclaimed wastewater reuse in agriculture. While the new regulation introduces binding quality standards, it does not include provisions for the enforcement or verification of compliance. Moreover, although standards are set for the quality of recycled water, food producers are not obliged to disclose information regarding the water sources used for irrigation. If I find out that consumers are willing to pay for acquiring information ensuring them that Regulation (EU) 2020/741 standards for recycled water reuse have been complied with, there will be proof of insufficiency of normative basic approach. In other words, using the current business scenario in which Regulation (EU) 2020/741 has already been enforced, I will elicit consumers' latent demand for further information on law compliance.

This study aims to investigate consumers' behaviour and their willingness to pay a premium for a food certification that guarantees compliance with the Regulation (EU) 2020/741 standards for recycled water reuse in agriculture. The certification scheme is employed as a mechanism to convey verified information of regulatory compliance, while willingness to pay is used to elicit consumers' preferences for such certification. Through a hypothetical choice experiment, the study simulates purchasing decisions involving products for which the safe and proper use of reclaimed water for irrigation is guaranteed by certification, such as a label displayed on the product. An experiment with German table grapes consumers, the main importer country among European member states, was conducted. Table grapes were chosen due to their significant economic, social, and environmental impact on the Puglia region, which is the leading producer in Italy and exporter of table grapes (Roselli et al., 2020).

Food safety is classified as a "credence attribute", meaning that its quality cannot be directly observed or verified by consumers, either before or after purchase, which can lead to asymmetric information issues (Nelson, 1970). Broadly, if producers assert that their products irrigated with recycled water are safe but are unable to provide credible evidence, consumers may behave reluctantly. Consequently, producers may struggle to achieve the expected financial returns on their investment, thereby diminishing their economic incentive to adopt higher food safety standards (Wongprawmas & Canavari, 2017).

The research is founded on the premise that a certification scheme can reduce information asymmetry between producers and consumers. By enhancing transparency, this certification could have the potential to mitigate key social barriers, strengthen consumer confidence, and facilitate the broader acceptance of circular economy practices within the agricultural sector.

This approach aims to increase consumer awareness and confidence, thereby supporting farmers in adopting sustainable water management practices. Indeed, a such certification can also serve as governance tool to establish and coordinate all actors involved in a reuse program, define rules and share liabilities among the parties. Enhancement of institutional arrangements has been recognised among the main concern for fostering the transition to water reuse in the European Union (Riazi et al., 2023).

Although it utilizes a well-established and recognized methodology, the originality of this research is rooted in its potential to offer a new governance instrument, fostering effective water management and addressing the challenges associated with sustainable resource utilization. Moreover, to the best knowledge of Author there is no other scientific study in which the effectiveness of EU Regulation 2020/741 is analysed against consumers' behaviour neither a certification guarantee for its compliance has been proposed.

2. Materials and Methods

2.1 The production of Apulian table grapes in time of water scarcity

The region of Puglia in southern Italy covers an area of 20,000 square kilometres and is known for its strong agricultural traditions. The main perennial crops are vineyards, cultivated on 96,971 hectares, and olive groves, which cover 351,980 hectares (ISTAT, 2020). At the national level, with 47,700 hectares cultivated, the region of Puglia is the first producer of table grapes, with 25,305 hectares cultivated in 2024, followed by Sicily (19,000 hectares). Puglia, and in particular the provinces of Bari, BAT, and Taranto, produce 53% of the national production. For the European market, Italy, Spain, and Greece are the main producers of table grapes. Specifically, Italy is the main supplier of table grapes to Europe, with a production of approximately one million tonnes of table grapes per year. Worldwide, it is estimated that approximately 5 million tonnes of table grapes are imported with a total value of 9 billion euros. With a share of 19% of the value in 2023, Peru was the most important exporter in the world, followed by the Netherlands, Italy, China, Chile, and the USA (Fiori et al., 2023; ISMEA, 2024). The countries with the highest imports from non-European suppliers are the United Kingdom and the Netherlands. Contrary to the UK, Germany and France tend to consume most of their grapes from and during the European season. The Netherlands is the point of entry for out-of-season imported grapes into mainland Europe. In 2021, Germany imported a total of 326,000 tonnes of table grapes, with 93% of this volume remaining within the country for domestic consumption (CBI, Ministry of Foreign Affairs, 2023).

The production of table grapes in Puglia, along with tourism, represents a significant economic driver for the region. However, the region is facing challenges due to climate change, characterized by prolonged droughts and increasing saltwater intrusion, which is severely impacting the productivity of its most important perennial crops. As highlighted by Roselli et al. (2020), ensuring a competitive market share often requires farmers to adopt different production models - early, normal, and delayed harvesting - to cover the entire harvesting period. While this strategy mitigates market risks associated with price volatility in the table grape sector, it also has significant implications for environmental resources, particularly water consumption. Using a Life Cycle Assessment (LCA) approach, the authors demonstrated that the impact on water resources varies across the three production models. Specifically, the early harvesting model requires an estimated input of 17,000 cubic meters of water over an 18-year life cycle, whereas the normal and delayed harvesting models demand substantially higher water inputs, at approximately 24,000 and 31,500 cubic meters, respectively.

In terms of water resources, Puglia is reliant on neighbouring regions for its irrigation requirements. The regions water management systems are characterized by inter-regional cooperation, a strategy adopted due to the scarcity of substantial permanent watercourses, except for the Ofanto and Fortore rivers (Tauro et al., 2024). The organization of the water service in the region occurs in two primary ways: firstly, collective distribution, managed by six Land Reclamation and Irrigation Consortia operating in conjunction with additional networks overseen by the Regional Agency for Irrigation and Forests (ARIF); and second, self-supply, involving individual users who have been authorised to withdraw water for irrigation purposes. It is noteworthy that self-supply groundwater plays a pivotal role, accounting for 65% of regional irrigation activities (Mirra et al., 2021).

The issue of over-extraction of groundwater has been identified as a key factor in the exacerbation of seawater intrusion, with detrimental consequences for the majority of regions along the Mediterranean coastline (Giannoccaro et al., 2019). Groundwater depletion and salinisation are problems that occur simultaneously in the coastal Apulian hydrogeological units. Indeed, it is evident that droughts resulting from climate change have a detrimental effect on the availability of water resources. Consequently, the depletion and degradation of aquifers are a consequence of the fact that 75% of annual irrigation need is met by groundwater abstractions (Serio et al., 2018; Vivaldi et al., 2022).

The consequences of salt intrusion into the groundwater, pose a significant risk to a major perennial crop in the Puglia region, namely table grapes. In addition to its deleterious effect on the capacity of table grapes to absorb water and other essential elements, high salt concentrations in irrigation water have also been demonstrated to decrease photosynthesis, thereby reducing yield and grape quality (Mirás-Avalos & Intrigliolo, 2017). Elevated salt concentrations in soil have been demonstrated to cause a variety of environmental and agronomical issues. These include reduced stability, water-holding capacity, and infiltration rates. Furthermore, the soil microbial community is often compromised, and the levels of biodiversity and organic matter are frequently diminished. Consequently, plants cultivated in saline environments frequently exhibit symptoms of ionic imbalance due to osmotic stress, nutrient deficiencies, and toxicities (Ali et al., 2024).

In such a condition, to address the challenges posed by climate change and ensure a reliable water source for irrigation, the reuse of treated wastewater emerges as a potentially advantageous solution. A paradigm shift in water resource management is therefore required.

2.1.2 State of the art of wastewater reuse in Puglia

Updated as of 2022, the Plan provides that among fifteen operational water reuse schemes, which effectively support crop irrigation are in the municipalities of Ostuni (BR), Fasano (BR), Gallipoli (LE), and Corsano (LE) (PTA Regione Puglia, 2022).

The availability of these schemes should enable a reduction in aquifer water extraction and should enhance aquifer water balance. Within the next 30 years, Puglia region also intends to invest in new facilities and run 63 treatment plants at full capacity. Moreover, several investments were made for the construction or improvement of 86 treatment facilities over the last two planning periods, 2007–2013 and 2014–2020 (Pollice et al., 2016). The estimated potential availability of reclaimed wastewater at the plant gate is 100 million m^3 across the region, with the capacity to increase to 160 million m^3 through facility upgrades (Arborea et al., 2017). However, as Giannoccaro, et al. (2019) suggest, in Mediterranean regions like Puglia, the short irrigation season limits the operation of tertiary wastewater treatment systems to six months per year.

As pointed out in Vivaldi et al. (2022), Puglia may achieve among the Italian regions the highest percentage of recycled water reused for agricultural irrigation over the upcoming decades. A plethora of demonstrative projects have been financed (for example, Demoware, IR2MA, Re-Water, Ecoloop, RIFARE) that explore a variety of technologies and potential uses of wastewater reuse. These initiatives also raise awareness and educate people about local water reuse choices (Al-Saidi, 2021). The economic viability of utilising wastewater for irrigation in the Puglia region has been extensively documented, demonstrating somehow lower costs than those associated with groundwater extraction (Canaj & Mehmeti, 2024). Fatone (2017) determined a cost of 0.294 €/m^3 for reclaimed water compared to 0.465 €/m^3 for groundwater.

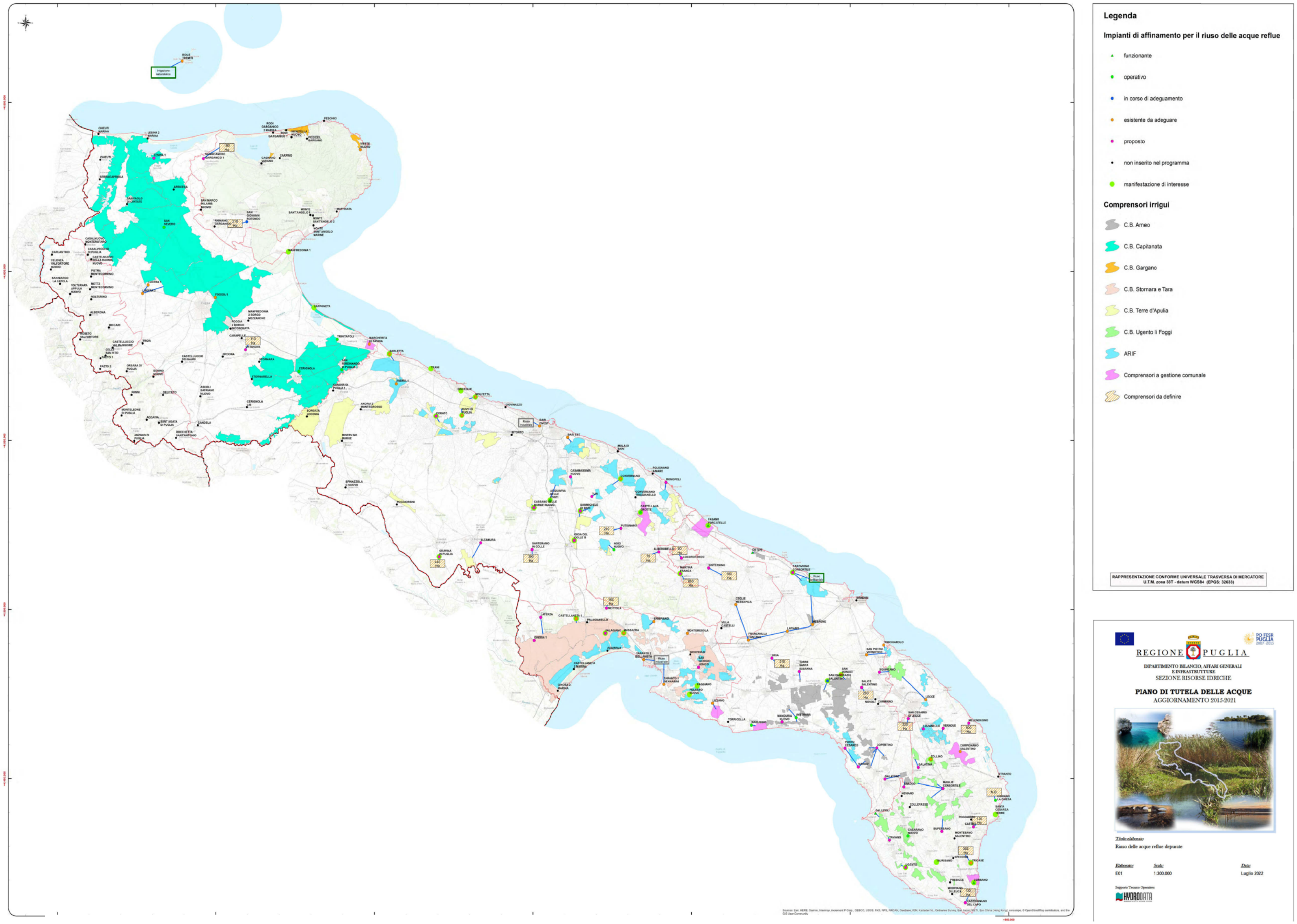


Figure 1. Wastewater treatment plants for reuse and irrigation district from PTA (2022).

In comparison with traditional groundwater utilisation, Canaj et al. (2021) discovered that the implementation of an innovative system incorporating tertiary reclaimed water as a supplementary irrigation source resulted in a cost reduction of approximately 6%. Most importantly, Regional Government transfers to citizens all costs for treatment by applying a surcharge tariff on urban water services.

In terms of wastewater management, several parties are involved in the recovery and reuse of wastewater. These parties are involved at various stages of the distribution chain, from the disinfection process to the reuse stage. In other words, the delivery of the resource depends on the cooperation and active participation of all parties concerned, including the Regional Government, regional water utility (Acquedotto Pugliese S.p.A.), the Apulian Water Authority, distribution networks (such as Reclamation and Irrigation Consortia), municipalities. On the other hands, farmers are the end users playing a key role in this intricate system. In fact, despite the latest purification technologies, financial sustainability, and all the agronomical and environmental benefits, the supply of reclaimed wastewater are sharply out of balance.

2.2 Methodology

2.2.1 Theoretical foundations

The origins of choice experiments (CEs) stem from diverse disciplines within the social sciences. In economics, their conceptual basis is rooted in the hedonic method, which views the demand for goods as a function of their attributes (Holmes, Adamowicz, & Carlsson, 2017). A pivotal development was Lancasters (1966) theory of consumer demand, which posited that utility is derived from the attributes of commodities. Around the same time, Luce & Tukey (1964) introduced a mathematical method for decomposing judgments into attribute weights, which was quickly adopted by marketing researchers. This marked the emergence of conjoint analysis, a tool for understanding the relative importance of product attributes and predicting market share. Despite its popularity, conjoint analysis faced two limitations: difficulties in aligning rating data with real-world choices and challenges in implementing choice simulators for market predictions (Holmes, Adamowicz, & Carlsson, 2017). These concerns were addressed by discrete choice theory, as formalized by McFadden (1972). Building on random utility theory, McFadden introduced the multinomial logit model, which combines hedonic analysis with utility maximization, laying a robust economic foundation for choice modelling. The integration of random utility models with welfare economics further enhanced the utility of CEs. By including price as an attribute, these models enabled the assessment of economic welfare measures (Small & Rosen, 1981). This conceptual advancement, coupled with the practical advantages of the multinomial logit model, led to widespread applications in fields such as marketing (Louviere & Hensher, 1983; Louviere &

Woodworth, 1983), and transportation (M. E. Ben-Akiva & Lerman, 1985; Hensher et al., 2005; Louviere, 2000). The pioneering application of hedonic stated-preference methods in environmental valuation was undertaken by Rae (1983) who utilized ranking techniques (e.g., most preferred, second most preferred) to estimate the value of visibility impairments in U.S. national parks. Subsequent research employing ranking methodologies includes the work of Smith and Desvousges (1986), which assessed the valuation of changes in water quality, and Lareau and Rae (1989), which estimated the economic value of reductions in diesel odour. However, ranking and rating methods for environmental valuation have become less popular over time, primarily due to difficulties in ensuring these methods align with economic theory (Louviere et al., 2010). In the early 1990s, stated-preference experiments that relied on choice-based methods began to gain prominence in environmental economics. One of the pioneering studies by Adamowicz et al. (1994) demonstrated the integration of revealed and stated-preference data through choice experiments. Building on this foundation, the application of choice experiments has expanded substantially over time. In recent decades, they have become increasingly prevalent in applied economics, particularly in the domains of environmental studies, agriculture, healthcare, and transportation research. Moreover, CEs have emerged as a prominent methodological tool in food preference research, valued for their ability to produce clear and interpretable insights using probabilistic models of inferential choice (Caputo & Scarpa, 2022). Their applications span a wide range of topics, including the analysis of consumer preferences and demand for various food quality attributes (Darby et al., 2008; Scarpa & Rose, 2008), as well as the assessment of labelling programmes (Aprile et al., 2012; Caputo, Nayga Jr, et al., 2013; Caputo, Vassilopoulos, et al., 2013; Loureiro & Lotade, 2005; Onozaka & McFadden, 2011). DCEs have also been applied to evaluate innovative food products (Van Loo et al., 2020), investigate emerging food technologies (Caputo, 2020; Kilders & Caputo, 2021), and perform ex-ante analyses of prospective food policies (Papoutsi et al., 2015). According to Alcon et al. (2019), CEs are based on the premise that the value of a good can be inferred from the values attributed to its specific characteristics. The implementation of CEs follows a systematic process comprising four key stages, as described by Hoyos (2010) and Riera et al. (2012): (1) defining the relevant attributes and their levels, (2) constructing and selecting appropriate choice sets, (3) designing and organizing the survey instrument, and (4) collecting data from respondents.

This methodology involves presenting individuals with a series of alternatives, each varying in the levels of the attributes being evaluated and asking them to select their preferred option. These choices reveal the alternative perceived as delivering the highest utility (McFadden, 1972) with one alternative typically representing the "status quo" or current condition as a baseline. The inclusion of a monetary attribute, such as the cost associated with implementing each alternative, is a critical component of the CE approach. This allows for the estimation of respondents' Willingness to Pay (WTP) for specific attributes, thereby providing a measure of their implicit value (Alcon et al., 2019). This approach is instrumental in capturing nuanced individual preferences, especially in the context of environmental valuation, and in exploring the relationships between different goods or services (Bateman, 2002).

2.2.2 Choice Experiment Design

The choice experiment design is primarily oriented towards developing a practical instrument to facilitate the implementation of the Risk Management Plan (RMP) as mandated by Regulation 2020/741. This design emphasises addressing the complex challenges associated with fostering active and effective engagement among all stakeholders in the wastewater reuse process. In particular, considering the critical role of information highlighted in the RMP, this research firstly explores consumers' willingness to pay a premium for a certification label as a guarantee of the standard safety compliance of the wastewater reused for irrigation. This study builds on previous researches examining consumer preferences for certification schemes and the disclosure of information about their use. Amfo et al., (2018) highlight the importance of assessing consumers' willingness to pay for certified produce irrigated with wastewater in Ghana. In the U.S., Li et al. (2018) found that consumers prefer limited information about water sources when reclaimed wastewater is used for winegrape irrigation. On the other hand, Savchenko et al. (2018) suggest that providing information on the potential risks of using recycled water leads to the greatest improvement in consumer welfare. Savchenko et al. (2019) claim that implementing a labelling policy to disclose the use of recycled irrigation water in both processed and fresh foods could significantly enhance consumer welfare by enabling more informed purchasing decisions. Despite these available analyses conducted in U.S. and Ghana, this is the first attempt carried out for design such a certification.

The attributes for the choice experiment were meticulously selected following a comprehensive review of the existing literature. A detailed presentation and description of the attributes and their respective levels are provided in Table 1.

The attribute related to the certification scheme instrument encompasses two options: a simple circular economy logo vs. a QR code. Both guarantee that the reclaimed wastewater used for irrigating table grapes complies with the safety standards established by Regulation (EU) 741/2020. The circular economy is experiencing momentum within the EU development strategy, drawing the attention of marketing companies' campaigns, and broadly speaking is linked to environment friendly behaves. By selecting the QR code consumers could obtain further information about the treatment process, analytical results, and control procedures, all in compliance with the regulatory framework. Canavari et al. (2010) define traceability as a fundamental element of information management since providing supplementary data, enhances transparency and fosters trust between consumers and stakeholders throughout the supply chain. In the circular economy field, Anastasiadis et al. (2022), in a study on Greek consumers and supply chain stakeholders, emphasized the critical role of traceability and digitalization in facilitating the transition to more sustainable agri-food practices.

The second attribute pertains to the nature of certification body, which could either be public or private. This indicates that the adherence to safety standards specified by the regulation can be certified by a public authority or a private certification organization. Furthermore, the location where certification takes place is also considered, with certification either issued in the selling country ("National", i.e., Germany) or the producing country (within an EU member state).

Table 1. CE attributes and levels

Attribute	*Level*	*Symbol on the product*
Certification instrument	Eco-label	
	Traceability	
Nature of Certification body	Public	-
	Private	-
Location of Certification body	National	-
	EU member state	-
Extra price	0.25 €/kg	-
	0.50 €/kg	-
	0.75 €/kg	-
	1.00 €/kg	-
	1.25 €/kg	-
	1.50 €/kg	-

Source: own elaboration

Finally, six extra price levels were established as euros per kilogram of table grapes, calculated based on the prices on German grocery market at the time of the analysis.

The attributes and their respective levels were systematically combined using Ngene software package to generate hypothetical product alternatives, which were then presented to participants as a *choice set*. A D-efficient design was adopted to optimize the experimental framework, a method extensively utilized in choice experiments due to its demonstrated robustness. Recent research further underscores its capacity to retain high levels of efficiency, even within the context of semiparametric estimation, thereby reinforcing its reliability and applicability (Caputo & Scarpa, 2022). The initial design for the choice experiment was constructed using non-informative priors, assuming marginal utilities equal to 1 for all attributes. A pilot survey was conducted with 46 respondents to collect preliminary data. The initial design achieved a D-error of approximately 0.683 and an A-error of approximately 0.891.

Based on the estimation results from the pilot survey, informative priors (means and variances) were incorporated to update the design and improve its efficiency. In the final D-efficient design, the D-error decreased to approximately 0.563 and the A-error to approximately 0.863, indicating a moderate improvement in design quality.

Furthermore, since the premium price levels tested in the pilot phase were found to be too low, the price levels for the final design were recalibrated. This adjustment was based on responses to a contingent valuation question included in the pilot survey, as well as on actual market prices for table grapes in Germany at the time of the study.

The final design consisted of 18 choice sets, which were organized into 3 blocks. Each block was randomly assigned to respondents during the survey, ensuring that each participant was presented with 6 choice sets. Each choice set included three alternatives: one representing the current situation or status quo (SQ), which served as a no-choice option, and two others featuring various combinations of attributes and their corresponding levels. The SQ alternative represented the current market scenario, in which the reuse of reclaimed water for irrigation is subject to Regulation (EU) 741/2020 accomplishment, while information of irrigation water sources is not mandated.

The choice set is reported in the questionnaire (Appendix).

The experimental design also incorporated two distinct wordings related to recycled water reuse to prove whether terminology influences willingness to pay for the proposed certification scheme. The design included two subgroups: the control group to which the term “reclaimed wastewater” was administered consistent with the terminology used in Regulation (EU) 741/2020, serving as baseline. In contrast, the treatment group was faced with the term “regenerated water”, which evokes the concept of circular economy.

In the econometric analysis, the attributes were coded as follows: the Status Quo (SQ) option was binary coded, with a value of 1 assigned if selected and 0 otherwise. Certification attributes (“Eco-label”, “QR-code”, “Private Certification”, “Public Certification”, “National”, and “EU member state”) were treated as dummy variables indicating the presence or absence of each feature. The "Price" attribute was handled as a continuous variable to capture its marginal effect on the choice probability.

2.2.3 Survey Design

Data were gathered through an online survey conducted in the Summer of 2024. A purpose questionnaire was administered by a professional firm (Netquest). The questionnaire was carefully structured into five distinct sections, beginning with a brief introduction that included consent to participate. This first introductory section provided participants with essential information about the purpose of the study, ensuring transparency and clarity regarding the survey’s objectives and procedures. Participants were then asked to provide informed consent, confirming their voluntary participation and understanding of their rights within the study. In particular, the privacy rights of participants have been observed in compliance with the EU General Data Protection Regulation (EU) 2016/679. Following this initial presentation, the survey proceeded with sections designed to explore various aspects of consumer preferences and perceptions related to table grapes and recycled water reuse in agriculture. Each section was tailored to address specific themes, ensuring a comprehensive and systematic approach to data collection. The second section focused on shopping habits, aiming to capture participants' consumption patterns, purchasing preferences, and expenditure on table grapes and other fresh produce.

The third section included fifteen statements meticulously designed to capture consumers awareness, perception and attitudes towards environmental concerns in general (Ryan & Spash, 2012; Stern et al., 1995) with a particular focus on issues related to water resources. The construction and inclusion of these statements drew upon the influential work of Nancarrow et al. (2009) which aimed to develop a comprehensive framework for identifying and addressing the primary factors shaping community support for or opposition to water reuse initiatives. The theoretical foundation for predicting behavioural intentions was rooted in Ajzen (1985) *Theory of Planned Behaviour*. According to this framework, attitudes (individuals' evaluations of a behaviour as positive or negative), subjective norms (the perceived social pressure to engage in or abstain from a behaviour), and perceived behavioural control (individuals' perceptions of the ease or difficulty of performing the behaviour) collectively influence their intentions and subsequent actions. Regarding environmental beliefs and attitudes, scales of attitudinal questions have been adapted on the base of well-established New Ecological Paradigm (Dunlap, 2008; Dunlap et al., 2000). According to Ati et al., (2024) institutional trust is established through the publics perception of governmental performance, which is reflected in citizens satisfaction in services and the governments responsiveness. In the context of wastewater management in agriculture, the public institutions, in which consumers place their trust, may operate at various levels -

European, National, or local - with different degrees of engagement. At the local level, water authorities are responsible for ensuring the equitable distribution of resources while maintaining water quality standards in compliance with current regulations.

Moreover, public acceptance of recycled water reuse has been attributed to feelings of disgust associated with the consumption of products, more commonly referred to in the literature as the "yuck factor" (Po et al., 2003; Ricart et al., 2019). The pronounced aversion to oral ingestion of reclaimed wastewater, as opposed to other forms of contact, is evident from studies indicating that farmers exhibit a higher willingness to irrigate crops with recycled water than to consume the same produce (Menegaki et al., 2007; Tsagarakis et al., 2007). Risk perception concerning wastewater reuse has also been polled.

A Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), was settled. All psychometric statements belonging to this section are shown in Table 2.

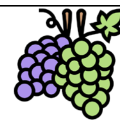
Table 2. Psychometric statements

Theme	N.	Statement
Environmental awareness	1	I am aware of the global issue of water scarcity and its implications for society and the natural ecosystem.
	2	Human activities have a relevant impact on the environment.
	3	Promoting eco-friendly food consumption habits is necessary.
	4	I believe that implementing the reuse of reclaimed wastewater* for irrigation can alleviate pressure on water resources.
Trust	5	I trust the scientific and technological knowledge concerning the treatment and reuse of reclaimed wastewater for irrigation.
	6	I trust the information provided by the local authorities about how reclaimed wastewater is treated and reused for irrigation.
	7	I trust the information provided by national authorities on how reclaimed wastewater is treated and reused for irrigation.
	8	I trust the information provided by European authorities on how reclaimed wastewater is treated and reused for irrigation.
Risk perception	9	I believe consuming fresh fruits and vegetables grown using reclaimed wastewater does not pose health risks for me
Yuck factor	10	I feel disgusted thinking about eating fresh fruits and vegetables grown with reclaimed wastewater for irrigation.
Information	11	It doesn't matter sources of irrigation water come from.
	12	In my choice of food, I pay attention to information labels.
Commitment	13	Ensuring environmental preservation for future generations is of utmost importance.
	14	In my choice of food, I prefer environment friendly production.
	15	I am willing to change my behaviour to protect the environment.

Source: own elaboration. Note: * For the treatment group, "regenerate water" was used in place of "reclaimed wastewater" throughout the questionnaire

The fourth section of the survey focused on the choice experiment. This section began with a thorough explanation of the hypothetical scenario, emphasizing the significance of recycled water reuse for irrigation and the minimum standards outlined in Regulation (EU) 2020/741. Participants were also provided with detailed information about the characteristics of the proposed certification tool, as outlined in Table 3.

Table 3 - Explanation of the Attributes Included in the Survey

Characteristics	 **Alternative A**	 **Alternative B**
Certification instrument	 Circular economy **label** certifying that the reclaimed wastewater used for irrigation of table grapes complies with the safety standards by Reg. 2020/741.	**QR code** by which you can get information on actors involved, analyses and controlling procedures implemented to achieve the safety standards by Reg. 2020/741.
Nature of Certification body	Public Fulfilment of safety standards laid down by Reg. 2020/741 is certified by a **public body.**	Private Fulfilment of safety standards laid down by Reg. 2020/741 is certified by a **private body**.
Location of Certification body	National Compliance with the safety standards laid down by Reg. 2020/741 is issued at the selling country, in **Germany**.	EU member state Compliance with the safety standards laid down by Reg. 2020/741 is issued at the production country, within a **European Union Member State**.
Extra price	This is the added price - on one kilogram of table grapes usually eaten - for getting such information on grapes produced with reclaimed wastewater within European Union.	

Source: own elaboration.

Before making their selections, participants were instructed to imagine themselves in a real purchasing situation, considering the current scenario where the use of recycled water for growing food produce is a practice already taking place in EU within the Regulation (EU) 2020/741 framework. In this context, participants might encounter a circular economy label, informing them that the table grapes had been safely grown using recycled water according to the standards outlined in Regulation (EU) 2020/741. Likewise, participants were invited to envision the presence of a QR code, enabling them access to detailed information about the control procedures and the stakeholders involved for ensuring safety compliance with the standards outlined in Regulation (EU) 2020/741. Then, respondents were asked to select their preferred option, taking in mind the price they usually pay for table grapes imported from an EU member state. To ensure impartiality and reduce potential bias, each choice card was preceded by a reminder informing respondents of the "no choice" option. This option represents the current market situation, where consumers select a table grape without any information about and guarantee on the safety use of recycled water for irrigation. An example of one of the choice cards provided to each participant is displayed in Figure 2.

Finally, the fifth section gathered sociodemographic information, collecting detailed data on participants age, gender, education, employment status, income, household composition, and prior knowledge of recycled water reuse in agriculture. This section provided a critical context to better understand the potential drivers behind respondents' choices and preferences.

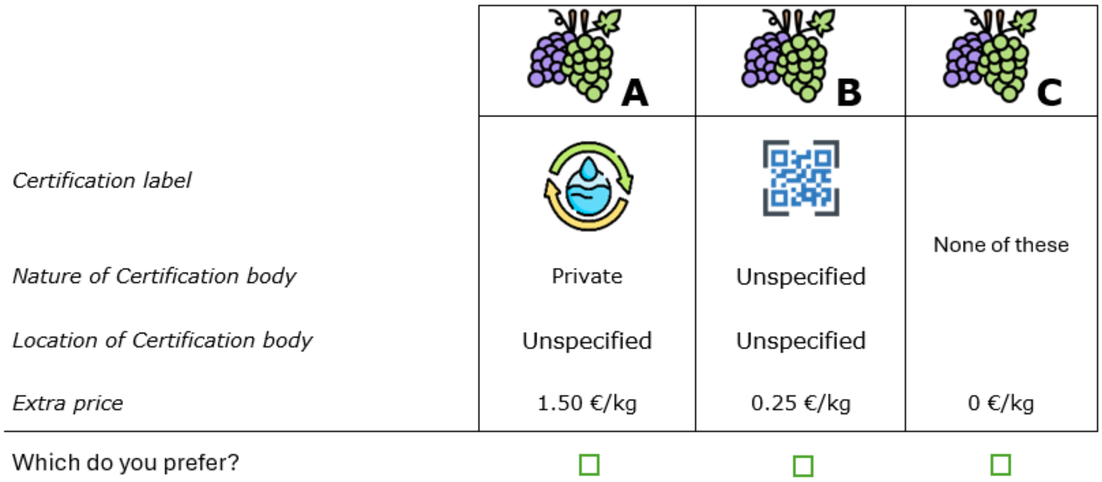


Figure 2. Example of choice card from the questionnaire.

2.2.4 Sampling

The target population was defined by specific inclusion criteria: (i) being the household member responsible for food purchasing and (ii) having consumed table grapes at least once within the past year. Participants were selected using stratified quota sampling to ensure a nationally representative sample. Quotas were established based on geographical distribution (Nielsen areas[1]), age (20 years and older), gender parity, and educational attainment, with a maximum of 40% of participants holding a university degree. Each completed survey was subjected to a thorough validation process to ensure data accuracy and procedural compliance before inclusion in the final dataset. The resulting sample consisted of 902 respondents. Table 4 presents a detailed summary of

[1] The Nielsen regions are groupings of multiple federal states in Germany, organized to ensure similarity across key market factors, such as consumer behaviour and purchasing power (https://de.wikipedia.org/wiki/Nielsengebiet).

the socio-demographic characteristics of the final sample. A *t-Test* was conducted to assess the representativeness of the sample. The analysis demonstrated that the sample was broadly representative of the general population with respect to key socio-demographic factors.

Table 4 - Sample descriptive statistics.

Variable	Sample	Germany[2]	*t-Test (p-value)*
Age (years)	58.5	52.0[3]	16.09(0.00)
Gender (% women)	50.0	50.7	-0.42(0.66)
University education (% graduated)	40.9	37.0	2.39(0.00)
Employment status (% employed)	55.9	77.2[4]	
Household size (numbers of members)	2.05	2.2	
Children (% of under 16 presences in the household)	43.4		
Household income (%)			
Less than 1.500€	12.1		
1.501-2.500€	20.9		
2.501-4.000€	37.0		
4.001-6.000€	21.5		
More than 6.001€	8.4		
Member/supporter of environmental campaign (%)	9.5		
Knowledge of the practice of wastewater reuse (%)	46.1		

Source: direct survey

[2] (DESTATIS , 2023)
[3] average age excluding those under 20 years old
[4] (DESTATIS, 2023)

The average age of respondents in the sample is 58 years, with a well-balanced gender distribution. Regarding educational attainment, 40.9% of respondents held a university degree. In terms of employment status, 55.9% of participants are employed, while the remaining is shared among retirees, students, and other non-working people. The average household size was 2.05 members, with 43% of households taking after at least one child under the age of 16. The income distribution in the sample reflects notable economic diversity. Approximately 12% of respondents reported monthly household incomes below €1,500, while 20.95% earned between €1,501 and €2,500. A significant proportion, 37.03%, reported incomes in the range of €2,501 to €4,000. The higher income brackets were represented by 21% of households earning between €4,001 and €6,000, and 8.43% exceeding €6,001 per month. Environmental engagement was somewhat limited, as only 9.5% of respondents reported being members or supporters of environmental campaigns. However, there was a fair knowledge of wastewater reuse for irrigation, with 46.1% of respondents expressing familiarity with the concept.

2.3 Methods

2.3.1 Econometric framework

The research utilized the Choice Experiment (CE) methodology to evaluate the value associated with a certification scheme that assures the safe reuse of reclaimed wastewater for agricultural produce. As stated previously, the CE approach has become a widely recognized method for ecological valuation (Adamowicz et al., 1994). It is a subset of stated preference techniques for environmental valuation, involving the elicitation of individual preferences within hypothetical market scenarios. The theoretical foundations of the CE methodology are rooted in Lancaster's consumer choice model (Lancaster, 1966) and random utility theory (Luce, 1959; Manski, 1977; McFadden, 1972). According to Lancasters framework, consumer satisfaction is derived from the attributes of a good rather than from the good itself. In alignment with this principle, CE involves presenting respondents with a series of alternatives defined by distinct attributes and their corresponding levels. Participants are then tasked with selecting the alternative that maximizes their utility, assuming rational decision-making behaviour. Random utility theory further underpins the CE methodology, positing that the utility associated with a given choice consists of two components: a deterministic component, reflecting observable factors, and a stochastic component, accounting for unobservable influences. Mathematically, the utility U associated with individual n choosing alternative i is expressed as:

$$U_{in} = V(X_{in}) + \varepsilon(X_{in}) \quad (1)$$

where $V(\cdot)$ represents the systematic (deterministic) portion influenced by measurable attributes, and $\varepsilon(\cdot)$ captures the random (unobserved) elements impacting the decision-making process. The likelihood of individual n selecting alternative i from a set of available alternatives J can be modelled using a Conditional Logit (CL) framework (Maddala, 1983; McFadden, 1972). The probability of this selection is mathematically expressed as:

$$Pr(Y_i = n) = \frac{exp[V(X_{in})]}{\sum_{j=1}^{J} exp\left[V\left(X_{jn}\right)\right]} \quad (2)$$

In this formulation, $V(\cdot)$ represents a linear function of specified attributes, and the random error term follows an independent and identically distributed (IID) Type I extreme value (Gumbel) distribution. Consequently, the conditional indirect utility function can be defined as:

$$V_{jn} = \psi_j + \sum \beta_{jk} X_{jk} + \sum \phi_{jn}\left(S_n * \psi_j\right) \quad (3)$$

where ψ_j denotes an alternative-specific constant, X_{jk} represents the *k-th* attribute of choice *j*, and β_{jk} is the parameter associated with X_{jk}. The vector S_n captures the socio-economic characteristics of individual n, while ϕ_{jn} corresponds to the coefficients related to these characteristics.

In scenarios where preference heterogeneity exists, the Independence of Irrelevant Alternatives (IIA) assumption inherent in the CL model may no longer hold, leading to biased estimations. To address this issue, the Mixed Logit Model (MXL) model offers a more flexible framework that does not rely on the IIA assumption and provides unbiased estimates even in the presence of preference heterogeneity among respondents (Train, 1998). The MXL model incorporates unobserved heterogeneity into the utility function, which is expressed as:

$$U_{in} = V\big(X_n(\gamma + \delta_i)\big) + \varepsilon(X_n) \tag{4}$$

Here, $V(\cdot)$ represents the deterministic component, $\varepsilon(\cdot)$ denotes the random error term, γ is the mean parameter, and δ_i captures random deviations arising from preference heterogeneity across individuals. The probability of individual *n* choosing alternative *i* under the MXL model is given by:

$$Pr(Y_i = n) = \frac{exp\big[V\big(X_n(\gamma + \delta_i)\big)\big]}{\sum_{j=1}^{J} exp\left[V\left(X_j(\gamma + \delta_i)\right)\right]} \tag{5}$$

When deviations from mean preferences are accounted for, the conditional indirect utility function is further extended as:

$$V_{jn} = \psi_j + \sum \beta_{jk} X_{jk} + \sum \tau_{nk} X_{jk} + \sum \phi_{jn} \left(S_n * \psi_j\right) \tag{6}$$

Where ψ_j denotes an alternative-specific constant, X_{jk} represents the *k*-th attribute value associated with choice *j*; β_{jk} is the parameter corresponding to that attribute. The vector τ accounts for deviations in individual preferences, S_n reflects the socio-economic characteristics of respondent *n,* and ϕ_{jn} comprises the coefficients tied to these socio-economic characteristics. The estimated mean preference coefficients (β)

are typically assumed to follow either a log-normal or normal distribution (Train, 1998). Additionally, individual-specific preference parameters (τ_{nk}) are considered invariant across all choices made by a given respondent but differ between respondents, thereby capturing variation in preferences at the individual level.

Furthermore, an in-depth analysis was conducted using Latent Class (LC) models, which are based on the principles of finite mixture modelling. This method assumes that the population is not a single homogeneous entity but rather consists of a mixture of unobserved subgroups or segments, each defined by distinct preference structures (Wedel & Kamakura, 2000). This segmentation allows for a nuanced understanding of heterogeneity within the population, capturing the unique attributes and behaviours of each subgroup. These subgroups are defined by segment-specific parameter sets. In latent class choice experiments, it is assumed that the utility an individual derives from a particular attribute is not unique to that individual but is influenced by their unobservable membership in one of q = 1, 2… Q latent classes. The probability of class membership *q* is determined by individual *i* choice of alternative *j* at time *t*, which is defined by a specific set of observable attributes (Greene & Hensher, 2003).

$$Prob_{jit|q} = \frac{exp\left(x'_{it,j}\beta_q\right)}{\sum_{j=1}^{Ji} exp\left(x'_{it,j}\beta_q\right)} \tag{7}$$

It is assumed that there is a total of *Q* latent preference classes, leading to the overall log-likelihood expression:

$$lnL = \sum_{i=1}^{N} ln\left[\sum_{q=1}^{Q} C_{iq}\left(\prod_{t}^{T_i} Prob_{jit|q}\right)\right]$$

8

where represents the probability that individual i belongs to class q. While this approach enables the segmentation of the population based on observed response patterns, the latent classes themselves do not provide insights into the reasons behind the variation in utility derived from the given attributes (Peschel et al., 2016). To better understand and characterize the latent classes, we adopt the method proposed by Boxall & Adamowicz (2002), incorporating sociodemographic characteristics to explain segment membership. The Latent Class Model (LCM) was estimated using the maximum simulated likelihood estimator (Train, 2009) with the Stata software package. The optimal number of latent classes was determined by assessing the goodness-of-fit for each model. This evaluation was based on several criteria, including the likelihood value at convergence, the Akaike Information Criterion (AIC), and the Bayesian Information Criterion (BIC). These indices allowed for the selection of the model that best balanced fit and model complexity.

2.3.2 Integration of Latent Psychological Traits

To account for latent psychological dimensions influencing respondents' preferences, this study adopts a two-step modelling approach (Halkos & Matsiori, 2018). While standard Discrete Choice Experiment models typically include only observable variables – such as product attributes and socio-demographic characteristics – this specification is extended to incorporate latent traits derived from attitudinal data. These unobserved traits reflect behavioural constructs such as environmental concern, perceived risk, and institutional trust, which are indirectly measured through a battery of Likert-scale statements (see Table 2).

In the first step, a Principal Component Analysis (PCA) was applied to the psychometric statements, extracting a reduced set of orthogonal components. These components synthesize the underlying latent constructs (Mariel & Arata, 2022). The component scores lt_{nk}, representing individual *n*'s position on latent dimension *k*, were computed as:

$$lt_{nk} = \sum_{m=1}^{M} \zeta_{km} I_{nm} + \varepsilon_{nk}$$

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Where I_{nm} denotes the attitudinal score of individual *n* on item *m*, ζ_{km} is the PCA loading, and ε_{nk} the residual.

In the second step, the resulting component scores were included as explanatory variables in the Random Utility Model. Specifically, for the CL and MXL models, they were interacted with the status quo alternative to capture the effect of latent attitudes on the probability of opting out. The conditional indirect utility function for individual *n*, alternative *j*, and choice task *t* is thus specified as:

$$U_{njt} = \sum_{k} \beta_k X_{njtk} + \sum_{r} \theta_r (Z_{nr} \cdot SQ_{jt}) + \sum_{l} \gamma_l \left(lt_{nl} \cdot SQ_{jt} \right) + \varepsilon_{njt}$$

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Where:

- X_{njtk} are the observed attribute levels of alternative j,
- Z_{nr} are the socio-demographic characteristics of respondent n,
- lt_{nl} are the latent components scores from PCA,
- SQ_{jt} is a dummy variable equal to 1 if the alternative j corresponds to the status quo,
- β_k, θ_r, and γ_l are parameters to be estimated,
- ε_{njt} is the stochastic error term.

This formulation enables the estimation of the marginal effect of latent constructs on the likelihood of choosing the opt-out option. The approach is consistent with prior work that incorporates behavioural and attitudinal variables into DCE frameworks through multivariate techniques (Boxall & Adamowicz, 2002; Mariel et al., 2021).

Furthermore, in the Laten Class Model, these PCA-derived latent traits were incorporated into the class membership function to explain heterogeneity in class allocation. The probability that individual *n* belongs to latent class *q* is specified as:

$$\psi_{nq} = \frac{\exp\left(\lambda_{0q} + \sum_h \lambda_{1qh} \mathrm{Z}_{nh} + \sum_l \lambda_{2ql} \mathrm{lt}_{nl}\right)}{\sum_{q=1}^{Q} \exp\left(\lambda_{0q} + \sum_h \lambda_{1qh} \mathrm{Z}_{nh} + \sum_l \lambda_{2ql} \mathrm{lt}_{nl}\right)}$$

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Where:

- Z_{nh} are socio-demographic variables,
- lt_{nl} are latent trait scores,
- $\lambda_{1qh}, \lambda_{2ql}$ are class-specific membership coefficients.

This specification allows for a more nuanced behavioural profiling of segments and accounts for preference heterogeneity beyond observable variables. Compared to fully integrated Hybrid Choice Models (M. Ben-Akiva et al., 2002; Mariel et al., 2024) this two-step method offers a more tractable alternative, particularly when dealing with complex latent structures in surveys with moderate sample sizes.

2.3.3 Economic evaluation

The economic value of the certification scheme proposed was estimated using the marginal rate of substitution (MRS) between the non-cost attributes and the cost attribute, which shows the willingness to pay (WTP). Upon estimating the parameters, the MRS between two given attributes, *i* and *j*, can be derived using the following expression:

$$MRS = -1 * \left(\frac{\beta_{attribute\ i}}{\beta_{attribute\ j}} \right) \quad (12)$$

In cases where price is incorporated as an attribute, the MRS formulation can be utilized to estimate the part worth or implicit price. The part-worth indicates the marginal WTP for a discrete change in the level of an attribute. This approach facilitates an understanding of the relative significance that individuals ascribe to various characteristics within the design of the choice experiment. As the CE methodology aligns with the principles of utility maximization and demand theory (Bateman, 2002; Hanemann, 1984), the part-worth of an attribute *j* can be estimated as follows:

$$WTP_J = -1 * \left(\frac{\beta_{attribute\ j}}{\beta_{price}}\right)$$

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Additionally, while WTP provides valuable insights, it is not the most effective tool for policy-making due to the inclusion of the status quo (Alcon et al., 2022). A more suitable approach is the estimation of compensating surplus (CS), which quantifies the change in individual welfare resulting from transitioning from the current situation to an alternative scenario (Bateman, 2002; Bennet & Adamowicz, 2001). This can be expressed using Equation 14 where V_{i0} represents the indirect utility function associated with the initial state and denotes the indirect utility function corresponding to an improved state included in the study. The parameter reflects the marginal utility of income.

$$CS = -\frac{1}{\beta_{price}}\left(ln\sum_{i} exp(V_{i0}) - ln\sum_{i} exp(V_{i1})\right)$$

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3. Results

3.1. Overview statistics

This paragraph presents an overview of the key descriptive statistics. The descriptive analysis explores consumer shopping habits related to table grape consumption and fresh produce more broadly, as well as preferences concerning product origin and certification labels, highlighting several significant patterns Additionally, a statistical analysis of psychometric items provides insights into consumer attitudes towards environmental awareness, trust in scientific knowledge and institutions, and other relevant perceptions regarding wastewater reuse. To facilitate the inclusion of attitudinal variables in the econometric models while reducing dimensionality and potential multicollinearity, a Principal Component Analysis (PCA) was also performed. This allowed the integration of consumers latent attitudes into the modelling framework in a more parsimonious and interpretable form. Finally, the analysis also investigates the impact of the linguistic treatment applied in the survey (i.e. “reclaimed” vs. “regenerated”) on participants perceptions.

3.1.1 Consumers’ shopping habits

In terms of annual consumption (Table 5), 38% of respondents reported consuming between 2 and 4 kilograms of table grapes, making this the most common consumption category. For 23% of respondents less than 2 kilograms is the annual amount, while about 22.5% consume between 4 and 6 kilograms, and 16% consume more than 6 kilograms. When considering the geographic origin of table grapes, a notable majority (about 56%)

of respondents prefer grapes sourced from European Union member states, featuring the importance of EU-origin produce among German consumers. In contrast, only 5.10% of respondents purchase grapes from non-EU countries. On the other hand, about 39% of interviewees do not pay attention for the origin of their table grapes. Approximately 80% of the German consumers in the sample spend around €50 per week on purchasing fresh fruits and vegetables.

Table 5- Shopping habits, N=902

Variable	Percent.
Table grape consumption	
< 2kg/year	23.1
between 2 and 4 kg/year	38.4
between 4 and 6 kg/year	22.5
> 6kg/year	16.1
Table grape origin	
From an EU member state	56.3
From a non-EU member state	5.1
I'm not sure/I don't really keep track of origin	38.6
Average expenditure for fresh produce	
< 50€/week	79.9
between 51 – 100€/week	17.9
between 101 - 150€/week	1.6
>150€/week	0.4
Preferences for fresh produce labelled	
Organic Farming	32.7
Rainforest Alliance	8.8
Carbon or Water footprint	7.6
Sustainable Agriculture	27.9
None/I don't know	56.4

Source: own elaboration

Regarding preferences for certification labels on vegetable and fruit products, the survey reveals a pattern in consumer purchasing behaviour. Almost 33% expressed buying organic farming-certified food. Sustainable agriculture certifications also garnered attention, with 27.9% of respondents indicating that they buy labelled fresh produce. On the other hand, certifications related to the Rainforest Alliance and carbon/water footprints were less spread, with only 8.8% and 7.6% of respondents, respectively. As a whole, 56.4% of respondents do not consider certification labels neither pay attention in their purchasing choice, suggesting a lack of awareness of or engagement with eco-labelling schemes.

3.1.2 Psychometric profile

This paragraph reports results of the psychometric profile of respondents. Table 6 presents the mean scores of various psychometric constructs, measured on a scale from 1 ("Strongly agree") to 7 ("Strongly disagree"). The results provide insights into consumer attitudes regarding environmental awareness, trust in authorities, risk perception, emotional responses to wastewater reuse (i.e., "yuck factor"), information sensitivity, and commitment related to environmental sustainability.

- **Environmental Awareness**: The results indicate a high level of environmental awareness among the participants. The mean scores, which range from 5.3 to 5.9, reflect a recognized awareness of water scarcity issues, the impact of human activity on the environment, and the importance of promoting eco-friendly consumption practices. The statement regarding the potential benefits of recycled water reused for irrigation – "*I believe that implementing the reuse of reclaimed wastewater/regenerated water can alleviate pressure on water resources*" - received the lowest mean score within this category (mean = 5.3), yet it still indicates a hight level of agreement.

Table 6. Psychometric profile. Means scores from 1 "Strongly disagree" to 7 "Strongly agree".

		Mean	Std. Dev.	Min	Max
Environmental awareness	I am aware of the global issue of water scarcity and its implications for society and the natural ecosystem.	5.6	1.3	1	7
	Human activities have a relevant impact on the environment.	5.9	1.3	1	7
	Promoting eco-friendly food consumption habits is necessary.	5.5	1.3	1	7
	I believe that implementing the reuse of reclaimed wastewater/regenerated water for irrigation can alleviate pressure on water resources.	5.3	1.3	1	7
Trust	I trust the scientific and technological knowledge concerning the treatment and reuse of reclaimed wastewater/regenerated water for irrigation.	5.0	1.3	1	7
	I trust the information provided by the local authorities about how reclaimed wastewater/regenerated water is treated and reused for irrigation.	4.7	1.5	1	7
	I trust the information provided by national authorities on how reclaimed wastewater/regenerated water is treated and reused for irrigation.	4.6	1.4	1	7
	I trust the information provided by European authorities on how reclaimed wastewater/regenerated water is treated and reused for irrigation.	4.6	1.5	1	7
Risk perception	I believe consuming fresh fruits and vegetables grown using reclaimed wastewater/regenerated water does not pose health risks for me	4.9	1.4	1	7
Yuck factor	I feel disgusted thinking about consuming fresh fruits and vegetables grown with reclaimed wastewater/regenerated water for irrigation.	3.1	1.7	1	7
Information	It doesn’t matter sources of irrigation water come from.	3.3	1.7	1	7
	In my choice of food, I pay attention to information labels.	4.7	1.5	1	7
Commitment	Ensuring environmental preservation for future generations is of utmost importance.	5.8	1.3	1	7
	In my choice of food, I prefer environmentally friendly production.	5.1	1.4	1	7
	I am willing to change my behaviour to protect the environment.	5.1	1.4	1	7

Source: direct survey.

- **Trust**: Trust in scientific and authorities' information of recycled water for irrigation is fair. The mean score for the statement *"I trust the scientific and technological knowledge concerning the treatment and reuse of reclaimed wastewater/regenerated water for irrigation"* was 5, indicating a fair level of trust. Trust in local, national, and European authorities information about the treatment and reuse of reclaimed wastewater is relatively lower, with mean scores ranging from 4.6 to 4.7, reflecting a cautious position among participants. It is worth noting that trust in the Government institutions does not report any significant difference.

- **Risk Perception**: The mean score for the statement, *"I believe consuming fresh fruits and vegetables grown using reclaimed wastewater/regenerated water does not pose health risks for me",* is 4.9, indicating that participants fairly agree. Since the statement was framed in the negative *("does not pose")*, this suggests that the participants in the sample generally perceive a low or negligible health risk associated with consuming fresh produce irrigated with reclaimed wastewater. However, they are not sharply in agreement.

- **Yuck Factor**: The statement *"I feel disgusted thinking about consuming fresh fruits and vegetables grown with reclaimed wastewater for irrigation"* recorded a relatively low mean score of 3.1, indicating that, on average, disgust is not a significant factor influencing participants perceptions of food produced with reclaimed wastewater. Yet, they are not sharply in disagreement as also proved by 1.7 value of standard deviation.

- **Information**: Regarding information, participants express a fair sensitivity on the importance of knowing sources of irrigation water, as reflected by a mean score of 3.3, in response to the statement *"It does not matter (...)"*. This mirrors the attention given to information labels in food choices, as indicated by a mean score of 4.7. All in all, consumers prefer receiving information on food and on water used for irrigation.

- **Commitment**: Participants declare a high commitment to environmental preservation, as reflected by the mean score (5.8) for the statement *"Ensuring environmental preservation for future generations is of the utmost importance"*. Likewise, participants expressed a fair preference for environmentally friendly food production (5.1), as well as a comparable level of willingness to change own behaviour to protect the environment (5.1).

In summary, although respondents are largely aware of impact of human activities on the environment (statement n. 2), their commitment to change behaviour to enhance environment protection is lower (statement n. 15). Furthermore, they exhibit a more cautious and neutral stance towards trust in public and scientific authorities, as well as the use of recycled water in food production.

Principal Component Analysis (PCA) was conducted on the set of psychometric items following the approach of Tyllianakis & Ferrini (2021). Two out of the initial 15 items were excluded based on their performance in the Pearson correlation matrix. Specifically, the item *"It doesnt matter where sources of irrigation water come from"* was removed due to its very low correlations with all other items, suggesting poor shared variance. Similarly, the item *"I trust the information provided by European authorities on how* *reclaimed wastewater is treated and reused for irrigation"* was excluded due to its very high correlation with the item referring to national authorities, indicating potential multicollinearity issue. The PCA was performed on the correlation matrix and followed by a varimax orthogonal rotation to enhance the interpretability of the extracted components. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.90, indicating excellent suitability for principal component extraction. Bartlett's test of sphericity was significant ($p < 0.001$), confirming that the correlation matrix was not an identity matrix and that the data were appropriate for dimensionality reduction.

Table 7 summarizes the results of the varimax-rotated Principal Component Analysis, reporting the loadings of each attitudinal statement on the three extracted components. Loadings greater than 0.30 were considered meaningful for the interpretation of the components.

Table 7. Rotated factor loadings (varimax rotation) from the Principal Component Analysis

Variable	Eco-awareness	Institutional Trust	Risk & Information
I am aware of the global issue of water scarcity and its implications for society and natural ecosystem.	**0.36**	-0.05	-0.09
Human activities have a relevant impact on the environment.	**0.35**	-0.07	-0.17
Promoting eco-friendly food consumption habits is necessary.	**0.39**	-0.01	-0.01
Ensuring environmental preservation for future generations is of utmost importance.	**0.39**	-0.06	-0.10
In my choice of food, I prefer environmentally friendly production.	**0.38**	0.06	0.24
I am willing to change my behaviour to protect the environment.	**0.39**	-0.01	0.06
I trust the scientific and technological knowledge concerning the treatment and reuse of reclaimed wastewater for irrigation.	0.03	**0.46**	-0.14
I trust the information provided by local authorities about how reclaimed wastewater is treated and reused for irrigation.	-0.02	**0.60**	0.05
I trust the information provided by national authorities on how reclaimed wastewater is treated and reused for irrigation.	-0.01	**0.59**	0.05
I believe that implementing reuse of reclaimed wastewater for irrigation can alleviate pressure on water resources.	0.21	0.06	**-0.33**
I believe consuming fresh fruit and vegetables grown using reclaimed wastewater does not pose health risks for me.	0.04	0.21	**-0.43**
I feel disgusted thinking consuming fresh fruit and vegetables grown with reclaimed wastewater for irrigation.	-0.01	0.06	**0.65**
In my choice of food, I pay attention for information labels.	0.31	0.09	**0.38**

Source: own elaboration

Three principal components were retained based on the Kaiser criterion (eigenvalues greater than 1) and the visual inspection of the scree plot. Together, these components explained more than 70% of the total variance and were interpreted as follows:

- Component 1: **Eco-awareness** – capturing environmental concern, sustainable food preferences, and behavioural willingness to protect the environment.
- Component 2: **Institutional Trust** – reflecting confidence in scientific and governmental information regarding wastewater reuse.
- Component 3: **Risk & Information** – indicating scepticism, emotional and health-related concerns associated with the reuse of reclaimed water while paying huge attention for information labels on food.

3.1.3 Treatment effect on wastewater perception

Table 8 presents the results of the psychometric analysis conducted on the two subgroups resulting from the applied treatment. Specifically, the analysis compares the responses of the control group, which was exposed to the term "Reclaimed wastewater", with those of the treatment group, which encountered the term "Regenerated water". To evaluate the differences between the groups regarding emotional responses, including risk perception and the *yuck factor*, three statistical tests were employed. The T-test for difference in means. The Kruskal-Wallis test was used to examine whether the median scores differed significantly between the groups, as it is a robust non-parametric test particularly suitable for ordinal data or non-normally distributed datasets. Additionally, the Kolmogorov-Smirnov *test* was applied to detect differences in the overall distribution of responses, making it possible to identify whether the treatment altered the shape, location, or spread of the response distributions beyond central tendencies.

Table 8 - Statements analysis against treatment

	Statement (N.)	Control group: "Reclaimed wastewater", N=452	Treatment group: "Regenerated water", N=450	Two-sample Kruskal–Wallis test	Two-sample Kolmogorov–Smirnov test
Environmental awareness	1	5.58	5.67		
	2	5.90	5.96		
	3	5.50	5.60		
	4	5.16	5.35 [a]	3.30*	
Trust	5	4.99	5.10		
	6	4.65	4.78		
	7	4.61	4.72		
	8	4.58	4.66		
Risk perception	9	4.80	5.06 [a]	7.73**	0.09**
Yuck factor	10	3.35	2.77 [a]	24.69***	0.14***
Information	11	3.23	3.36		
	12	4.68	4.63		
Commitment	13	5.76	5.85		
	14	5.09	5.08		
	15	5.16	5.14		

Note: [a] T-test significant at 95%; Statistically significant by level: * $p<0.1$; ** $p<0.05$; *** $p<0.01$
Source: own elaboration

The results demonstrate statistically significant differences for both risk perception and yuck factor. For *risk perception***,** the treatment group reported a higher mean score (5.06) compared to the control group (4.80), with the Kruskal-Wallis test and the Kolmogorov-Smirnov test indicating significant differences between the groups. The results indicate that consumers in the treatment subsample agree more upon the statement that consuming fresh produce grown with "regenerated water" does not pose a health risk. In relation to the *yuck factor*, the treatment group exhibited a substantially lower mean score (2.77) than the control group (3.35), with the Kruskal-Wallis test and the Kolmogorov-Smirnov test showing highly significant differences.

For the statement n. 4 which refers to the usefulness of recycling water to enhance water scarcity, treatment shows a slight effect, being consumers average score always over the value of 5 within the 7-point Likert scale.

The treatment effect interacts with consumer's knowledge of reuse practice. As shown in Table 9, there is a significant effect by the terminology "reclaimed wastewater" on those respondents who had not previous knowledge of water reuse. By wording the practice as "regenerate water" any difference between those who already knew and did not know is not statistically significant.

Table 9. Treatment effect combined with previous knowledge

		Treatment	
Statement	Knowledge of the practice	Reclaimed	Regenerated
N. 4	No	5.04 [a]	5.34
	Yes	5.34	5.36
N. 9	No	4.57 [a, b]	4.96
	Yes	5.11	5.17
N. 10	No	3.7 [a, b]	2.76
	Yes	2.86	2.77

Note: [a] Two-sample Kruskal–Wallis test significant at 95%;
[b] Two-sample Kolmogorov–Smirnov test significant at 95%
Source: own elaboration

These findings reveal that the terminology "Regenerated water" significantly reduces both the perceived risk and feelings of disgust (yuck factor) compared to "Reclaimed wastewater". The use of the term "Regenerated water" appears to mitigate negative psychological responses, underscoring the critical role of language in influencing public attitudes toward the use of treated wastewater in agricultural practices.

3.2. Econometrics models

The first step involved examining the percentage of respondents who frequently chose the status quo (SQ) option and, consequently, showed reluctance to pay for or select the proposed certification programs (Alcon et al., 2019; Barreiro-Hurle et al., 2018). Among the 902 respondents, approximately 14% (130 individuals) always chose the SQ option, while 772 respondents selected alternatives characterized by certification attributes. Following Alcon et al. (2019), it is necessary to differentiate between "legitimate zeros" and those who provided "protest responses" among those who consistently selected the status quo. Legitimate zeros are individuals who do not value the proposed good or service and therefore are unwilling to pay for it. Protest responses occur when respondents refuse participation in the hypothetical market due to reasons unrelated to the value of the good, such as disagreement with the survey structure or payment vehicle (Barrio & Loureiro, 2013).

To identify true protest respondents, a set of six follow-up close options plus one open answer was provided to the 130 individuals, allowing them to select multiple motivations (i.e., AND format). The options and each frequency of responses are reported in Table 10. Protest respondents were identified as those who selected at least once the option "*I dont believe in food certification labels*" or "*I think it is the responsibility of public authorities to cover all additional costs*" among their multiple possible answers.

Based on this criterion, 91 true protest respondents (10% of the initial sample) were excluded from the further analysis. Consequently, the final sample consisted of 811 respondents, yielding 14,598 choice observations for econometric modelling.

Table 10. follow-up questions to identify protest responses (sample of 130 respondents)

		Freq.
1.	I don't believe in food certification labels.	60
2.	I think it is the responsibility of public authorities to cover all additional costs.	43
3.	Others (open answer)	26
4.	I doubt reclaimed wastewater reuse can effectively provide benefits to the environment.	25
5.	I prefer not to know which type of water is used.	20
6.	I doubt that water scarcity could become a significant problem in my region.	17
7.	I wouldn't buy any agricultural produce grown with reclaimed wastewater.	11
	Total	202

Note: Respondents could select multiple motivations (AND format). Protest respondents were identified as those who selected motivation 1 and/or 2.

3.2.1 CL and MXL models

To establish a baseline understanding of consumer preferences among the available alternatives in the choice sets, a Conditional Logit (CL) model was first estimated (Table 12). This basic model serves to capture the influence of each attribute on the probability of choosing a particular alternative.

The explanatory variables included the Status Quo (SQ) option, representing the absence of any guarantee regarding the safe reuse of wastewater. The SQ was coded as a binary variable, taking the value of 1 when the status quo option was selected and 0 otherwise. Attributes related to certification schemes – Eco-label, QR-code, Private Certification, Public Certification, National Certification, and European Certification –

were dummy coded. The “Price” attribute was incorporated as a continuous variable to capture its marginal effect on the likelihood of selecting an alternative. The results of the CL model indicate that the coefficient for the status quo option is positive, indicating a preference among respondents toward opting out of the certified alternatives. However, the relatively modest magnitude of this coefficient, particularly when compared to other attributes, suggests that while a subset of respondents exhibits hesitancy or resistance to certified options, the overall preference leans toward engaging with certification schemes. Notably, all the coefficients associated with the choice attributes are positive and statistically significant at the 1% level, indicating a positive interest in information related to the reuse of wastewater for table grape cultivation. Price is identified as a fundamental determinant of choice, as reflected by its negative and highly significant coefficient ($p<0.001$). This result highlights the pronounced sensitivity of respondents to price, demonstrating that higher price levels substantially reduce the probability of selecting a certified alternative.

Further analysis was conducted through the implementation of an extended Conditional Logit (CL) model, which incorporated interaction terms between socio-demographic variables and both the status quo and price attributes. This approach aimed to provide deeper insights into the behavioural and psychological factors influencing consumers’ choices. A detailed explanation of the variables used in the analysis is provided in Table 11. Interactions with the SQ attribute were specified for the following variables: **Age** (continuous), **Female** (dummy), **Graduated** (dummy), and **No labels** (dummy indicating a preference for products without certification). The variable **Income**, coded as an ordinal scale from 1 to 5, was interacted with the **Price** attribute to capture potential differences in price sensitivity across income groups.

Further interaction terms were included for **Practice knowledge**, indicating whether the respondent was already familiar with wastewater reuse practices, and **Regenerated water**, a dummy variable capturing the potential effect of using the term "regenerated water" instead of "reclaimed water" in the description of the treatment process.

Finally, the model included three continuous attitudinal components obtained through Principal Component Analysis (PCA): **Eco-awareness**, **Institutional Trust**, and **Risk & Information**, each interacted with the SQ attribute to account for psychological dimensions shaping consumer preferences.

Table 11 - Description of explanatory variables

Variable	Description
Age	Continuous
Female	1 if female; 0 otherwise
Graduated	1 if holding a university degree
Income	1 = Less than 1.500€ 2 = 1.501-2.500€ 3 = 2.501-4.000€ 4 = 4.001-6.000€ 5 = More than 6.001€
No labels	1 if no label is preferred; 0 otherwise
Practice knowledge	1 if the wastewater reuse practice is already known; 0 otherwise
Regenerated water	1 if the term "regenerated water" is used; 0 otherwise
Eco-awareness	Continuous

Institutional Trust	Continuous
Risk & Information	Continuous

Source: own elaboration from direct survey

In general, the baseline Conditional Logit model provided an initial understanding of how certification attributes, traceability features, and price influence consumer choices. However, due to its linear specification and the absence of interaction terms, the model was limited in capturing heterogeneity across demographic and attitudinal profiles. To address this, an extended (quadratic) CL model was estimated, incorporating interaction terms between socio-demographic variables and both the status quo and price attributes. This enhanced specification significantly improved the model's explanatory power by allowing for a more nuanced representation of individual-level variation in preferences. By comparing CL-linear and CL-quadratic all interaction models it is possible to reject the restrictions given that Likelihood Ratio test (LR) statistically rejects the hypothesis of interactions coefficients equal zero (LR = 247.03; $\chi^2_{0.05,11} = 19.675$). So, CL – quadratic model is preferred. This enhanced specification allowed the model to capture variations in preferences related to demographic characteristics such as age, gender, and income.

When considering consumer heterogeneity via the quadratic CL model with interaction terms, the status quo coefficient became negative and significant (β = -1.98, p<0.01), highlighting a generalized preference for certified options once socio-demographic and psychometric factors were explicitly modelled. Thus, consumers prefer to be assured about the use of recycled resources in agriculture rather than choosing the default, no-guarantee option. It is important to note that the experimental design was based on a hypothetical scenario in which agricultural products are already grown using recycled water resources. Respondents were asked whether they would prefer to receive information and an assurance about the safety of the practice or not, highlighting a clear interest in transparency and sustainability in food production.

The results regarding the symbol on the product suggest that both the Eco-label and QR-code are positively valued by consumers. However, the magnitude of the coefficients indicates a slightly stronger preference for the simpler circular economy logo. In terms of certification body, the coefficient for private certification (β=0.31, p<0.01) is positive but significantly smaller than that for public certification (β=0.88, p<0.01). This indicates that consumers tend to regard certifications issued by public organizations as more reliable and trustworthy compared to those from private entities.

Concerning the origin of certification, both national and European certifications (EU member state) exhibit strong positive effects, with certification originating in the producer country (i.e., certification from another European member state) receiving a slightly higher preference.

Several covariates significantly influenced preferences, revealing distinct segments within the sampled population. Older respondents (Age x SQ: $\beta = 0.07$, $p < 0.01$), female consumers (Female x SQ: $\beta = 0.19$, $p < 0.01$), and individuals with higher educational attainment (Graduated x SQ: $\beta = 0.36$, $p < 0.01$) displayed a significant positive association with choosing the status quo, indicating greater resistance or caution toward adopting the certified options. Additionally, consumers preferring fewer product labels or expressing label scepticism (No labels x SQ: $\beta = 0.46$, $p < 0.01$) were also significantly more likely to remain with the status quo. Conversely, respondents with higher levels of institutional trust (Trust × SQ: $\beta = -0.15$, $p < 0.01$) and greater environmental awareness

(Eco-awareness × SQ: β = -0.08, $p < 0.01$) were significantly less likely to choose the status quo, indicating a greater openness toward certified alternatives.

Similarly, individuals already familiar with wastewater reuse practices (Practice knowledge × SQ: β = -0.13, $p < 0.1$) also showed a reduced tendency to remain with the status quo. Higher-income individuals demonstrated reduced price sensitivity (Income x Price: β = 0.12, $p < 0.01$).

Although all the variables related to the choice experiment attributes and the status quo were statistically significant, the Hausman test (Hausman & McFadden, 1984) indicated a violation of the Independence of Irrelevant Alternatives (IIA) assumption (χ^2=16.47, *p*=0.036).

Due to the violation of the IIA assumption, it is necessary to estimate a Mixed Logit (MXL) model. The MXL model relaxing the IIA assumption, accounts for unobserved preference heterogeneity across respondents. While both models incorporate the same attributes and interaction terms, the MXL model further integrates random parameters for choice attributes, thereby enhancing its capacity to capture variability in consumer preferences. Among the three models evaluated, although the CL model shows a slightly higher pseudo-R^2 (0.1043), the MXL model achieves a better overall fit as indicated by lower AIC (8814.99) and BIC (9004.70) values, suggesting improved explanatory performance despite the increase in model complexity. The Mixed Logit model also accounts for unobserved heterogeneity by allowing parameters to vary across individuals, making it behaviourally more realistic for capturing preference variation. This flexibility enables the MXL model to represent substitution patterns and preference heterogeneity that the fixed-parameter CL model cannot accommodate.

The Random Parameter Logit (MXL) model, estimated using 1,000 random draws, explicitly accounted for unobserved individual preference heterogeneity and further reinforced the results obtained from the previous specifications. The magnitude of coefficients for certification attributes increased substantially, indicating stronger overall preferences: certification from an EU member state ($\beta = 1.59$, $p < 0.01$), national certification ($\beta = 1.32$, $p < 0.01$), public certification ($\beta = 1.26$, $p < 0.01$), eco-label ($\beta = 1.15$, $p < 0.01$), and QR-code ($\beta = 0.71$, $p < 0.01$). As expected, the price attribute exhibits a negative and statistically significant coefficient ($\beta = -2.01$, $p < 0.001$), indicating that higher prices substantially reduce the utility associated with selecting the alternatives. Significant standard deviations for these attributes highlighted substantial preference heterogeneity among respondents. Interaction terms in the MXL model reaffirmed earlier results: older respondents (Age x SQ: $\beta = 0.08$, $p < 0.05$), female respondents (Female x SQ: $\beta = 0.31$, $p < 0.05$), higher-educated individuals (Graduated x SQ: $\beta = 0.44$, $p < 0.01$), and respondents with label scepticism (No labels x SQ: $\beta = 0.50$, $p < 0.01$) continued showing strong inclinations toward the status quo. Similarly, increased institutional trust remained negatively associated with status quo preference (Trust x SQ: $\beta = -0.24$, $p < 0.01$), emphasizing that consumers who trust institutional claims were significantly more open to certified products. High-income consumers also demonstrated persistent reduced-price sensitivity (Income x Price: $\beta = 0.19$, $p < 0.01$).

Table 12 - Econometric models results.

	CL - linear		CL – quadratic, all interaction		MXL model – quadratic, all interaction	
Mean	β	SE	β	SE	β	SE
SQ	0.38***	0.08	-1.98***	0.62	-2.73***	1.03
Eco-label	0.74***	0.06	0.75***	0.06	1.15***	0.10
Qr-code	0.55***	0.05	0.55***	0.05	0.71***	0.10
Private cert.	0.31***	0.08	0.31***	0.08	0.26**	0.13
Public cert.	0.87***	0.08	0.88***	0.08	1.26***	0.12
National	0.77***	0.07	0.78***	0.07	1.32***	0.11
EU member state	0.94***	0.05	0.95***	0.06	1.59***	0.11
Price	-0.79***	0.05	-1.16***	0.09	-2.01***	0.17
Predictors						
Age x SQ			0.07***	0.02	0.08**	0.04
Age^2 x SQ			-0.00***	0.00	-0.00**	0.00
Female x SQ			0.19***	0.07	0.31**	0.13
Graduated x SQ			0.36***	0.07	0.44***	0.13
Income x PRICE			0.12***	0.03	0.19***	0.05
No labels x SQ			0.46***	0.08	0.50***	0.13
Practice knowledge x SQ			-0.13*	0.07	-0.17	0.12
Regenerated water x SQ			0.02	0.07	-0.04	0.12
Eco-awareness x SQ			-0.08***	0.02	-0.05	0.04
Institutional Trust x SQ			-0.15***	0.03	-0.24***	0.05
Risk & Information x SQ			-0.01	0.03	-0.00	0.05
SD						
Label					1.47***	0.108
Qr-code					1.68***	0.105
Private cert.					1.45***	0.132
Public cert.					1.20***	0.100
National					-0.47	0.126
European					1.45***	0.290
N	14,598		14,598		14,598	
Log-Likelihood (LL)	-4911.995		-4788.482		-4382.493	
LR chi^2	867.70		1114.73		811.98	
Prob > chi^2	0.000		0.000		0.000	
Pseudo-R^2	0.0812		0.1043		0.0848	
AIC	9839.991		9614.96		8814.98	
BIC	9900.700		9759.15		9004.70	

Statistically significant by level: * p<0.1; ** p<0.05; *** p<0.01

The MXL model offers valuable insights into the heterogeneity of consumer preferences. Notably, the standard deviations for all parameters were found to be statistically significant, indicating substantial variation in preferences across individuals. The relatively high magnitudes of these standard deviations suggest that, for each attribute, there is considerable heterogeneity in how consumers value each attribute. To explore these aspects, further analysis was carried out through the implementation of a Latent Class Logit (LC) model.

3.2.2 Latent class Logit model

To identify the most appropriate latent class structure, a series of Latent Class Logit models were estimated, ranging from two to five classes. The selection was guided by fit statistics including the Log-likelihood (LL), the Consistent Akaike Information Criterion (CAIC), and the Bayesian Information Criterion (BIC), as reported in Table 13. These criteria suggested the potential presence of up to five latent classes with distinct preference structures. However, models with more than five classes failed to converge, indicating potential estimation instability and lack of additional explanatory gain beyond this point. Although the 4-class model achieved the lowest CAIC and BIC values, further inspection of the segment profiles revealed that one of the classes lacked clear behavioural distinctiveness, and several coefficients were not statistically significant. This suggested that the additional segmentation might introduce complexity without offering substantive interpretive gains.

Table 13. Criteria for Number of Classes

Classes	*LLF*	*Nparam*	*CAIC*	*BIC*
2	-4304.168	27	8816.19	8789.19
3	-4164.115	46	8682.35	8636.35
4	-3988.488	65	8477.364	8412.364
5	-3956.53	84	8559.715	8475.715

Selecting the appropriate number of latent classes is a critical step, as it directly influences the usefulness of the segmentation for policy design and marketing applications (Nocella et al., 2012). However, this task is inherently challenging, since information criteria such as BIC and CAIC can be affected by factors like sample size, model complexity, and the number of estimated parameters (Yang & Yang, 2007). Moreover, as the number of classes increases, the statistical significance of the estimated parameters often declines, especially in classes with lower membership probabilities, thus compromising their interpretability (Andrews & Currim, 2003). In light of these considerations, the 3-class solution was selected as the final model. It offered a strong balance between statistical robustness and interpretability, with each segment displaying meaningful and coherent preference structures, thus providing more actionable insights into consumer behaviour.

The LC model statistics, detailed in the following Table 14, provide a robust statistical framework for understanding heterogeneity in consumer preferences for certification schemes in agricultural products. The model fit statistics indicate strong explanatory power, with a log-likelihood value of -4164.11, an Akaike Information Criterion (AIC) of 8420.22, and a Bayesian Information Criterion (BIC) of 8769.30. The identified latent classes exhibited distinct choice patterns regarding the product attributes and were further characterized by socio-demographic and psychometric covariates included in the class membership functions. The model classified approximately 26% of respondents into Class 1, the largest proportion of respondents (42%) into Class 2, and the remaining 32% into Class 3, serving as the baseline group.

Table 14 - Econometric results: 3 classes LCM

	Class 1		Class 2		Class 3	
	Coef. (SE)		Coef. (SE)		Coef. (SE)	
SQ	1.16 (0.38)	***	-1.26 (0.21)	***	1.41 (0.22)	***
Eco-label	3.87 (0.54)	***	0.07 (0.11)		1.16 (0.16)	***
QR-code	3.80 (0.49)	***	-0.10 (0.12)		0.41 (0.16)	**
Private Cert.	0.27 (0.22)		0.78 (0.16)	***	0.22 (0.21)	
Public Cert.	0.04 (0.20)		1.61 (0.18)	***	1.29 (0.20)	***
National	2.35 (0.30)	***	0.39 (0.13)	***	0.96 (0.20)	***
EU member state	1.14 (0.17)	***	1.06 (0.10)	***	1.09 (0.15)	***
Price	-1.40 (0.27)	***	-0.93 (0.12)	***	-2.10 (0.17)	***
Co-variates						
Age	-0.02 (0.01)	**	-0.00 (0.00)		0	
Female	-0.21 (0.23)		-0.36 (0.21)	*	0	
Graduated	-0.37 (0.24)		-0.51 (0.22)	**	0	
Income	-0.01 (0.11)		0.14 (0.09)		0	
No labels	-0.71 (0.26)	***	-0.74 (0.23)	***	0	
Practice knowledge	0.14 (0.23)		0.05 (0.20)		0	
Regenerated water	-0.23 (0.22)		-0.02 (0.20)		0	
Eco-awareness	0.14 (0.07)	*	0.05 (0.06)		0	
Institutional Trust	0.12 (0.9)		0.24 (0.08)	***	0	
Risk & Information	-0.01 (0.09)		0.08 (0.09)			
_cons	1.69 (0.69)	**	0.68 (0.63)		0	
Size	26%		42%		32%	
Model statistics						
No. of observation	14,598					
Log-Likelihood	-4164.11					
AIC	8420.22					
BIC	8769.30					

Statistically significant by level: * p<0.1; ** p<0.05; *** p<0.01

Class 1 - Label-responsive (26%). Respondents within Class 1 exhibit a significant positive preference for maintaining their current (status quo) purchasing behaviour ($\beta = 1.16$, $p < 0.01$), suggesting a pronounced reluctance to adopt new certified options. However, this segment attributes substantial value to visual and informational labelling, particularly the eco-label and the QR-code, alongside national and certifications issued by an EU member state (producer country). Moderate price sensitivity characterizes this group ($\beta = -1.40$, $p < 0.01$). In terms of sociodemographic characteristics, young ($\beta = -0.02$, $p < 0.05$) and environmental awareness ($\beta = 0.14$, $p < 0.10$) significantly increase membership likelihood, whereas habitual purchasers of uncertified products ("no labels") are significantly less represented ($\beta = -0.71$, $p < 0.01$).

Class 2 – Institution-oriented (42%). Class 2 strongly rejects the status quo alternative ($\beta = -1.26$, $p < 0.01$), displaying clear openness to certified products. This segment primarily values public certification ($\beta = 1.61$, $p < 0.01$), with secondary preference given to certification issued in the producer country, that is an EU member state ($\beta = 1.06$, $p < 0.01$); lesser private certification ($\beta = 0.78$, $p < 0.01$), and national certification ($\beta = 0.39$, $p < 0.01$). Unlike Class 1, respondents in Class 2 show no significant preference for either eco-label or QR-code attributes. Price sensitivity is evident but comparatively lower than the other classes ($\beta = -0.93$, $p < 0.01$). This class is significantly less likely to include females ($\beta = -0.36$, $p < 0.10$) or university graduates ($\beta = -0.51$, $p < 0.05$). Institutional trust positively correlates with class membership ($\beta = 0.24$, $p < 0.01$), whereas habitual non-adopters of certified products are less prevalent ($\beta = -0.74$, $p < 0.01$). Consequently, Class 2 comprises consumers whose adoption of certified products is predominantly driven by institutional trust rather than visual informational signals.

Class 3 – Price-sensitive (32%). Representing the reference group, Class 3 indicates a significant preference for the status quo ($\beta = 1.41$, $p < 0.01$), yet simultaneously attributes positive utility to all certification attributes examined. Nonetheless, this segment is characterized by the highest price sensitivity across all classes ($\beta = -2.10$, $p < 0.01$), indicating that economic considerations dominate their decision-making processes despite their general receptivity toward certified attributes.

3.3 Economic valuation: Willingness to pay and Compensating Surplus estimation

The Willingness to Pay (WTP) values were estimated on each model implemented for the econometric analysis, including the linear-basic CL model, the extended CL quadratic model, the MXL incorporating interaction terms, and the LC model (Table 15). WTP estimates reflect the monetary amounts that consumers are willing to pay for each different attribute of the certification scheme.

The linear CL model establishes a foundational estimate of WTP for each attribute. The quadratic CL model, which incorporates interaction terms, captures non-linear relationships and potential interdependencies between attributes, leading to distinct WTP estimates. The MXL accounts for unobserved heterogeneity in consumer preferences, thereby offering potentially more accurate WTP estimates by relaxing the IIA assumption (i.e., irrelevance of the alternative) inherent in the CL model. Furthermore, the LC model, which segments consumers into distinct homogeneous classes, provides deeper insights into preference heterogeneity, differentiating between individuals who are inclined to remain in their "current situation" and those willing to be engaged with the proposed certification. Willingness to pay (WTP) estimates were derived using the Delta method through the *nlcom* command in Stata. For the extended models, specifically the quadratic Conditional Logit (CL) and the quadratic Mixed Logit (MXL) models, WTP values were calculated by explicitly considering the interaction between the income variable and price, as incorporated into the econometric specifications. This adjustment ensures that the heterogeneity in price sensitivity linked to income levels is appropriately reflected in the premium price estimates.

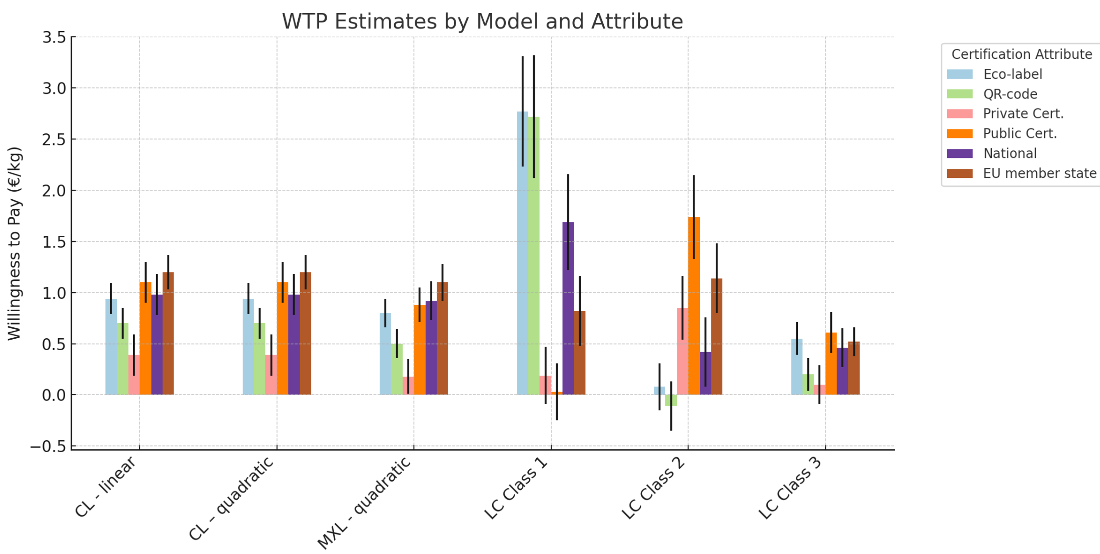
Table 15. WTP for certification scheme attributes (€/kilograms). [95% confidence interval]

	CL - linear	CL – quadratic, all interaction	MXL model – quadratic, all interaction	LC model		
				Class 1	Class 2	Class 3
Eco-label	0.94*** [0.78; 1.09]	0.94*** [0.78; 1.09]	0.80*** [0.66; 0.93]	2.77*** [2.24; 3.31]	0.08 [-0.15; 0.31]	0.55*** [0.39; 0.71]
QR-code	0.70*** [0.55; 0.84]	0.70*** [0.55; 0.84]	0.50*** [0.36; 0.66]	2.72*** [2.12; 3.32]	-0.11 [-0.36; 0.13]	0.20** [0.04; 0.35]
Private Cert.	0.39*** [0.19; 0.58]	0.39*** [0.19; 0.58]	0.18** [0.01; 0.35]	0.19 [-0.09; 0.48]	0.85*** [0.54; 1.16]	0.10 [-0.09; 0.30]
Public Cert.	1.10*** [0.91; 1.30]	1.10*** [0.91; 1.30]	0.88*** [0.71; 1.04]	0.03 [-0.25; 0.31]	1.74*** [1.32; 2.15]	0.61*** [0.41; 0.81]
National	0.98*** [0.78; 1.17]	0.98*** [0.78; 1.17]	0.92*** [0.73; 1.10]	1.69*** [1.21; 2.15]	0.42** [0.08; 0.76]	0.46*** [0.27; 0.65]
EU member state	1.20*** [1.03; 1.36]	1.20*** [1.03; 1.36]	1.10*** [0.92; 1.28]	0.82*** [0.47; 1.15]	1.14*** [0.80; 1.48]	0.52*** [0.38; 0.66]

Statistically significant by level: * p<0.1; ** p<0.05; *** p<0.0

To ensure a clearer understanding, the results are presented in the bar graph (Fig. 3), which illustrates the mean WTP for each attribute across the different econometric models. In the linear CL model, the highest premium is associated with European certification (1.20 €/kg), followed by public certification (1.10 €/kg), national certification (0.98 €/kg), eco-label (0.94 €/kg), QR-code (0.70 €/kg), and private certification (0.39 €/kg). Similarly, in the quadratic CL model with interactions, the same ordering is observed, with identical WTP values to the linear specification, confirming robustness of the results.

Figure 3. Graph-bar of the mean WTP estimates for each attribute across different models.



Source: own elaboration.

In the MXL model (quadratic with interactions), where random taste variation is allowed, WTP estimates are slightly lower across all attributes. European certification again commands the highest premium (1.10 €/kg), followed by national certification

(0.92 €/kg), public certification (0.88 €/kg), eco-label (0.80 €/kg), QR-code (0.50 €/kg), and private certification (0.18 €/kg).

The Latent Class reveals significant heterogeneity in consumer preferences through distinct WTP patterns across the identified segments. In Class 1, the highest WTP values are recorded for eco-label (2.77 €/kg) and QR-code (2.72 €/kg), confirming the strong valuation of visual tools. Additionally, this segment places a notable premium on national certification (1.69 €/kg), whereas neither public nor private certifications achieve statistical significance.

Class 2 consumers, characterized by strong institutional trust, display the highest WTP for public certification (1.74 €/kg), certification issued in the producer country - EU member state (1.14 €/kg), and private certification (0.85 €/kg). In contrast, visual traceability tools, including the eco-label and QR-code, do not significantly influence their valuation.

Class 3, representing more price-sensitive and status quo-oriented consumers, shows moderate WTP values, with the highest premiums assigned to public certification (0.61 €/kg), eco-label (0.55 €/kg), and EU member state certification (0.52 €/kg).

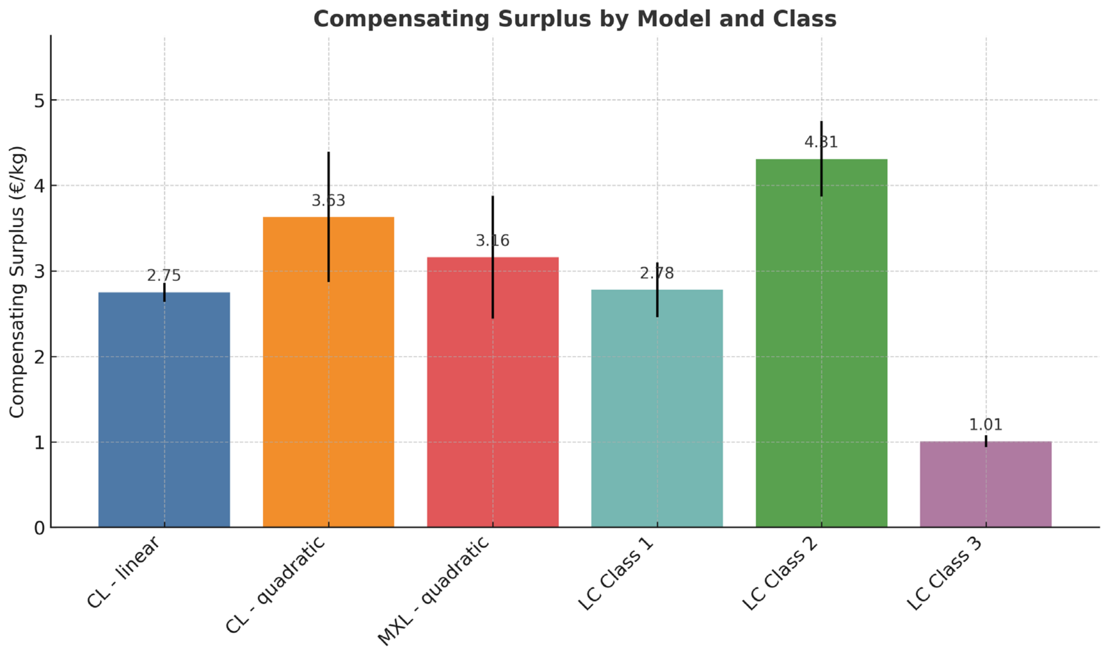
However, when the goal is to inform policy design, Compensating Surplus (CS) serves as a more appropriate and accurate indicator. It not only represents the value consumers place on specific attributes but also accounts for their WTP in response to changes in the current situation. Specifically, the compensating surplus (CS) represents the monetary amount, expressed in €/kg, that a respondent is willing to pay to shift from the reference scenario – where no certification or guarantee is provided – to an alternative product featuring a certification marked by a simple symbol evoking circular economy principles, issued by a public authority in the producer country (within an EU member state). This metric reflects the maximum amount consumers would be willing to pay above their current expenditure to obtain such certification while maintaining their existing level of utility. In other words, the CS captures the additional benefit consumers derive from receiving information that ensures product safety and aligns with European standards.

For the linear and quadratic Conditional Logit (CL) and quadratic Mixed Logit (MXL) models, CS was derived using manually constructed utility difference formulas that accounted for the full set of interaction terms – particularly between the status quo and socioeconomic or attitudinal characteristics – as well as the interaction between income and price. The results are presented in Figure 4.

The estimated compensating surplus for an Eco-label certified by a public body in the producer country is 2.75 €/kg in the linear CL model and increases to 3.63 €/kg when interaction effects are introduced in the quadratic CL specification. The MXL model produces a similar estimate of 3.16 €/kg, reflecting the average welfare gain while incorporating random preference heterogeneity. These results confirm that consumers place substantial value on certified and traceable products, particularly when endorsed by public institutions and supported by clear labelling. At the same time, the heterogeneity observed across models and segments highlights the importance of accounting for behavioural and sociodemographic variation in policy and market design.

In contrast, for the Latent Class (LC) model, CS was estimated with the Delta method, based on the indirect utility differences. This approach allows capturing the heterogeneity of welfare valuations across distinct preference segments.

The results reveal substantial variation in welfare estimates across the three latent



classes, reflecting the distinct preference structures identified in the econometric analysis.

Figure 4. Mean CS across models for an eco-label scheme, certified by a public body in the producer country. Error bars represent the Standard Errors
Source: own elaboration.

Class 1, characterized by significant responsiveness to traceability and explicit sustainability indicators (eco-label and QR-code), exhibits a significant compensating surplus of **2.78 €/kg**. Despite their preference for the status quo – no formal safety guarantees – this high welfare estimate underscores the substantial value these consumers assign to clear communication about reclaimed wastewater safety and transparency of irrigation practices.

Class 2, previously characterized as institutionally driven consumers with strong preferences for public certification and European/national origin, reports the highest compensating surplus, estimated at **4.31 €/kg**. This large welfare gain highlights their strong reliance on authoritative institutional assurances regarding the safety standards of reclaimed irrigation water. Their pronounced rejection of the status quo further illustrates the essential role that trusted certification plays in enhancing consumer welfare and promoting the acceptance of reclaimed wastewater use.

Class 3, in contrast, which is highly price-sensitive and cautious toward adopting certified alternatives, presents a modest compensating surplus of **1.01 €/kg**. Although moderately responsive to public certification and eco-labelling, their valuation of explicit safety information remains limited. For this segment, economic considerations predominantly shape preferences, making formal safety guarantees valuable only if closely associated with perceived economic benefits.

Overall, the results underscore the importance of differentiated communication strategies: while explicit information and transparency regarding the safety of the reuse practice significantly enhance welfare for some consumers (Class 1), authoritative institutional endorsements have greater resonance for others (Class 2), and economic affordability remains central for a more cautious and price-sensitive group (Class 3). These segment-specific valuations should be carefully taken into account by policymakers and market actors in designing tailored certification schemes and strategically promoting consumer acceptance of agricultural products irrigated with reclaimed wastewater, with explicit assurance of their safety.

4. Discussion

This study aimed to assess consumers' willingness to engage with, and pay for, a certification scheme that guarantees the safe reuse of wastewater in agricultural irrigation. Furthermore, it explored the impact of terminology – specifically the distinction between "reclaimed wastewater" and "regenerated water" – on consumer perception and purchasing behaviour.

The results reveal considerable variation in both consumer preferences and willingness to pay for certified guarantee of compliance with EU safety standards. Such heterogeneity in food purchase decision-making is well-established in previous experimental economics literature (Bazzani et al., 2020; Giannoccaro, Carlucci, et al., 2019; Gracia & de-Magistris, 2016; Greene & Hensher, 2013; Loureiro & Umberger, 2007; Wongprawmas & Canavari, 2017). In this respect, the different econometric models applied in this research consistently captured diverse preference structures, reinforcing the robustness of the findings.

The results support the study's primary hypothesis, demonstrating that the regulatory approach alone, even when accompanied by the implementation of a Risk Management Plan, is insufficient to foster public acceptance of wastewater reuse in agriculture. Consumers demand additional cue in the form of certification that inform and provide them with guarantee of law compliance. Moreover, a significant willingness to pay for certified products has been found, indicating that consumers seek formal, trustworthy, and easily verifiable means of Regulation (EU) 2020/741 accomplishment. These results are consistent with previous research highlighting that a hypothetical labelling policy indicating the safe reuse of wastewater on food would result in greater consumer welfare in the U.S. (Savchenko et al., 2019). By contrast, simple disclosure of information about water sources has been found to lower WTP, reinforcing the notion that poorly framed or insufficiently trustful information can jeopardise consumer acceptance (Li et al., 2018; Savchenko et al., 2018). These findings underscore the need for information that is transparent, accessible and, overall credible.

On the certification attributes, this study also provides key insights into the certification guarantee that consumers find most worthful. Respondents showed a clear preference for simple, recognisable eco-labels – especially those aligned with circular economy principles – over more demanding formats such as QR codes. While digital traceability systems are essential for ensuring transparency (Anastasiadis et al., 2022; Radini et al., 2023), they may be perceived as too technical for everyday use. Eco-labels, by contrast, offer immediate, intuitive reassurance, enhancing trust and influencing purchasing decisions.

The high compensating surplus associated with certified best option (i.e., public, at the EU eco-label) indicates that consumers value certification not only as a source of information, but as a signal of regulatory compliance and safety. This further supports the findings of (Savchenko et al., 2019), who showed that water reuse labelling could expand consumer welfare. Additionally, certification is perceived more credible when issued by public authorities and when originating from the country of production, likely due to perceptions of stronger regulatory oversight (Wu et al., 2021)

The second research hypothesis argued that the terminology used to describe the reuse of recycled water could influence consumer perception and food purchase decision-making regarding the purchase of food products irrigated with such water. The findings from the treatment analysis offer a support for the following result: the term "regenerated water" is associated with more favourable attitudinal responses compared to "reclaimed wastewater", particularly in reducing risk perception and emotional aversion (the so-called yuck factor). This is consistent with previous studies highlighting the impact of linguistic framing on public attitudes (Ellis et al., 2019; Menegaki et al., 2009). However, this perceptual shift was not reflected in the behavioural data. The econometric models did not detect a statistically significant influence of terminology on respondents' choices in the hypothetical market scenario.

The influence of individual attitudes, particularly risk perception and emotional aversion, on consumer acceptance of recycled water use in agriculture is well established in the literature as a significant determinant of food purchase decision-making (Dolnicar et al., 2010; Fielding & Roiko, 2014; Nancarrow et al., 2008; Price et al., 2015). In accordance with this, the present study integrated attitudinal dimensions into the choice models through psychometric components derived from principal component analysis. However, the "risk and information" component – capturing concerns related to scepticism toward water reuse – did not emerge as a statistically significant predictor of consumer behaviour. This contrasts with findings from other contexts, such as the study by Ahmmadi et al., (2021) in which risk perception was the strongest behavioural determinant in an extended Theory of Planned Behaviour framework applied to Iranian consumers. Their model showed that incorporating risk perception significantly improved explanatory power. Nevertheless, direct comparisons should be made with caution. Unlike most previous studies that analyse consumer preferences between products irrigated with conventional vs. "alternative" water, the present research employed a hypothetical choice experiment in which all options (also the status quo) involved recycled water, with the certification scheme acting as the key differentiating attribute. As such, the study shifts the analytical focus from product differentiation to the governance of standards accomplishment. Within this framework, concerns related to water safety and emotional aversion appear to be outweighed by other behavioural drivers – most notably, institutional trust.

The attitudinal component capturing confidence in information provided by public institutions and scientific authorities emerged as a statistically significant and positive predictor of consumer preference for certified options. This effect was particularly pronounced in Class 2, the segment exhibiting the highest willingness to pay, where institutional trust functions as a critical enabling condition for consumer engagement, especially in contexts involving innovative or potentially sensitive technologies such as wastewater reuse. This finding is consistent with previous studies that underscore the role of institutional trust in shaping attitudes towards water governance and food safety. As a matter of fact, a growing body of research underscores the central role of institutional trust in shaping public acceptance of water reuse. As shown across different studies, trust is fostered not only by the perceived competence of delivery institutions (Nkhoma et al., 2021) but also by transparent procedures and a sense of shared identity between the public and regulatory bodies (Ross et al., 2014). Moreover, trust functions as a key mediator between risk perception and behavioural acceptance, particularly in the context of potable reuse schemes (Ormerod & Scott, 2013).

The preference for certification issued by public authorities, as opposed to private or unfamiliar entities, highlights a broader societal demand for credibility, transparency, and institutional legitimacy, especially when consumers cannot directly verify product safety. As Dumortier et al., (2017) observe, trust in food labels is notably higher when certification comes from public institutions, and Smith et al., (2018) stress the role of institutional oversight in fostering confidence in sustainability claims. In this context, certification serves not merely as an informational tool, but as a governance mechanism that provides reassurance, particularly under conditions of uncertainty.

In addition, the results identify a younger and environmentally aware segment (Class 1) that, despite showing moderate satisfaction with to the status quo, expresses a marked preference for traceability tools and eco-symbols aligned with circular economy principles. For these consumers, environmental consciousness appears to mitigate some of the scepticism surrounding the use of recycled water in agriculture. This finding is consistent with evidence showing that consumers who are more engaged with environmental issues are also more responsive to eco-labels, particularly when these are perceived as credible and issued by public institutions (Testa et al., 2015).

In contrast, Class 3 represents a price-sensitive segment of consumers, characterised by the lowest willingness to pay for certified alternatives and limited responsiveness to sustainability signals. This attitude may reflect a broader distrust in certification schemes, particularly when environmental claims are perceived as superficial or strategically constructed. Research indicates that concerns about greenwashing – where sustainability labels are viewed as marketing tools lacking robust verification – can substantially erode consumer trust (Lyon & Montgomery, 2015; Testa et al., 2015). Such scepticism often results in the rejection of symbolic assurances, especially among consumers who prioritise affordability and remain unconvinced by institutional narratives or labelling efforts.

Regarding policy implications, this study – focusing on a certification scheme assuring the safe reuse of recycled water for irrigating table grapes – aligns with the strategic priorities of the European Circular Economy Action Plan (EC, 2020), which promotes water reuse to reduce freshwater dependency and enhance environmental resilience. As recent literature emphasises, the transition to circular water systems depends not only on technological solutions or regulatory frameworks, but also on the strength and coherence of institutional arrangements (Riazi et al., 2023). Institutional arrangements – including legal frameworks, governance structures, and coordination mechanisms – should not only guarantee technical safety and regulatory compliance, but also enable public trust, transparency, and stakeholder engagement, particularly where consumer acceptance is essential (López-Ruiz & González-Gómez, 2023; Riazi et al., 2023). Although the 2020 Action Plan represents progress over its 2015 predecessor, it still offers limited integration of water reuse objectives and insufficient attention to institutional barriers such as fragmented responsibilities, pricing uncertainty, and lack of participatory processes (Riazi et al., 2023)

This study contributes to this discussion by demonstrating how a publicly endorsed certification scheme, grounded in Regulation (EU) 2020/741 and risk management principles, can serve as a trust-building instrument – a function often underdeveloped in EU policy. As the findings suggest, trust in public and scientific institutions is a key driver of consumer support for recycled water use. However, fostering such trust requires more than legal compliance: it demands integrated governance, local responsiveness, and inclusive communication that treats consumers as active participants in the transition process (Forester, 1999; Abderrahman, 2000; EU, 2020).

Despite its valuable contribution to the literature on consumer behaviour regarding wastewater reuse, this study presents several limitations. While the observed high willingness to pay and compensating surplus values suggest a generally positive response to certification schemes ensuring compliance and risk management, such elevated figures may partly reflect hypothetical bias – a well-known limitation in stated preference methods (Caputo & Scarpa, 2022; Lusk & Hudson, 2004; Neill et al., 1994). Consequently, these estimates should be interpreted with caution, as participants stated preferences may not fully align with actual market behaviour. Moreover, although the choice experiment employed here is a well-established tool in consumer research, it inherently lacks the capacity to replicate real-world purchasing dynamics (Caputo & Scarpa, 2022). A notable strength of this study lies in its experimental design, which incorporates certification-related attributes linked to Regulation (EU) 2020/741, while also accounting for behavioural and psychological drivers, including trust and emotional responses. Nevertheless, the generalizability of the findings remains limited, as the research was conducted solely in Germany.

5. Conclusion

This thesis explored consumer preferences and behavioural responses to a certification scheme guaranteeing the safe reuse of recycled water in agriculture, with specific reference to table grape production. Through a discrete choice experiment and rigorous econometric estimation techniques, the analysis demonstrated that consumers place considerable value on a hypothetical certification guarantee, particularly when it is publicly endorsed and aligned with the principles of the circular economy. The findings of this research have shown that, while a regulatory framework is a fundamental prerequisite, it alone is not sufficient to enhance public acceptance. On the other hand, the new regulatory course, by establishing rigorous standards, provides the foundation for the implementation of market-based mechanisms, such as the one explored in this research.

The findings indicate that the acceptance of reclaimed water for irrigation is not solely determined by regulatory factors but is also significantly influenced by personal perceptions and beliefs, namely trust in institutions and environmental awareness. Therefore, results suggest that there are no one-size-fits-all solutions or generalizable recipes for fostering consumer acceptance. By issuing Regulation (EU) 2020/741, policymakers have paved the way for a unique regulation across Member States; however, a further step is needed to inform and guarantee the compliance with the law. Moreover, the findings reveal a consumer preference for a publicly issued certification guarantee, suggesting that an EU initiative would be worthwhile. This would also avoid private initiatives where an overuse of circular economy logo could be affected by greenwashing concerns.

Despite the inherent limitations of stated preference methods, the findings offer robust evidence that certification can bridge the gap between formal regulatory settlements and consumer expectations. The substantial compensating surplus associated with certified options suggests that consumers are willing to pay a premium for transparent and trustworthy information on law compliance, thereby providing a potential economic incentive also for producers.

Although linguistic framing, such as referring to water as “recycled” or “regenerated” rather than “reclaimed wastewater”, has a perceptual influence, its impact appears limited to consumers’ perception of health risk and disgust. Nonetheless, the favourable reception of these alternative terms underscores their value in risk communication strategies.

Overall, the findings support the adoption of certification schemes administered by competent public authorities as effective policy instruments for fostering consumer acceptance and facilitating the implementation of Regulation (EU) 2020/741. When embedded within inclusive and transparent governance frameworks, certification can help reduce information asymmetries, reinforce stakeholder engagement, and advance the transition towards a more circular and resilient water management.

References

Abderrahman, W. A. (2000). Urban water management in developing arid countries. *International Journal of Water Resources Development*, *16*(1), 7–20.

Abou-Shady, A., Siddique, M. S., & Yu, W. (2023). A Critical Review of Recent Progress in Global Water Reuse during 2019–2021 and Perspectives to Overcome Future Water Crisis. *Environments - MDPI*, *10*(9). https://doi.org/10.3390/environments10090159

Adamowicz, W., Louviere, J., & Williams, M. (1994). Combining revealed and stated preference methods for valuing environmental amenities. *Journal of Environmental Economics and Management*, *26*(3), 271–292.

Ahmmadi, P., Rahimian, M., & Movahed, R. G. (2021). Theory of planned behavior to predict consumer behavior in using products irrigated with purified wastewater in Iran consumer. *Journal of Cleaner Production*, *296*, 126359. https://doi.org/10.1016/j.jclepro.2021.126359

Ait-Mouheb, N., Mayaux, P. L., Mateo-Sagasta, J., Hartani, T., & Molle, B. (2020). Water reuse: A resource for Mediterranean agriculture. In *Water Resources in the Mediterranean Region*. Elsevier Inc. https://doi.org/10.1016/B978-0-12-818086-0.00005-4

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In *Action control: From cognition to behavior* (pp. 11–39). Springer.

Al-Saidi, M. (2021). From Acceptance Snapshots to the Social Acceptability Process: Structuring Knowledge on Attitudes Towards Water Reuse. *Frontiers in Environmental Science*, *9*(March), 1–15. https://doi.org/10.3389/fenvs.2021.633841

Alcon, F., Albaladejo-García, J. A., Zabala, J. A., Marín-Miñano, C., & Martínez-Paz, J. M. (2019). Understanding social demand for sustainable nature conservation. The case of a protected natural space in South-Eastern Spain. *Journal for Nature Conservation*, *51*(February), 125722. https://doi.org/10.1016/j.jnc.2019.125722

Alcon, F., Martin-Ortega, J., Berbel, J., & De Miguel, M. D. (2012). Environmental benefits of reclaimed water: An economic assessment in the context of the Water Framework Directive. *Water Policy*, *14*(1), 148–159. https://doi.org/10.2166/wp.2011.001

Alcon, F., Pedrero, F., Martin-Ortega, J., Arcas, N., Alarcon, J. J., & de Miguel, M. D. (2010). The non-market value of reclaimed wastewater for use in agriculture: A contingent valuation approach. *Spanish Journal of Agricultural Research*, *8*(SUPPL. 2), 1–6. https://doi.org/10.5424/sjar/201008s2-1361

Alcon, F., Zabala, J. A., & Martínez-Paz, J. M. (2022). Assessment of social demand heterogeneity to inform agricultural diffuse pollution mitigation policies. *Ecological Economics*, *191*(January 2021). https://doi.org/10.1016/j.ecolecon.2021.107216

Ali, S. A., Vivaldi, G. A., Tallou, A., Lopriore, G., Stellacci, A. M., Montesano, F. F., Mazzeo, A., Ferrara, G., Gadaleta, A., & Camposeo, S. (2024). Sustainability Potential of Marginal Areas for Food, Feed, and Non-Food Production in the Puglia Region, Southern Italy: Part II: A Review. *Agronomy*, *14*(3). https://doi.org/10.3390/agronomy14030472

Amfo, B., Donkoh, S. A., & Ansah, I. G. K. (2018). Determinants of consumer willingness to pay for certified safe vegetables. *International Journal of Vegetable Science*, *25*(1), 95–107. https://doi.org/10.1080/19315260.2018.1484836

Anastasiadis, F., Manikas, I., Apostolidou, I., & Wahbeh, S. (2022). The role of traceability in end-to-end circular agri-food supply chains. *Industrial Marketing Management*, *104*(May 2021), 196–211. https://doi.org/10.1016/j.indmarman.2022.04.021

Andrews, R. L., & Currim, I. S. (2003). A comparison of segment retention criteria for finite mixture logit models. *Journal of Marketing Research*, *40*(2), 235–243.

Aprile, M. C., Caputo, V., & Nayga Jr, R. M. (2012). Consumers' valuation of food quality labels: the case of the European geographic indication and organic farming labels. *International Journal of Consumer Studies*, *36*(2), 158–165.

Arborea, S., Giannoccaro, G., de Gennaro, B. C., Iacobellis, V., & Piccinni, A. F. (2017). Cost-benefit analysis of wastewater reuse in Puglia, Southern Italy. *Water (Switzerland)*, *9*(3), 1–17. https://doi.org/10.3390/w9030175

Arena, C., Genco, M., & Mazzola, M. R. (2020). Environmental benefits and economical sustainability of urban wastewater reuse for irrigation—a cost-benefit analysis of an existing reuse project in puglia, italy. *Water (Switzerland)*, *12*(10), 1–23. https://doi.org/10.3390/w12102926

ARERA. (2019). Autorità di regolazione per energia reti e ambiente. Tratto da https://www.arera.it/

Ati, S., Satpathy, S., & Saxena, S. (2024). Perceived public service performance, trust in the government, and citizens' willingness to participate: Evidence from water governance in Visakhapatnam, India. *Water Policy*, *26*(6), 618–634.

Barreiro-Hurle, J., Espinosa-Goded, M., Martinez-Paz, J. M., & Perni, A. (2018). Choosing not to choose: A meta-analysis of status quo effects in environmental valuations using choice experiments. *Economía Agraria y Recursos Naturales*, *18*(1), 79–109.

Barrio, M., & Loureiro, M. (2013). The impact of protest responses in choice experiments: an application to a Biosphere Reserve Management Program. *Forest Systems*, *22*(1), 94–105.

Bateman, I. J. (2002). *Economic valuation with stated preference techniques: a manual*. Edward Elgar.

Bazzani, C., Capitello, R., Ricci, E. C., Scarpa, R., & Begalli, D. (2020). Nutritional knowledge and health consciousness: Do they affect consumer wine choices? evidence from a survey in Italy. *Nutrients*, *12*(1). https://doi.org/10.3390/nu12010084

Ben-Akiva, M. E., & Lerman, S. R. (1985). *Discrete choice analysis: theory and application to travel demand* (Vol. 9). MIT press.

Ben-Akiva, M., Walker, J., Bernardino, A. T., Gopinath, D. A., Morikawa, T., & Polydoropoulou, A. (2002). Integration of choice and latent variable models. *Perpetual Motion: Travel Behaviour Research Opportunities and Application Challenges*, *2002*, 431–470.

Bennet, J., & Adamowicz, V. (2001). *Some fundamentals of environmental choice modelling. Chapter in J. Bennet and R. Blamey (Eds) The Choice Modelling Approach to Environmental Valuation*. Cheltenham: Edward Elgar.

Berbel, J., Mesa-Pérez, E., & Simón, P. (2023). Challenges for Circular Economy under the EU 2020/741 Wastewater Reuse Regulation. *Global Challenges*, *7*(7), 1–12. https://doi.org/10.1002/gch2.202200232

Birol, E., Koundouri, P., & Kountouris, Y. (2010). Assessing the economic viability of alternative water resources in water-scarce regions: Combining economic valuation, cost-benefit analysis and discounting. *Ecological Economics*, *69*(4), 839–847. https://doi.org/10.1016/j.ecolecon.2009.10.008

Bisselink, B., Bernhard, J., Gelati, E., Adamovic, Guenther, Mentaschi, L., Feyen, L., &

de Roo, A. (2020). Climate change and Europe's water resources. In *Publications Office of the European Union*. https://doi.org/10.2760/15553

Boxall, P. C., & Adamowicz, W. L. (2002). Understanding heterogeneous preferences in random utility models: a latent class approach. *Environmental and Resource Economics*, *23*, 421–446.

Brouwer, S., Maas, T., Smith, H., & Frijns, J. (2015). *Trust in Water Reuse Review report on international experiences in public involvement and stakeholder collaboration*. *1*(619040), 1–46.

Canaj, K., & Mehmeti, A. (2024). Unveiling drivers and barriers in advancing agricultural wastewater reuse in Southern Italy: A SWOT analysis informed by stakeholder insights. *Cleaner Water*, *1*, 100008. https://doi.org/https://doi.org/10.1016/j.clwat.2024.100008

Canaj, K., Morrone, D., Roma, R., Boari, F., Cantore, V., & Todorovic, M. (2021). Reclaimedwater for vineyard irrigation in a mediterranean context: Life cycle environmental impacts, life cycle costs, and eco-efficiency. *Water (Switzerland)*, *13*(16). https://doi.org/10.3390/w13162242

Canavari, M., Centonze, R., Hingley, M., & Spadoni, R. (2010). Traceability as part of competitive strategy in the fruit supply chain. *British Food Journal*, *112*(2), 171–186.

Caputo, V. (2020). Does information on food safety affect consumers' acceptance of new food technologies? The case of irradiated beef in South Korea under a new labelling system and across different information regimes. *Australian Journal of Agricultural and Resource Economics*, *64*(4), 1003–1033.

Caputo, V., Nayga Jr, R. M., & Scarpa, R. (2013). Food miles or carbon emissions? Exploring labelling preference for food transport footprint with a stated choice study. *Australian Journal of Agricultural and Resource Economics*, *57*(4), 465–482.

Caputo, V., & Scarpa, R. (2022). Methodological Advances in Food Choice Experiments and Modeling: Current Practices, Challenges, and Future Research Directions. *Annual Review of Resource Economics*, *14*, 63–90. https://doi.org/10.1146/annurev-resource-111820-023242

Caputo, V., Vassilopoulos, A., Nayga Jr, R. M., & Canavari, M. (2013). Welfare effects of food miles labels. *Journal of Consumer Affairs*, *47*(2), 311–327.

CBI, Ministry of Foreign Affairs. (2023, Febbraio). The European market potential for table grapes. Tratto da CBI - Market information, Ffresh Fruit and Vegetables, Table grapes: https://www.cbi.eu/market-information/fresh-fruit-vegetables/table-grapes/market-potential

Communication, E. C. D.-G. for. (2020). *Circular economy action plan – For a cleaner and more competitive Europe*. Publications Office of the European Union. https://doi.org/doi/10.2779/05068

Cruz, R. (2009). Medición del agua de riego. *Tecnicaña*, *34*, 27–33.

Darby, K., Batte, M. T., Ernst, S., & Roe, B. (2008). Decomposing local: A conjoint analysis of locally produced foods. *American Journal of Agricultural Economics*, *90*(2), 476–486.

DESTATIS . (2023, Giugno). Population. Tratto da https://www.destatis.de/EN/Themes/Society-Environment/Population/Current-Population/_node.html

DESTATIS. (2023). Employment. Tratto da https://www.destatis.de/EN/Themes/Labour/Labour-Market/Employment/_node.html

Directive, C. (1980). 80/778/EEC of 15 July 1980 Relating to the Quality of Water Intended for Human Consumption Official. *JL*, *229*, 30.

Directive, E. U. W. (1991). Council Directive of 21. May 1991 concerning urban waste water treatment (91/271/EEC). *J. Eur. Commun*, *34*, 40.

Dolgen, D., & Alpaslan, M. N. (2023). *Reuse of Wastewater from the Circular Economy (CE) Perspective BT - A Sustainable Green Future: Perspectives on Energy, Economy, Industry, Cities and Environment* (S. S. Oncel (ed.); pp. 385–408). Springer International Publishing. https://doi.org/10.1007/978-3-031-24942-6_18

Dolnicar, S., & Hurlimann, A. (2009). Drinking water from alternative water sources: differences in beliefs, social norms and factors of perceived behavioural control across eight Australian locations. *Water Science and Technology*, *60*(6), 1433–1444. https://doi.org/10.2166/wst.2009.325

Dolnicar, S., Hurlimann, A., & Grün, B. (2011). What affects public acceptance of recycled and desalinated water? *Water Research*, *45*(2), 933–943. https://doi.org/10.1016/j.watres.2010.09.030

Dolnicar, S., Hurlimann, A., & Nghiem, L. D. (2010). The effect of information on public acceptance - The case of water from alternative sources. *Journal of Environmental Management*, *91*(6), 1288–1293. https://doi.org/10.1016/j.jenvman.2010.02.003

Doria, M. (2010). Factors Influencing Public Perception of Drinking Water Quality. *Water Policy*, *12*. https://doi.org/10.2166/wp.2009.051

Drechsel, P., Scott, C. A., Raschid-Sally, L., Redwood, M., & Bahri, A. (2010). *Wastewater irrigation and health: assessing and mitigating risk in low-income countries*. International Water Management Institute.

Dumortier, J., Evans, K. S., Grebitus, C., & Martin, P. A. (2017). The Influence of Trust and Attitudes on the Purchase Frequency of Organic Produce. *Journal of International Food and Agribusiness Marketing*, *29*(1), 46–69. https://doi.org/10.1080/08974438.2016.1266565

Dunlap, R. E. (2008). The new environmental paradigm scale: From marginality to worldwide use. *The Journal of Environmental Education*, *40*(1), 3–18.

Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). New trends in measuring environmental attitudes: measuring endorsement of the new ecological paradigm: a revised NEP scale. *Journal of Social Issues*, *56*(3), 425–442.

Ellis, S. F., Savchenko, O. M., & Messer, K. D. (2019). What's in a name? Branding reclaimed water. *Environmental Research*, *172*(December 2018), 384–393. https://doi.org/10.1016/j.envres.2019.01.059

EU, C. (2019). *Communication from the commission to the european parliament, the european council, the council, the european economic and social committee and the committee of the regions*. COM/2019/640 Final. 2019. Available online: https://eur-lex. europa. eu ….

European Commission. (2019). The European green deal. COM (2019) 640 final. *Brussels*, *11*(12), 2019.

European Environmental Agency. (2021). *Water resources across Europe : confronting water stress : an updated assessment* (Issue 12).

European Environmental Agency. (2024). *Europe' s state of water 2024 The need for improved water resilience*. Luxembourg: Publications Office of the Europeans Union, 2024. https://doi.org/10.2800/02236

Directive 2000/60/EC, Directive 2000/60/EC of the European Parliament and of the

Council of 23 October 2000 establishing a framework for Community action in the field of water policy (2000).

European Parliament and The Council. (1998). Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption. In *Directive 98/78/EC of the European Parliament and Of The Council*.

European Parliament, R. 2020/741. (2020). REGULATION (EU) 2020/741 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 May 2020 on minimum requirements for water reuse. *L177*, *2019*(February 2019), 32–55.

Fao, F. (2018). Food and agriculture organization of the United Nations. *Rome, URL: Http://Faostat. Fao. Org*, 403.

Faria, D., Oliveira, A., Baeza, J. A., Saenz de Miera, B., Calvo, L., Gilarranz, M. A., & Naval, L. (2020). Sewage treatment using Aqueous Phase Reforming for reuse purpose. *Journal of Water Process Engineering*, *37*, 101413. https://doi.org/https://doi.org/10.1016/j.jwpe.2020.101413

Fatone, F. (2017). Studio di fattibilità per il riutilizzo ai fini irrigui delle acque reflue affinate licenziate dal depuratore a servizio dellabitato.

Field, B. C., & Field, M. K. (2002). *Environment Economics*. New York: McGraw-Hill Irwin.

Fielding, K. S., Dolnicar, S., & Schultz, T. (2018). Public acceptance of recycled water. *International Journal of Water Resources Development*, *35*(4), 551–586. https://doi.org/10.1080/07900627.2017.1419125

Fielding, K. S., Gardner, J., Leviston, Z., & Price, J. (2015). Comparing Public Perceptions of Alternative Water Sources for Potable Use: The Case of Rainwater, Stormwater, Desalinated Water, and Recycled Water. *Water Resources Management*, *29*(12), 4501–4518. https://doi.org/10.1007/s11269-015-1072-1

Fielding, K. S., & Roiko, A. H. (2014). Providing information promotes greater public support for potable recycled water. *Water Research*, *61*, 86–96. https://doi.org/10.1016/j.watres.2014.05.002

Fiori, L., Meloni, C., Montanaro, C., Valente, A., Mario, S. Di, & Ruberto, R. (2023). *ESPORTARE UVA DA TAVOLA IN ARABIA SAUDITA Impaginazione e grafica :*

Florides, F., Giannakoudi, M., Ioannou, G., Lazaridou, D., Lamprinidou, E., Loukoutos, N., Spyridou, M., Tosounidis, E., Xanthopoulou, M., & Katsoyiannis, I. A. (2024).

Water Reuse: A Comprehensive Review. *Environments - MDPI*, *11*(4). https://doi.org/10.3390/environments11040081

Forester, J. (1999). *The deliberative practitioner: Encouraging participatory planning processes*. Mit Press.

Giannoccaro, G., Arborea, S., de Gennaro, B. C., Iacobellis, V., & Piccinni, A. F. (2019). Assessing reclaimed urban wastewater for reuse in agriculture: Technical and economic concerns for Mediterranean regions. *Water (Switzerland)*, *11*(7). https://doi.org/10.3390/w11071511

Giannoccaro, G., Carlucci, D., Sardaro, R., Roselli, L., & De Gennaro, B. C. (2019). Assessing consumer preferences for organic vs eco-labelled olive oils. *Organic Agriculture*, *9*(4), 483–494. https://doi.org/10.1007/s13165-019-00245-7

Giannoccaro, G., Casieri, A., de Vito, R., Zingaro, D., & Portoghese, I. (2019). Impatti economici dell'interruzione del servizio irriguo consortile nell'area della capitanata (puglia). stima empirica per il pomodoro da industria nel periodo 2001-2016. *Aestimum*, *74*, 101–114. https://doi.org/10.13128/aestim-7382

Gioia, M., Mari, F., & Cardillo, C. (2012). Il valore della terra. Un contributo alla conoscenza del mercato italiano dei terreni agricoli attraverso i dati della RICA. *Quaderno - INEA*, 1–135.

Gracia, A., & de-Magistris, T. (2016). Consumer preferences for food labeling: What ranks first? *Food Control*, *61*, 39–46. https://doi.org/10.1016/j.foodcont.2015.09.023

Greene, W. H., & Hensher, D. A. (2003). A latent class model for discrete choice analysis: contrasts with mixed logit. *Transportation Research Part B: Methodological*, *37*(8), 681–698.

Greene, W. H., & Hensher, D. A. (2013). Revealing additional dimensions of preference heterogeneity in a latent class mixed multinomial logit model. *Applied Economics*, *45*(14), 1897–1902. https://doi.org/10.1080/00036846.2011.650325

Grey, D., Garrick, D., Blackmore, D., Kelman, J., Muller, M., & Sadoff, C. (2013). Water security in one blue planet: Twenty-first century policy challenges for science. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *371*(2002). https://doi.org/10.1098/rsta.2012.0406

Halkos, G., & Matsiori, S. (2018). Environmental attitudes and preferences for coastal zone improvements. *Economic Analysis and Policy*, *58*, 153–166.

Hanemann, W. M. (1984). Welfare evaluations in contingent valuation experiments with discrete responses. *American Journal of Agricultural Economics*, *66*(3), 332–341.

Hausman, J., & McFadden, D. (1984). Specification tests for the multinomial logit model. *Econometrica: Journal of the Econometric Society*, 1219–1240.

Hensher, D. A., Rose, J. M., & Greene, W. H. (2005). Applied choice analysis: A primer. In *Applied Choice Analysis: A Primer*. https://doi.org/10.1017/CBO9780511610356

Holmes, T. P., Adamowicz, W. L., & Carlsson, F. (2017). Choice Experiments. In P. A. Champ, K. J. Boyle, & T. C. Brown, A Primer on Nonmarket Valuation (p. 133-186).

Hoyos, D. (2010). The state of the art of environmental valuation with discrete choice experiments. *Ecological Economics*, *69*(8), 1595–1603.

ISMEA. (2024). ISMEA - Tendenze e dinamiche recenti. *Tendenze e Dinamiche Recenti*, *Frutta-F*, 1–14.

ISTAT. (2020). Settimo censimento Generale dellAgricoltura. Tratto da Istituto Nazionale di Statistica: https://www.istat.it/statistiche-per-temi/censimenti/agricoltura/7-censimento-generale/

Jaramillo, M. F., & Restrepo, I. (2017). Wastewater reuse in agriculture: A review about its limitations and benefits. *Sustainability (Switzerland)*, *9*(10). https://doi.org/10.3390/su9101734

Khalid, S., Shahid, M., Natasha, Bibi, I., Sarwar, T., Shah, A. H., & Niazi, N. K. (2018). A review of environmental contamination and health risk assessment of wastewater use for crop irrigation with a focus on low and high-income countries. *International Journal of Environmental Research and Public Health*, *15*(5), 1–36. https://doi.org/10.3390/ijerph15050895

Kilders, V., & Caputo, V. (2021). Is animal welfare promoting hornless cattle? Assessing consumer's valuation for milk from gene-edited cows under different information regimes. *Journal of Agricultural Economics*, *72*(3), 735–759.

Kirchherr, J., Piscicelli, L., Bour, R., Kostense-Smit, E., Muller, J., Huibrechtse-Truijens, A., & Hekkert, M. (2018). Barriers to the Circular Economy: Evidence From the European Union (EU). *Ecological Economics*, *150*, 264–272. https://doi.org/https://doi.org/10.1016/j.ecolecon.2018.04.028

Laboratorio REF. (2020, September). Riuso delle acque depurate in agricoltura: una scelta indifferibile. SPL Collana Ambiente, Acqua n. 158.

Lancaster, K. J. (1966). A New Approach to Consumer Theory. *Journal of Political Economy*, *74*(2), 132–157. https://doi.org/10.1086/259131

Lareau, T. J., & Rae, D. A. (1989). Valuing WTP for diesel odor reductions: an application of contingent ranking technique. *Southern Economic Journal*, 728–742.

Lazarova, V. (2013). Global milestones in water reuse: keys to success and trends in development. *Water*, *15*, 12–22.

Li, T., McCluskey, J. J., & Messer, K. D. (2018). Ignorance Is Bliss? Experimental Evidence on Wine Produced from Grapes Irrigated with Recycled Water. *Ecological Economics*, *153*(February), 100–110. https://doi.org/10.1016/j.ecolecon.2018.07.004

Liu, Y.-Y., & Haynes, R. J. (2011). Origin, nature, and treatment of effluents from dairy and meat processing factories and the effects of their irrigation on the quality of agricultural soils. *Critical Reviews in Environmental Science and Technology*, *41*(17), 1531–1599.

López-Ruiz, S., & González-Gómez, F. (2023). Regenerate and reuse water in Spain: Facts and politics. *Water Management and Circular Economy*, 177–196. https://doi.org/10.1016/B978-0-323-95280-4.00005-9

Loureiro, M. L., & Lotade, J. (2005). Do fair trade and eco-labels in coffee wake up the consumer conscience? *Ecological Economics*, *53*(1), 129–138.

Loureiro, M. L., & Umberger, W. J. (2007). A choice experiment model for beef: What US consumer responses tell us about relative preferences for food safety, country-of-origin labeling and traceability. *Food Policy*, *32*(4), 496–514. https://doi.org/10.1016/j.foodpol.2006.11.006

Louviere, J. J. (2000). *Stated choice methods: analysis and applications*. Cambridge University Press.

Louviere, J. J., Flynn, T. N., & Carson, R. T. (2010). Discrete choice experiments are not conjoint analysis. *Journal of Choice Modelling*, *3*(3), 57–72.

Louviere, J. J., & Hensher, D. A. (1983). Using discrete choice models with experimental design data to forecast consumer demand for a unique cultural event. *Journal of Consumer Research*, *10*(3), 348–361.

Louviere, J. J., & Woodworth, G. (1983). Design and analysis of simulated consumer choice or allocation experiments: an approach based on aggregate data. *Journal of Marketing Research*, *20*(4), 350–367.

Luce, R. D. (1959). *Individual choice behavior* (Vol. 4). Wiley New York.

Luce, R. D., & Tukey, J. W. (1964). Simultaneous conjoint measurement: A new type of fundamental measurement. *Journal of Mathematical Psychology*, *1*(1), 1–27.

Lusk, J. L., & Hudson, D. (2004). Willingness-to-pay estimates and their relevance to agribusiness decision making. *Applied Economic Perspectives and Policy*, *26*(2), 152–169.

Lyon, T. P., & Montgomery, A. W. (2015). The means and end of greenwash. *Organization & Environment*, *28*(2), 223–249.

Maddala, G. S. (1983). *Limited-dependent and qualitative variables in econometrics* (Vol. 149). Cambridge University Press.

Maffettone, R. ., & Gawlik, B. M. (2022). *Technical Guidance - Water Reuse Risk Management for Agricultural Irrigation Schemes in Europe*. Publications Office of the European Union. https://doi.org/10.2760/590804

Mannina, G., Gulhan, H., & Ni, B.-J. (2022). Water reuse from wastewater treatment: The transition towards circular economy in the water sector. *Bioresource Technology*, *363*, 127951. https://doi.org/10.1016/j.biortech.2022.127951

Manski, C. F. (1977). The structure of random utility models. *Theory and Decision*, *8*(3), 229.

Mariel, P., & Arata, L. (2022). Incorporating attitudes into the evaluation of preferences regarding agri-environmental practices. *Journal of Agricultural Economics*, *73*(2), 430–451. https://doi.org/10.1111/1477-9552.12456

Mariel, P., Artabe, A., Liebe, U., & Meyerhoff, J. (2024). An assessment of the current use of hybrid choice models in environmental economics, and considerations for future applications. *Journal of Choice Modelling*, *53*, 100520.

Mariel, P., Hoyos, D., Meyerhoff, J., Czajkowski, M., Dekker, T., Glenk, K., Bredahl Jacobsen, J., Liebe, U., Bøye Olsen, S., Sagebiel, J., & Thiene, M. (2021). *Environmental Valuation with Discrete Choice Experiments Guidance on Design, Implementation and Data Analysis*.

McClaran, N., Behe, B. K., Huddleston, P., & Fernandez, R. T. (2020). Recycled or reclaimed? The effect of terminology on water reuse perceptions. *Journal of Environmental Management*, *261*, 110144. https://doi.org/https://doi.org/10.1016/j.jenvman.2020.110144

McFadden, D. (1972). *Conditional logit analysis of qualitative choice behavior*.

Menegaki, A. N., Hanley, N., & Tsagarakis, K. P. (2007). The social acceptability and valuation of recycled water in Crete: A study of consumers' and farmers' attitudes. *Ecological Economics*, *62*(1), 7–18. https://doi.org/10.1016/j.ecolecon.2007.01.008

Menegaki, A. N., Mellon, R. C., Vrentzou, A., Koumakis, G., & Tsagarakis, K. P. (2009). What's in a name: Framing treated wastewater as recycled water increases willingness to use and willingness to pay. *Journal of Economic Psychology*, *30*(3), 285–292. https://doi.org/10.1016/j.joep.2008.08.007

Mesa-Jurado, M. A., Martin-Ortega, J., Ruto, E., & Berbel, J. (2012). The economic value of guaranteed water supply for irrigation under scarcity conditions. *Agricultural Water Management*, *113*, 10–18. https://doi.org/10.1016/j.agwat.2012.06.009

Mikhailovich, K. (2009). Wicked Water: Engaging with Communities in Complex Conversations about Water Recycling. *EcoHealth*, *6*(3), 324–330. https://doi.org/10.1007/s10393-010-0296-z

Mirás-Avalos, J. M., & Intrigliolo, D. S. (2017). Grape composition under abiotic constrains: Water stress and salinity. *Frontiers in Plant Science*, *8*(May), 1–8. https://doi.org/10.3389/fpls.2017.00851

Mirra, L., De Gennaro, B. C., & Giannoccaro, G. (2021). Farmer evaluation of irrigation services. Collective or self-supplied? *Land*, *10*(4), 1–15. https://doi.org/10.3390/land10040415

Morris, J. C., Georgiou, I., Guenther, E., & Caucci, S. (2021). Barriers in Implementation of Wastewater Reuse: Identifying the Way Forward in Closing the Loop. *Circular Economy and Sustainability*, *1*(1), 413–433. https://doi.org/10.1007/s43615-021-00018-z

Nancarrow, B. E., Leviston, Z., Po, M., Porter, N. B., & Tucker, D. I. (2008). What drives communities' decisions and behaviours in the reuse of wastewater. *Water Science and Technology*, *57*(4), 485–491.

Nancarrow, B. E., Leviston, Z., & Tucker, D. I. (2009). Measuring the predictors of communities' behavioural decisions for potable reuse of wastewater. *Water Science* *and Technology*, *60*(12), 3199–3209. https://doi.org/10.2166/wst.2009.759

Neill, H. R., Cummings, R. G., Ganderton, P. T., Harrison, G. W., & McGuckin, T. (1994). Hypothetical surveys and real economic commitments. *Land Economics*, 145–154.

Nelson, P. (1970). Information and Consumer Behavior. *Journal of Political Economy*, *78*(2), 311–329. https://doi.org/10.1086/259630

Nkhoma, P. R., Alsharif, K., Ananga, E., Eduful, M., & Acheampong, M. (2021). Recycled water reuse: what factors affect public acceptance? *Environmental Conservation*, *48*(4), 278–286. https://doi.org/10.1017/S037689292100031X

Nocella, G., Boecker, A., Hubbard, L., & Scarpa, R. (2012). Eliciting consumer preferences for certified animal-friendly foods: can elements of the theory of planned behavior improve choice experiment analysis? *Psychology & Marketing*, *29*(11), 850–868.

Ofori, S., Puškáčová, A., Růžičková, I., & Wanner, J. (2021). Treated wastewater reuse for irrigation: Pros and cons. *Science of the Total Environment*, *760*. https://doi.org/10.1016/j.scitotenv.2020.144026

Onozaka, Y., & McFadden, D. T. (2011). Does local labeling complement or compete with other sustainable labels? A conjoint analysis of direct and joint values for fresh produce claim. *American Journal of Agricultural Economics*, *93*(3), 693–706.

Ormerod, K. J., & Scott, C. A. (2013). Drinking wastewater: Public trust in potable reuse. *Science, Technology, & Human Values*, *38*(3), 351–373.

Papoutsi, G. S., Nayga Jr, R. M., Lazaridis, P., & Drichoutis, A. C. (2015). Fat tax, subsidy or both? The role of information and children's pester power in food choice. *Journal of Economic Behavior & Organization*, *117*, 196–208.

Peschel, A. O., Grebitus, C., Steiner, B., & Veeman, M. (2016). How does consumer knowledge affect environmentally sustainable choices? Evidence from a cross-country latent class analysis of food labels. *Appetite*, *106*, 78–91. https://doi.org/10.1016/j.appet.2016.02.162

Po, M., Kaercher, J. D., & Nancarrow, B. E. (2003). Literature Review of Factors Influencing Public Perceptions of Water Reuse. *CSIRO Land and Water Technical Report*, *54*(03), 1–44.

Po, M., Nancarrow, B. E., Leviston, Z., Porter, N. B., Syme, G. J., & Kaercher, J. D.

(2005). Water for a Healthy Country Predicting Community Behaviour in Relation to Wastewater Reuse. *CSIRO Water for a Healthy Country Flagship Report*, *April 2014*, 128.

Pollice, A., Caldrola, C. G., Liberti, A., Monterisi, A., & Tondi, F. (2016). Il riuso delle acque in agricoltura in Puglia. *Progetto DEMOWARE*.

Price, J., Fielding, K. S., Gardner, J., Leviston, Z., & Green, M. (2015). Developing effective messages about potable recycled water: The importance of message structure and content. *Water Resources Research*, *51*(4), 2174–2187. https://doi.org/https://doi.org/10.1002/2014WR016514

Procházková, M., Touš, M., Horňák, D., Miklas, V., Vondra, M., & Máša, V. (2023). Industrial wastewater in the context of European Union water reuse legislation and goals. *Journal of Cleaner Production*, *426*, 139037. https://doi.org/https://doi.org/10.1016/j.jclepro.2023.139037

PTA Regione Puglia. (2022). Piano di Tutela delle Acque, aggiornamento 2015-2021. Riuso delle acque reflue depurate.

Radini, S., González-Camejo, J., Andreola, C., Eusebi, A. L., & Fatone, F. (2023). Risk management and digitalisation to overcome barriers for safe reuse of urban wastewater for irrigation – A review based on European practice. *Journal of Water Process Engineering*, *53*(January). https://doi.org/10.1016/j.jwpe.2023.103690

Rae, D. A. (1983). The value to visitors of improving visibility at Mesa Verde and Great Smoky National Parks. In *Managing air quality and scenic resources at national parks and wilderness areas* (pp. 217–234). Routledge.

Riazi, F., Fidélis, T., & Teles, F. (2023). Fostering the transition to water reuse: the role of institutional arrangements in the European union circular economy action plans. In *Water Management and Circular Economy* (pp. 427–450). Elsevier.

Ricart, S., Rico, A. M., & Ribas, A. (2019). Risk-yuck factor nexus in reclaimed wastewater for irrigation: Comparing farmers' attitudes and public perception. *Water (Switzerland)*, *11*(2). https://doi.org/10.3390/w11020187

Riera, P., Signorello, G., Tiene, M., Mahieu, P. A., Navrud, S., Kaval, P., Rulleau, B., Mavsar, R., Madureira, L., & Meyerhoff, J. (2012). Non-market valuation good practice guidelines proposal for forest goods and services. *Journal of Forest Economics*, *18*, 259–270.

Rock, C., Solop, F. I., & Gerrity, D. (2012). Survey of statewide public perceptions regarding water reuse in Arizona. *Journal of Water Supply: Research and Technology-Aqua*, *61*(8), 506–517. https://doi.org/10.2166/aqua.2012.070

Roselli, L., Casieri, A., de Gennaro, B. C., Sardaro, R., & Russo, G. (2020). Environmental and economic sustainability of table grape production in Italy. *Sustainability (Switzerland)*, *12*(9). https://doi.org/10.3390/su12093670

Ross, V. L., Fielding, K. S., & Louis, W. R. (2014). Social trust, risk perceptions and public acceptance of recycled water: Testing a social-psychological model. *Journal of Environmental Management*, *137*, 61–68. https://doi.org/10.1016/j.jenvman.2014.01.039

Ruberto, M., Catini, A., Lai, M., & Manganiello, V. (2021). The impact of irrigation on agricultural productivity : the case of FADN farms in Veneto. In *Economia agro-alimentare : XXIII, 3, 2021*. Franco Angeli. https://doi.org/10.3280/ecag2021oa12779

Ryan, A. M., & Spash, C. L. (2012). The awareness of consequences scale: an exploration, empirical analysis, and reinterpretation. *Journal of Applied Social Psychology*, *42*(10), 2505–2540.

Saliba, R., Callieris, R., D'Agostino, D., Roma, R., & Scardigno, A. (2018). Stakeholders' attitude towards the reuse of treated wastewater for irrigation in Mediterranean agriculture. *Agricultural Water Management*, *204*(February), 60–68. https://doi.org/10.1016/j.agwat.2018.03.036

Sapkota, A. R. (2019). Water reuse, food production and public health: Adopting transdisciplinary, systems-based approaches to achieve water and food security in a changing climate. *Environmental Research*, *171*, 576–580. https://doi.org/https://doi.org/10.1016/j.envres.2018.11.003

Savchenko, O. M., Kecinski, M., Li, T., Messer, K. D., & Xu, H. (2018). Fresh foods irrigated with recycled water: A framed field experiment on consumer responses. *Food Policy*, *80*(October), 103–112. https://doi.org/10.1016/j.foodpol.2018.09.005

Savchenko, O. M., Li, T., Kecinski, M., & Messer, K. D. (2019). Does food processing mitigate consumers' concerns about crops grown with recycled water? *Food Policy*, *88*(September), 101748. https://doi.org/10.1016/j.foodpol.2019.101748

Scarpa, R., & Rose, J. M. (2008). Design efficiency for non-market valuation with choice modelling: how to measure it, what to report and why. *Australian Journal of Agricultural and Resource Economics*, *52*(3), 253–282.

Serio, F., Miglietta, P. P., Lamastra, L., Ficocelli, S., Intini, F., De Leo, F., & De Donno, A. (2018). Groundwater nitrate contamination and agricultural land use: A grey water footprint perspective in Southern Apulia Region (Italy). *Science of The Total Environment*, *645*, 1425–1431. https://doi.org/https://doi.org/10.1016/j.scitotenv.2018.07.241

Singh, P. K., Deshbhratar, P. B., & Ramteke, D. S. (2012). Effects of sewage wastewater irrigation on soil properties, crop yield and environment. *Agricultural Water Management*, *103*, 100–104. https://doi.org/https://doi.org/10.1016/j.agwat.2011.10.022

Small, K. A., & Rosen, H. S. (1981). Applied welfare economics with discrete choice models. *Econometrica: Journal of the Econometric Society*, 105–130.

Smith, H. M., Brouwer, S., Jeffrey, P., & Frijns, J. (2018). Public responses to water reuse – Understanding the evidence. *Journal of Environmental Management*, *207*, 43–50. https://doi.org/10.1016/j.jenvman.2017.11.021

Smith, V. K., & Desvousges, W. H. (1986). *Measuring water quality benefits* (Vol. 3). Springer Science & Business Media.

Stern, P. C., Dietz, T., & Guagnano, G. A. (1995). The new ecological paradigm in social-psychological context. *Environment and Behavior*, *27*(6), 723–743.

Tauro, E., Mirra, L., Russo, S., Valentino, G., Carone, D., & Giannoccaro, G. (2024). Economic analysis of irrigation services. An application of the hedonic price method on the FADN data. *Rivista Di Economia Agraria*, *79*, 49–60. https://doi.org/10.36253/rea-14361

Testa, F., Iraldo, F., Vaccari, A., & Ferrari, E. (2015). Why eco-labels can be effective marketing tools: Evidence from a study on Italian consumers. *Business Strategy and the Environment*, *24*(4), 252–265.

Train, K. E. (1998). Recreation demand models with taste differences over people. *Land Economics*, 230–239.

Train, K. E. (2009). *Discrete choice methods with simulation*. Cambridge university press.

Tsagarakis, K. P., Mellon, R. C., Stamataki, E., & Kounalaki, E. (2007). Identification of recycled water with an empirically derived symbol increases its probability of use. *Environmental Science and Technology*, *41*(20), 6901–6908. https://doi.org/10.1021/es0627491

Tyllianakis, E., & Ferrini, S. (2021). Personal attitudes and beliefs and willingness to pay to reduce marine plastic pollution in Indonesia. *Marine Pollution Bulletin*, *173*(PB), 113120. https://doi.org/10.1016/j.marpolbul.2021.113120

UNESCO. (2021). *The United Nations world water development report 2021: valuing water*. United Nations.

Van Loo, E. J., Caputo, V., & Lusk, J. L. (2020). Consumer preferences for farm-raised meat, lab-grown meat, and plant-based meat alternatives: Does information or brand matter? *Food Policy*, *95*, 101931.

Verlicchi, P., Al Aukidy, M., Galletti, A., Zambello, E., Zanni, G., & Masotti, L. (2012). A project of reuse of reclaimed wastewater in the Po Valley, Italy: Polishing sequence and cost benefit analysis. *Journal of Hydrology*, *432–433*, 127–136. https://doi.org/10.1016/j.jhydrol.2012.02.024

Vivaldi, G. A., Zaccaria, D., Camposeo, S., Pasanisi, F., Salcedo, F. P., & Portoghese, I. (2022). Appraising water and nutrient recovery for perennial crops irrigated with reclaimed water in Mediterranean areas through an index-based approach. *Science of the Total Environment*, *820*. https://doi.org/10.1016/j.scitotenv.2021.152890

Voulvoulis, N. (2018). Water reuse from a circular economy perspective and potential risks from an unregulated approach. *Current Opinion in Environmental Science & Health*, *2*, 32–45. https://doi.org/https://doi.org/10.1016/j.coesh.2018.01.005

Water Reuse Europe. (2018). Water Reuse Europe Review 2018 Board of Directors. *Water Reuse Europe*.

Wedel, M., & Kamakura, W. A. (2000). *Market segmentation: Conceptual and methodological foundations*. Springer Science & Business Media.

Wessels, M. T. (2023). What's in a Name? Politicising Wastewater Reuse in Irrigated Agriculture. *Water Alternatives*, *16*(2), 563–580.

WHO. (2011). Guidelines for drinking-water quality. *WHO Chronicle*, *38*(4), 104–108.

Winpenny, J., Heinz, I., Koo-Oshima, S., Salgot, M., Collado, M., Hérnadez, F., & Torricelli, R. (2017). *Reutilización del agua en la agricultura : ¿ Beneficios para todos ? Reutilización del agua en la agricultura : ¿ Beneficios para todos ?*

Wongprawmas, R., & Canavari, M. (2017). Consumers' willingness-to-pay for food safety labels in an emerging market: The case of fresh produce in Thailand. *Food Policy*, *69*, 25–34. https://doi.org/10.1016/j.foodpol.2017.03.004

Wu, W., Zhang, A., van Klinken, R. D., Schrobback, P., & Muller, J. M. (2021). Consumer Trust in Food and the Food System: A Critical Review. *Foods (Basel, Switzerland)*, *10*(10). https://doi.org/10.3390/foods10102490

Yang, C.-C., & Yang, C.-C. (2007). Separating latent classes by information criteria. *Journal of Classification*, *24*(2), 183–203.

Yi, L., Jiao, W., Chen, X., & Chen, W. (2011). An overview of reclaimed water reuse in China. *Journal of Environmental Sciences*, *23*(10), 1585–1593. https://doi.org/https://doi.org/10.1016/S1001-0742(10)60627-4

Young, R. A., & Loomis, J. B. (2014). *Determining the Economic Value of Water* (R. Economics (ed.)).

Appendix

Survey for "reclaimed wastewater" (control group)[5], block 1 of the choice set.

Dear Participant,

You are invited to participate in this survey, carried out by the University of Bari "Aldo Moro" - Italy, aimed at exploring public perceptions and preferences regarding the safe use of reclaimed wastewater in agricultural production.

Water reclamation involves treating urban wastewater, sewage, or industrial wastewater to get alternative water source for irrigation.

Your participation is entirely voluntary, and there are no right or wrong answers. Your answers will be anonymous and will be used only for research purposes in accordance with current legislation*.

The survey is expected to take approximately **10 minutes** to complete.

By sharing your opinions and preferences, you will contribute with valuable information that can support the development of this study aimed at enhancing sustainability of agricultural products.

If you have any questions, concerns, or require further information about the survey or your participation, please do not hesitate to contact the primary researcher at eleonora.tauro@uniba.it.

** The data provided here will be managed in accordance with current legislation (European Union Regulation 2016/679 of 27 April on the protection of individuals regarding the processing of personal data and the free movement of such data and Organic Law 3/2018 of 5 December on the Protection of Personal Data and the guarantee of digital rights).*

[5] For the treatment group, the same questionnaire was used but the term "reclaimed wastewater" was replaced with "regenerated water".

SECTION 1: CONSUMERS SHOPPING HABITS

1. On average, how many table grapes did you consume over the last year?
    - Less than 2kg/per year
    - Between 2 and less than 4 kg/per year
    - Between 4 and 6 kg/per year
    - More than 6 kg/per year
    - I don't know/I don't remember

2. How much did you pay for table grapes at the last purchase time?
    - Less than 3 EUR/kg
    - Between 3 and 5 EUR/kg
    - More than 6 EUR/kg
    - I only consume table grapes outside (e.g., restaurant, catering, canteen, etc.)

3. Do you usually buy fresh fruits and vegetables with some of the following certification labels?
    - Organic farming
    - Rainforest alliance
    - Carbon or water footprint
    - Sustainable agriculture
    - None/ I don't know

4. How much do you weekly spend on – considering all family members with you, purchasing fresh fruits and vegetables?
    - Less than 50 EUR a week
    - Between 51 – 100 EUR a week
    - Between 101 – 150 EUR a week
    - More than 150 EUR a week

5. Where does table grapes you largely buy come from?

- From an EU member state
- From a non-EU member state
- I'm not sure; I don't really keep track of origin

SECTION 2: Psychometric statements

Now, please rate the following statements on a scale from1 to 7, with 1 being "Strongly disagree" and 7 "Strongly agree".

1	2	3	4	5	6	7
Strongly disagree	**Disagree**	**Somewhat disagree**	**Neither Agree nor Disagree**	**Somewhat agree**	**Agree**	**Strongly agree**

Statements	
I am aware of the global issue of water scarcity and its implications for society and the natural ecosystem.	1 2 3 4 5 6 7
Human activities have a relevant impact on the environment.	1 2 3 4 5 6 7
Promoting eco-friendly food consumption habits is necessary.	1 2 3 4 5 6 7
I believe that implementing the reuse of reclaimed wastewater for irrigation can alleviate pressure on water resources.	1 2 3 4 5 6 7
I trust the scientific and technological knowledge concerning the treatment and reuse of reclaimed wastewater for irrigation.	1 2 3 4 5 6 7
I trust the information provided by the local authorities about how reclaimed wastewater is treated and reused for irrigation.	1 2 3 4 5 6 7
I trust the information provided by national authorities on how reclaimed wastewater is treated and reused for irrigation.	1 2 3 4 5 6 7
I trust the information provided by European authorities on how reclaimed wastewater is treated and reused for irrigation.	1 2 3 4 5 6 7
I believe consuming fresh fruits and vegetables grown using reclaimed wastewater does not pose health risks for me.	1 2 3 4 5 6 7
I feel disgusted thinking about eating fresh fruits and vegetables grown with reclaimed wastewater for irrigation.	1 2 3 4 5 6 7
It doesn't matter sources of irrigation water come from.	1 2 3 4 5 6 7
Ensuring environmental preservation for future generations is of utmost importance.	1 2 3 4 5 6 7

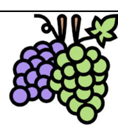
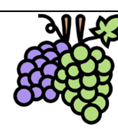
In my choice of food, I prefer environmentally friendly production.	1	2	3	4	5	6	7
I am willing to change my behaviour to protect the environment.	1	2	3	4	5	6	7
In my choice of food, I pay attention for information labels.	1	2	3	4	5	6	7

SECTION 3: CHOICE EXPERIMENT

Given the mounting pressure on water resources fuelled by climate change, in some agricultural areas across the European Union reclaimed wastewater for irrigation has been already reused. Although foods comply with EU Regulation 2020/741's safety requirements, consumers are not provided with information about the reuse of reclaimed wastewater for irrigation.

Therefore, we propose a voluntary certification tool for agricultural produce grown with reclaimed wastewater for irrigation. The certification aims to make farming practices transparent and to raise awareness among citizens about the safety and sustainability of European supply food chain.

Hereafter, you will be faced with table grapes grown within European Union for which safe reuse of reclaimed wastewater for irrigation is certified in different ways. Characteristics of the suggested certification tool intended to table grape is explained in the following table.

Characteristics	 **Alternative A**	 **Alternative B**
Certification label	Circular economy **label** certifying that the reclaimed wastewater used for irrigation of table grapes complies with the safety standards by Reg. 2020/741.	**QR code** by which you can get information on actors involved, analyses and controlling procedures implemented to achieve the safety standards by Reg. 2020/741.

Nature of Certification body	Public Fulfillment of safety standards laid down by Reg. 2020/741 is certified by a **public body.**	Private Fulfillment of safety standards laid down by Reg. 2020/741 is certified by a **private body**.
Location of Certification body	National Compliance with the safety standards laid down by Reg. 2020/741 is issued at the selling country, in **Germany**.	EU member state Compliance with the safety standards laid down by Reg. 2020/741 is issued at the production country, within a **European Union Member State**.
Extra price	This is the added price - on one kilogram of table grape usually eaten - for getting such information on grapes produced with reclaimed wastewater within European Union.	

Now, imagine you're shopping for table grapes and notice a Circular Economy Label claiming that the grapes have been safely grown with reclaimed wastewater. Picture you also being able to scan a QR code to learn more about the actors involved and analyses and control procedures to achieve the safety standards by Reg. 2020/741. **Keeping in mind the price of the European Union's table grape you currently pay for, which option do you prefer*?**

**We kindly remind you that choosing alternative "C" means choosing a table grape without any kind of information in case the reclaimed wastewater for irrigation has been used.*

Card 1[6]

	A	B	C
Certification label		None	None of these
Nature of Certification body	Private	Private	
Location of Certification body	National	EU member state	
Extra price	0.25 €/kg	0.75 €/kg	0 €/kg
Which do you prefer?	□	□	□

Card 2

	A	B	C
Certification label	None		None of these
Nature of Certification body	Public	Private	
Location of Certification body	EU member state	Unspecified	
Extra price	1.50 €/kg	0.50 €/kg	0 €/kg
Which do you prefer?	□	□	□

[6] The six cards presented refer to the first block of the experimental design.

Card 3

	A	B	C
Certification label			None of these
Nature of Certification body	Private	Unspecified	
Location of Certification body	Unspecified	Unspecified	
Extra price	1.50 €/kg	0.25 €/kg	0 €/kg
Which do you prefer?	☐	☐	☐

Card 4

	A	B	C
Certification label			None of these
Nature of Certification body	Unspecified	Public	
Location of Certification body	Unspecified	EU member state	
Extra price	0.25 €/kg	1.25 €/kg	0 €/kg
Which do you prefer?	☐	☐	☐

Card 5

	A	B	C
Certification label	None		None of these
Nature of Certification body	Private	Public	
Location of Certification body	Unspecified	EU member state	
Extra price	1.25 €/kg	1.00 €/kg	0 €/kg
Which do you prefer?	☐	☐	☐

Card 6

	A	B	C
Certification label		None	None of these
Nature of Certification body	Private	Public	
Location of Certification body	National	EU member state	
Extra price	0.50 €/kg	1.50 €/kg	0 €/kg
Which do you prefer?	☐	☐	☐

PROTESTER QUESTIONS SECTION[7]

1. What prompts your consistent preference for choosing option C?

- o I doubt reclaimed wastewater reuse can effectively provide benefits to the environment.
- o I don't believe in food certification labels.
- o I think it is the responsibility of public authorities to cover all additional costs.
- o I prefer not to know which type of water is used.
- o I doubt that water scarcity could become a significant problem in my region.
- o I wouldn't buy any agricultural produce grown with reclaimed wastewater.
- o Others____

SECTION 4: SOCIODEMOGRAPHIC INFORMATION

1. Age:

____

2. Gender:
   - o Male
   - o Female

3. Highest Level of Education Completed:

[7] These questions were only shown to those who always selected option C

- Lower Secondary education
- Upper Secondary/Post-Secondary education (Includes high schools, technical schools, and vocational schools or preparing courses for employment)
- Bachelor's degree (or equivalent)
- Master's degree (or equivalent)
- Doctoral degree: Advanced programs leading to a PhD or equivalent.
- None of the above / I have no school diploma

4. Current job position:
   - Student
   - Unemployed
   - Self-employed
   - Hired employee.
   - Retired

5. Monthly income considering whole household unit:
   - Less than 1.500€
   - 1.501-2.500€
   - 2.501-4.000€
   - 4.001-6.000€
   - More than 6.001€
   - Do not know/Do not answer

6. How many members are in your household (including yourself)? _______

7. And how many are children (less than 16 years)? ______

8. Are you member or supporting person for environmental campaign?
   - Yes
   - No

9. Is this the first time you've heard of reclaimed wastewater for irrigation?

- o Yes
- o No

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IV.5 “Dottorati su tematiche Green”