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Brief Description	This document provides detailed information on the updated requirements of the end-users in the framework of HYDROUSA project. The deliverable aims to investigate the requirements and specifications of the users regarding water management and water treatments.
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EXECUTIVE SUMMARY

The purpose of deliverable *D5.3: Updated user requirements and specifications definition* is to present the methodology and the outcome of the activities that took place for fine tuning and updating the initial user requirements from the end user perspective. The user requirements were focused in each demonstration area of HYDROUSA project (six demonstration sites located in three islands - Tinos, Lesbos and Mykonos). This information was gathered through open co-creation activities and namely co-creation workshops and questionnaire surveys that were organized by the project partners in the demonstration sites, with the participation of key stakeholders and the general public. This is the updated version of the user requirements and specifications, which were elicited during the first year of the project and documented in *D5.2: User requirements and specifications definition*.

The document is describing the reasons for carrying out co-creation activities, the methodology that was followed at each one and a summary of the overall results obtained from the survey activity.

Questionnaires were delivered in all 3 islands, where participants assisted in the assessment of their requirements and specifications. More specifically, 19 end-users participated in the survey in Lesbos Island, 14 in Mykonos Island and 27 in Tinos Island. Participants were aware of the need to save water and exploit collected and/or treated water/wastewater for several domestic and agricultural purposes. They were also interested in the process of water/wastewater treatment, rainwater harvesting, water distribution and storage, as well as in devices for measuring water quality and quantity.

Participants were also willing to adopt new technologies, autonomous systems, sensors and applications, while they attached significance to irrigation and especially precision irrigation. Regarding personal use of collected/treated rainwater, that involves direct body contact with the processed water, end-users appeared to be skeptical. On the other hand, they highlighted the significance of collecting and using water. However, they also stated that they were not widely informed and interested on innovative solutions such as irrigation algorithms.

All the activities were employed with local stakeholders at each demonstration site in Greek language. Each questionnaire included a brief description about the technologies that will be implemented in the specific demonstration site (demo site). The collected data were analyzed using both qualitative and quantitative techniques for ensuring precision, reliability and integrity of the results.

The results will lead to the development of the integrated HYDROUSA platform, both in terms of software and hardware components, which will be able to cover the different needs of its end-users on using reclaimed and recycled water in a broad spectrum of applications (e.g. agricultural irrigation, non-potable domestic use). Finally, the results of this deliverable will contribute to the development of commercial solutions for monitoring and controlling water loops in various applications with emphasis on decentralized, remote areas.

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1. INTRODUCTION

The main aim of the user requirements and specifications definitions survey is to verify the consistency of HYDROUSA project activities, related with the development of integrated systems for monitoring and controlling water loops, with the effective needs of the local stakeholders (at each demonstration site) that will be the end-users of HYDROUSA systems developed in the area.

Understanding the user requirements is an essential part of information systems design, while it is very critical to the success of interactive systems (N. Bevan et al., 2018). Despite its complexity, the significance of monitoring and controlling water loops through ICT solutions is demonstrated by the broad research conducted regarding water management (J. Park et al, 2020). A precise survey of the user requirements can provide an in-depth analysis and understanding of the different needs of the different stakeholders in each demonstration island area. Consequently, user requirements analysis provides accurate descriptions of the content, functionality and quality demanded by prospective users. The benefits of this approach can include increased productivity, enhanced quality of work, reductions in support and training costs, and improved user satisfaction (M. Maguire et al., 2002).

There are many possible methods that can be used to elicit user requirements and specifications, such as scenario building, conditionalizing, hedging etc (Glenn J. Browne and Michael B. Rogich, 2001). In the current survey, a combination of techniques such as generating arguments and counterarguments was utilized. In this way, apart from understanding user requirements, a clarification of requirements that need further elicitation can be achieved.

2. METHODOLOGY

Three demo sites were established on three islands (Tinos, Lesbos and Mykonos). In the two demo site (Tinos, Lesbos) farmers, local authorities, crop advisors, technical support services and inhabitants participated in the project events and co-creation workshops that took place in each island creating a community of representative end-users. Due to Covid-19 restrictions, in Mykonos demo site, the co-creation workshop did not took place, and the surveys were given to the local end-users.

Before the co-creation workshops, HYDROUSA consortium identified the main features in which the contribution of local stakeholders will play a crucial role in the development of the systems. Then the questionnaires to submit to end-users in the demonstration areas were prepared. This was followed by the organization of local co-creation workshop at Tinos and Lesbos demo sites aiming to get preliminary feedback about the current practices in irrigation and domestic use of water, their expectations and remarks on the proposed systems. At the end of the two organized co-creation workshops, the questionnaires were distributed to the participants. In the case of Mykonos, due to problems caused by the outbreak of the pandemic by Covid-19 in Greece, questionnaires were distributed to the end-users of the project without the organization of a co-creation workshop.

The questionnaires aimed to identify the needs in each demonstration site. Approximately 20 questionnaires were distributed to end-users in each site. Questions included: demographics, the information and the interaction with HYDROUSA platform, ICT infrastructure, how they use water resources in agriculture, the importance of each system that will be developed at every demonstration area, existing technologies used for agriculture and domestic use of water, the features that end-users require for increased efficacy etc.

After analyzing the results, concrete ideas and needs were extracted and evaluated. Additionally, the requirements and tolerance levels of the provided capabilities and functions of HYDROUSA systems will be specified and the qualitative analysis of the results will ensure precision and integrity.

2.1 Preparation of the questionnaires

In each HYDRO site there was an initial analysis on requirements and specifications at the beginning of the project. These preliminary specifications emerged after discussions with local stakeholders in combination with the needs of the individual systems of the project. These specifications were recorded into special sheets, which were used as questionnaires during the HYDROUSA technical tour, for validating these specifications and for identifying any possible deficiencies. During the technical tour, AGENSO staff met with users and stakeholders of the various sites and conducted interviews to identify their needs based on the preliminary specifications, but also to identify additional information and requirements after investigating the test sites. Stakeholders and users from the demo sites, established in Mykonos, Lesbos and Tinos Islands, answered questions related to the water/wastewater treatment system that will be developed in each demo site. The interviews were structured in such a way, to respond to the different needs of every system, as it was derived through the description of each HYDRO site.

The first report on user requirements was based on the consortium members and the local stakeholders. However, it was really important to identify the needs of the final end-users, the way they use water, the information they require, the importance of the several systems that will be developed and how they will confront all these innovations. For this reason, three different

questionnaires were prepared. AGENSO in collaboration with HYDROUSA partners was responsible for the development of the questionnaires. Based on the specifications that came out from the technical tour, it was required to have more information from the end-users of each demo site. For this reason, three different questionnaires were prepared. AGENSO in collaboration with HYDROUSA partners was responsible for the creation of the questionnaires. The first report on user requirements was based on the consortium members and the local stakeholders. However, it was really important to identify the needs of the final end-users, the way they use water, the information they require, the importance of the several systems that will be developed and how they will confront all these innovations.

Each questionnaire for the end-users began with a description of the aim, followed by an abstract for each demo site describing what will be developed at each specific area also giving a schematic presentation of the systems. After making the stakeholders familiar with the systems of HYDROUSA, the questions section started. Each questionnaire was divided into six sections (Table 2.1):

Table 2.1 Question categories in the questionnaire

CATEGORY		NUMBER OF QUESTIONS
I.	**Demographics**	6 questions
II.	**General questions**	10 questions
III.	**General questions about the development of HYDROUSA systems**	3 questions
IV.	**Hardware of HYDROUSA**	9 questions
V.	**HYDROUSA platform**	8 questions
VI.	**Importance of HYDROUSA project**	1 question

In total 39 questions were proposed including guided and non-guided answers. The second section of the questionnaires differentiates between the demo sites because of the different systems that are developed in each area.

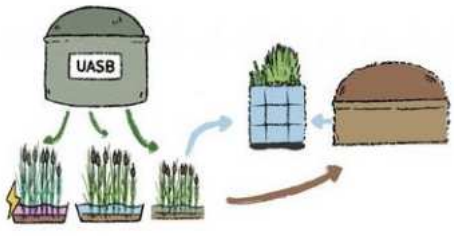

Figure 2.1 Schematic presentation of water treatment system in HYDRO1

2.2 HYDRO1 & 2, Antissa, Lesbos

The first demonstration area HYDRO1 is established in Antissa, Lesbos Island. A sewage treatment system is developed for achieving water reuse and biogas production. Specifically, the Upflow Anaerobic Sludge Blanket Reactor - UASB technology is applied, in which biogas is first produced and then upgraded to methane, which can be valorized as a fuel. The UASB effluent is treated by a two stage sub-surface vertical constructed wetland. This system produces cheap reclaimed water and therefore increases the water supply. It also recycles the nutrients contained in sewage. During the dry period no wastewater is discharged into the sea. A schematic of the installation of the different components of HYDRO1 is presented in Figure 2.1.

HYDRO2 is also established on Lesbos Island. The irrigation water used for this system is nutrient-rich treated effluent of HYDRO1 and is used to cultivate 1 ha of land in an agroforestry system. In this system, variety of plants are cultivated: forestry trees for fruit and timber production, orchards/bushes, herbs and annual crops as well as goji berries and aromatic plants for essential oil production (Figure 2.2).

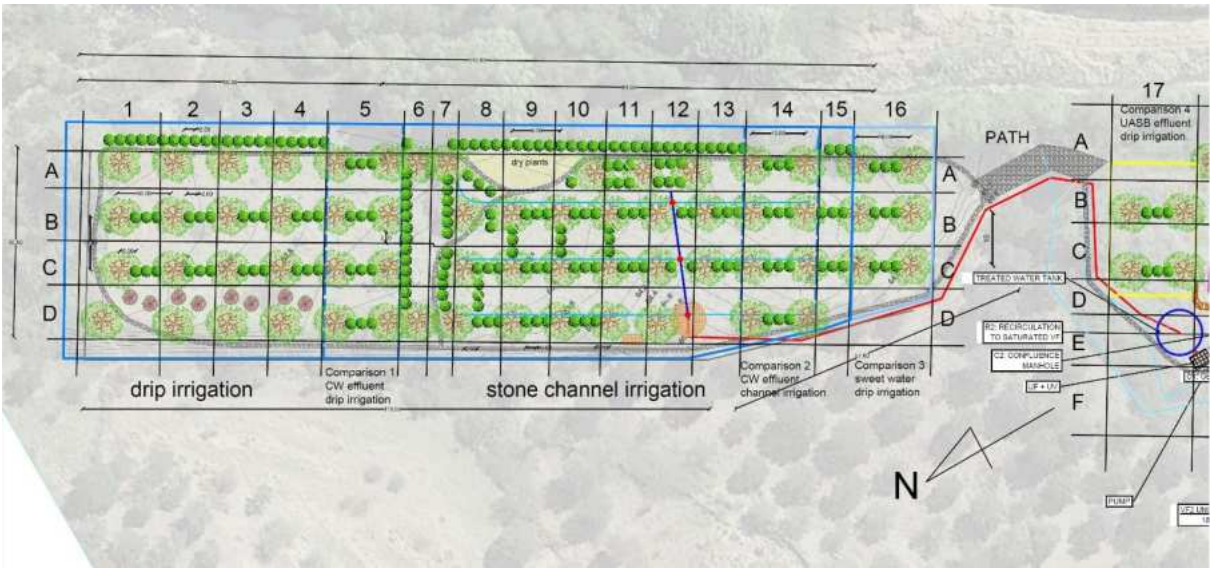

Figure 2.2 Schematic presentation of the HYDRO2 demo site

2.2.1 Co-creation workshop & questionnaires

In the co-creation workshop conducted in Lesbos Island, participants constituted of builders, farmers, teachers, local authorities and artists (Figure 2.3). After a preliminary introduction to the project, participants provided input on designing the agroforestry system. This approach aimed to the proper definition of the needs and interests of locals, taking into account regional plants, old water catchment techniques and fencing and use the ancient knowledge of people in the islands to preserve the heritage of the landscape of the island.

Figure 2.3 Co-creation workshop in Lesbos

2.3 HYDRO3 & 4, Mykonos

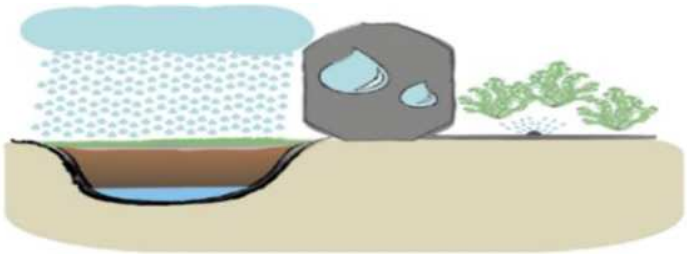

Figure 2.4 The subsurface system in HYDRO3

At the third demo site in Mykonos (HYDRO3), an innovative rainwater harvesting system is implemented in a remote area without house roofs. Rainwater is collected with a sub-surface collection system. This water is used to irrigate 0.4 ha of oregano. This cultivation was selected because of its low water demands (Figure 2.4).

At HYDRO4 site, a rainwater harvesting system of domestic residences already existed and was upgraded through the HYDROUSA project. Rainwater is harvested for domestic use, for aquifer storage and watering of local crops. With this system the problem of salinization is reduced. Then the water is used to irrigate a 0.2 ha of lavender. Lavender was selected because of its popular essential oils. (Figure 2.5).

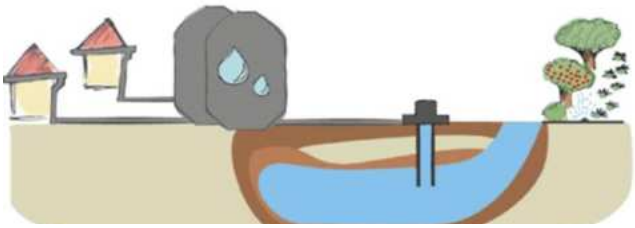

Figure 2.5 Domestic rainwater harvest system in HYDRO4

2.3.1 Co-creation workshop & questionnaires

Unfortunately, due to Covid-19 pandemic outbreak, the implementation of the co-creation workshop in Mykonos Island was impossible. As a result, questionnaires were answered through personal interviews. The number of end-users that participated was 14.

2.4 HYDRO5 & 6, Tinos

At HYDRO5 a solar desalination plant is treating seawater and brine from the existing desalination plant. This system is producing fresh (sweet) water and salt. Furthermore fresh water is used to irrigate a greenhouse to grow tropical fruits, consequentially reducing fruit imports (Figures 2.6 and 2.7).

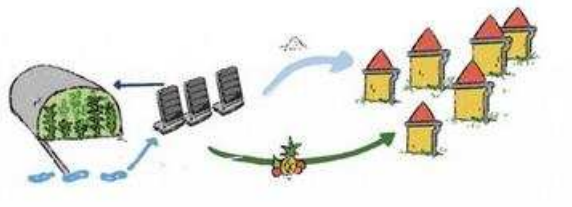

Figure 2.6 Schematic presentation of the desalination system in HYDRO5

Figure 2.7 Desalination system coupled with the tropical greenhouse

At HYDRO6, water loops are integrated within a remote eco-tourist facility. This includes production of drinking water from vapor water, the treatment of greywater and rainwater harvesting. The reclaimed water is used to irrigate 0.15 ha of local crops and all the activities of the system are powered using renewable energy. This system acts as a decentralized solution for water and nutrient cycles: there is no fertilizer import; little external water supply is needed and almost full sufficiency for food production is achieved (Figure 2.8).

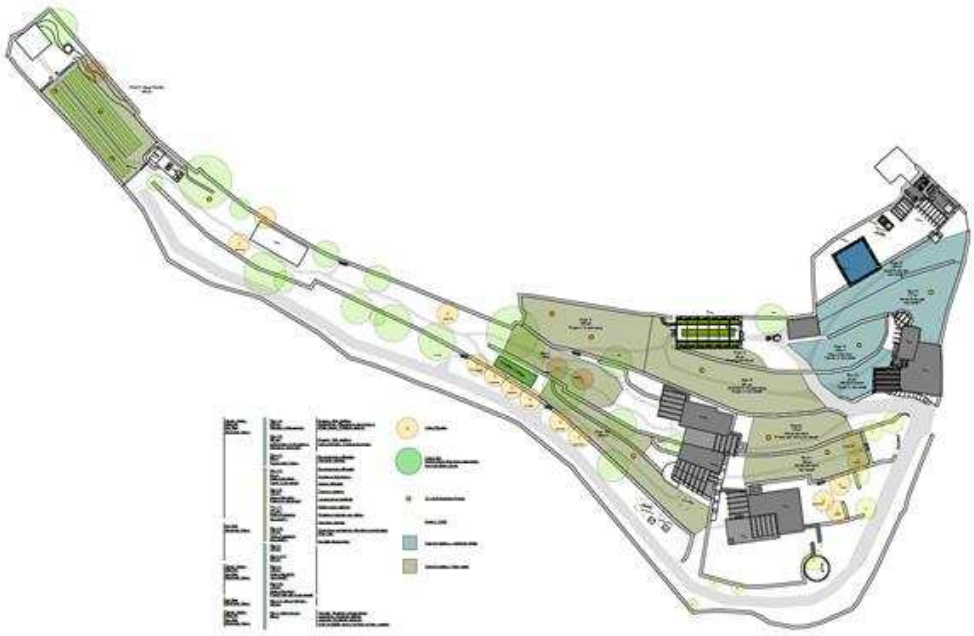

Figure 2.8 The setup of the eco-tourist facility along with HYDRO6 systems

2.4.1 Co-creation workshop & questionnaires

The co-creation workshop in Tinos Island took place at the Cultural Foundation of Tinos and was organized by Impact Hub Athens (Figure 2.9). Many end-users and stakeholders participated, including farmers, agronomists, entrepreneurs, local government representatives, builders, artists and educators. The participants of the workshop were key-target audience for the exploitation of the project and will be the beneficiaries of the systems that HYDROUSA develops.

The workshop was carried out using the World Café methodology, which encouraged the participants to discuss about several issues related with water management that the island faces. At the end of the workshop the questionnaires were distributed in order to record the needs of the participants related with the Information and Communication Technologies and the parameters that must be measured for monitoring and controlling the reclaimed water in Tinos Island. All the participants answered the questions helping to better implement the systems of demo sites HYDRO5 and HYDRO6.

Figure 2.9 Co-creation workshop in Tinos

3. ANALYSIS OF THE COLLECTED DATA

3.1 HYDRO1 AND HYDRO2 – LESBOS ISLAND

In the framework of the current report for Lesbos island a survey for the investigation of user requirements was performed through a questionnaire (as shown in Annex section) with a total of 19 participants. All 19 participants were residents of the Island.

Demographics (Questions 3-8)

In the this part of the report, participants were asked to reply to questions about their age, gender, level of education, their access on the internet and their representative category (i.e., domestic, agricultural, commercial user etc).

Regarding the age of the participants, 31% belongs to the group of 18-34 years old, 32% to the group of 65+ and 16% to the group of 45-54 years old, while another 21% belongs to the group of 35-44 years old (Figure 3.1).

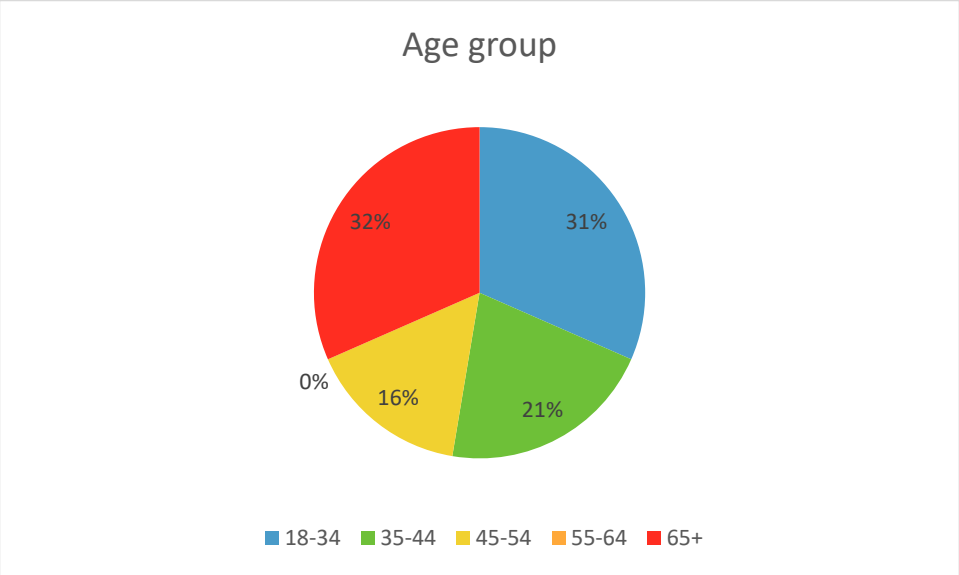

Figure 3.1 Age of participants based on 4 distinct age groups

Concerning the gender of the participants, 83% of them were men and 17% of them women (Figure 3.2).

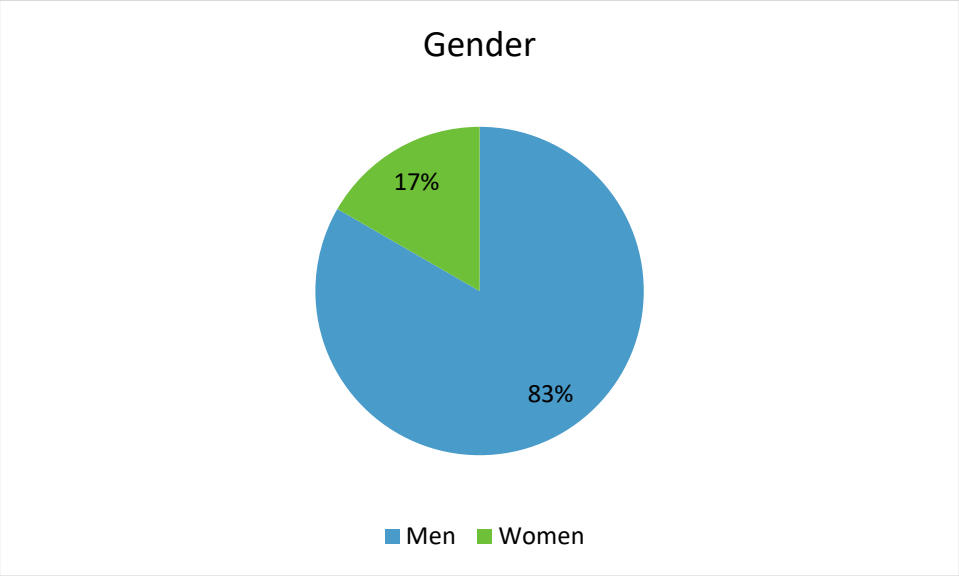

Figure 3.2 Classification of participants based on their gender

The level of education of the participants was also monitored based on a classification in 4 representative categories: primary education, secondary education, graduate and post-graduate/PhD. Based on the results, one out of two end-users (47%) have secondary level education. The second half of the end-users are divided in the other three categories; 16% have primary level education, 21% are graduates and 16% are post graduates (Figure 3.3).

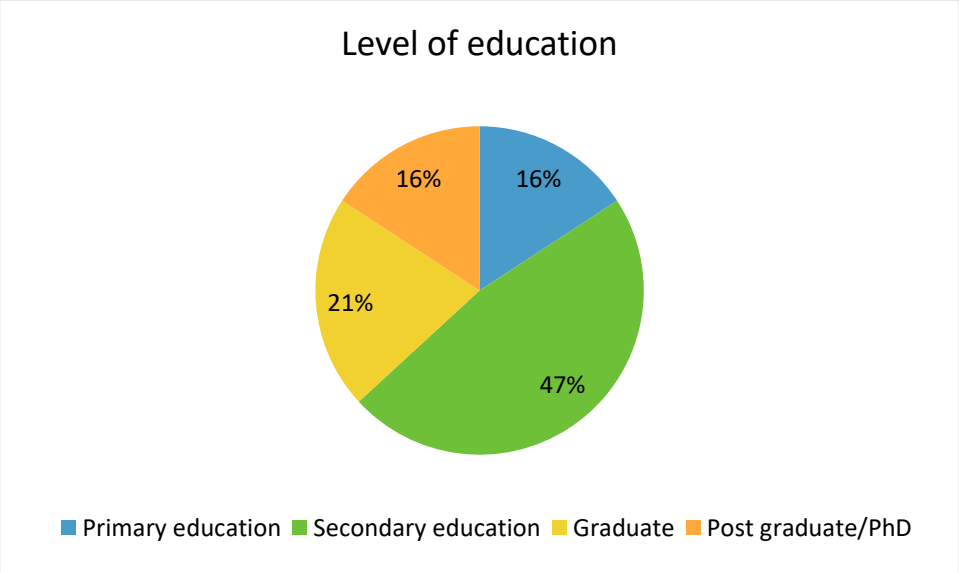

Figure 3.3 Classification of participants based on their level of education

Subsequently, participants were asked to point out their representative category, depending on the way they use water. A 61% of the participants declared they are domestic users, 39% agricultural users, and 5% commercial users (Figure 3.4).

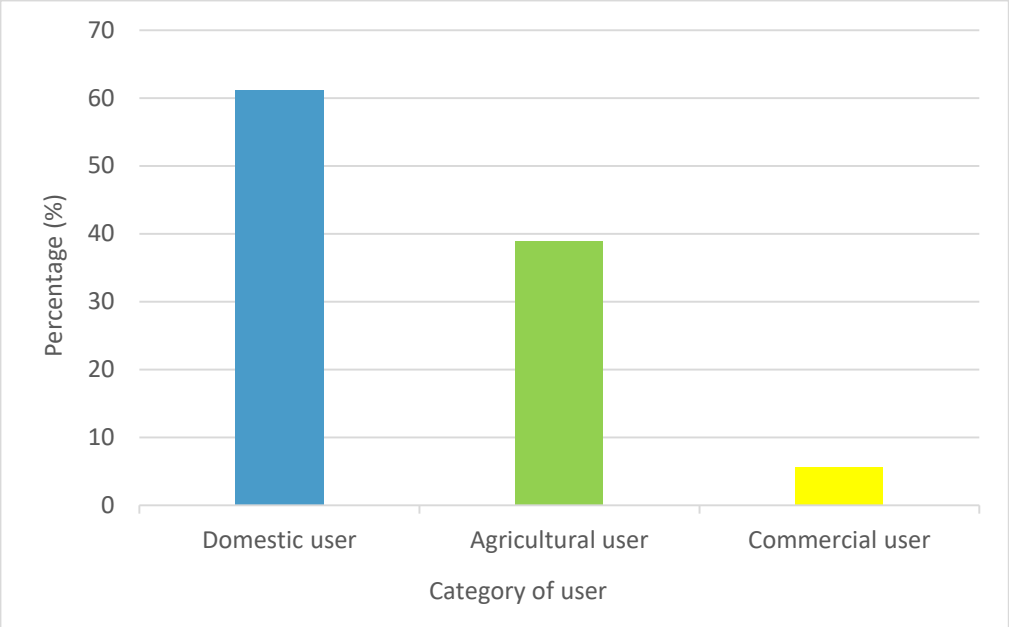

Figure 3.4 Classification of participants based on the way they use water

Afterwards, participants were asked to reply on the devices they use to access the internet, with the possible answers to include personal computer (desktop), a tablet, or a smartphone and the scenario of having no internet access at all. The analysis of their answers highlighted that the vast majority of the participants accessed the internet via a smartphone in a percentage exceeding 65% (Figure3.5). Apart from the smartphone, 17% of the participants use a tablet in order to access the internet and 33% use a personal computer (Figure 3.5).

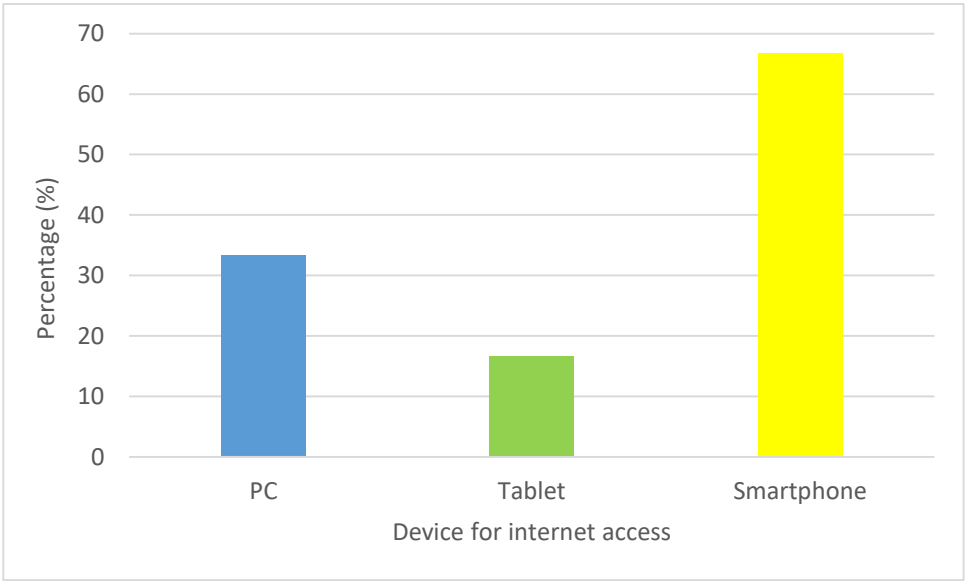

Figure 3.5 Type of device used by the participants for accessing the internet

General Personal Questions (Questions 9-18)

In the current part of the survey, participants were asked to reply to questions about their perception regarding:

- The importance of saving water, reusing water purified by biological treatment, collecting treated wastewater for irrigation purposes, establishing an agroforestry bio community that will use biologically treated wastewater and the importance of using treated wastewater in herb cultivation and essential oil production.
- The significance of methane production destined for exploitation as fuel, through biological treatment of wastewater.
- Opinion regarding the significance of precision irrigation.
- The importance of using treated wastewater for several purposes.
- Their interference with the use of technologies in order to monitor water quantity and quality.

The analysis of the questions of the participants indicated that all participants highlighted the importance of saving water to a certain extent. More specifically, almost half of the end-users (42%), declared they consider water saving as very important and 37% of the participants as important. Only 21% characterized saving water as of little importance (Figure 3.6). No participants stated that they attach no importance on saving water.

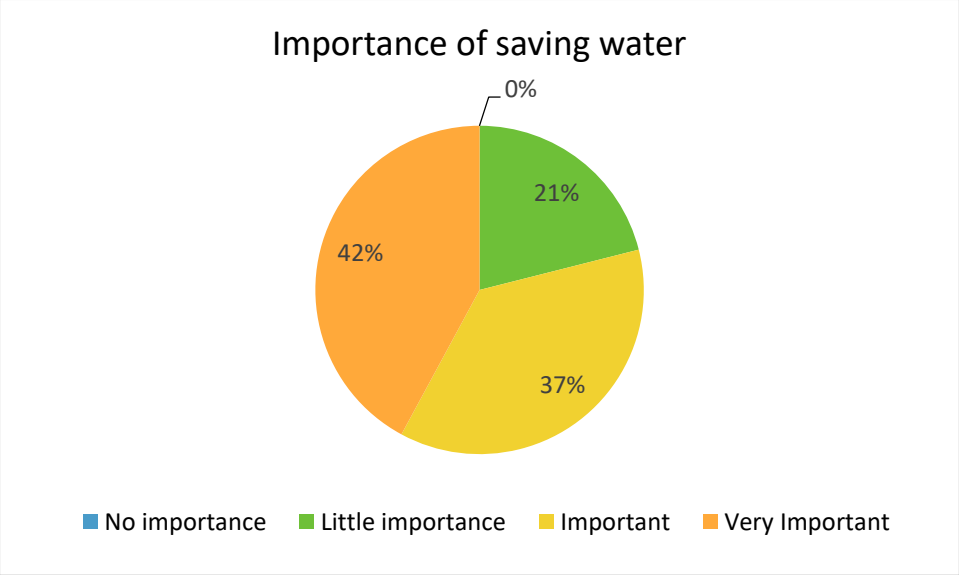

Figure 3.6 Perception of participants regarding the importance of saving water

Regarding the perception of participants on the importance of reusing treated wastewater purified by biological treatment, none of the participants answered that it is not considered important (Figure 3.7). Most of the participants (47%) considered reusing treated wastewater as of little importance, 21% as important and 32% as very important (Figure 3.7). No participants stated that they attach no importance on reusing treated wastewater.

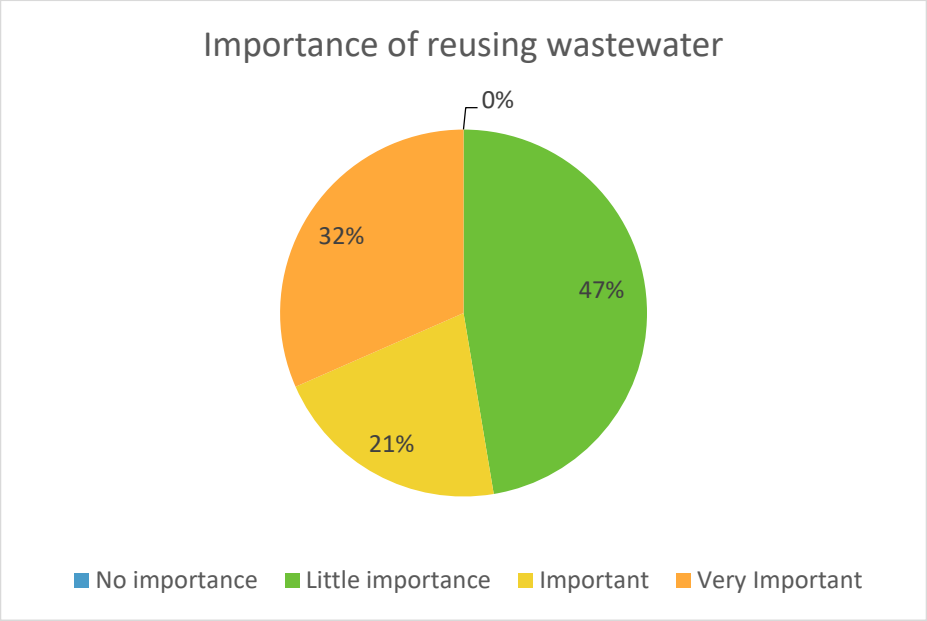

Figure 3.7 Perception of participants regarding the importance of reusing treated wastewater after biological treatment

In addition to that, participants were asked to evaluate the importance of collecting and storing wastewater, in order to use it for irrigation, after biological treatment. One out of two participants (53%) stated that it is important to collect and store treated wastewater for irrigation needs (Figure 3.8). One third of the participants (31%) characterized it as slightly important, and 16% as very important respectively (Figure 3.8). No participants stated that they consider this as not important.

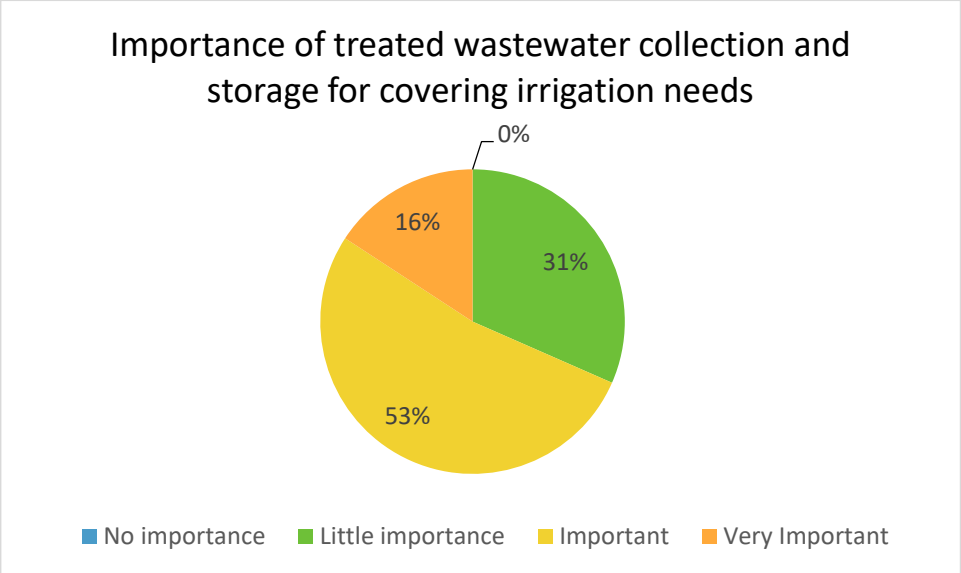

Figure 3.8 Perception of participants regarding the importance of collecting and storing treated wastewater, in order to use it for irrigation purposes after biological treatment

Apart from the exploitation of wastewater, the end-users were asked about their perception regarding the importance of the establishment of an agroforestry biocommunity that will use biologically treated wastewater. Only 16% of the participants stated that the establishment of such a biocommunity is

slightly important, while 47% that it is important. A percentage of 37% of the participants characterized it as very important (Figure 3.9). No participants stated that they consider this as not important.

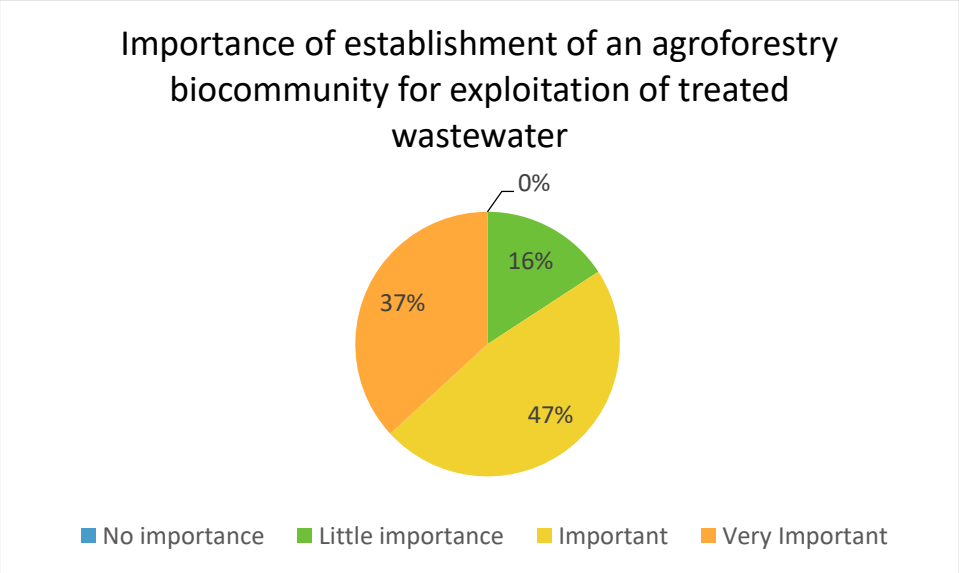

Figure 3.9 Perception of participants regarding the importance of establishing an agroforestry biocommunity that will exploit treated wastewater

When asked about the importance of using treated wastewater in herb cultivation, 47% of the participants stated it is very important to collect and use treated wastewater in herbs cultivation and essential oil production (Figure 3.10); 37% of the end-users characterized it as important, while only 16% characterized it as slightly important (Figure 3.10).

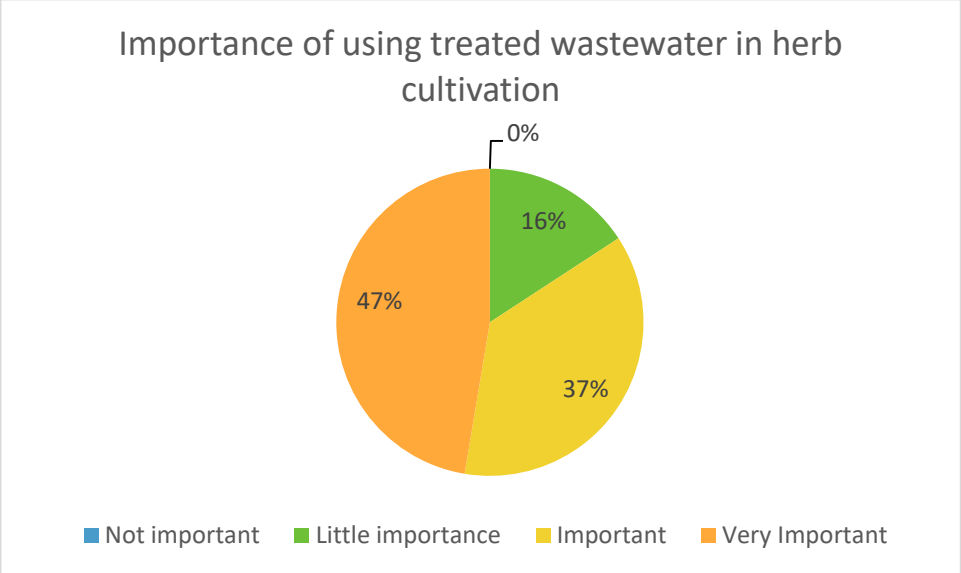

Figure 3.10 Perception of participants regarding the importance of using treated wastewater in herb cultivation

The next aspect of the current part of the survey referred to the importance of methane production through biological treatment of wastewater for exploitation as fuel. 5% of the participants

characterized this process as not being important; while 58% characterized it as important and 37% as very important (Figure 3.11).

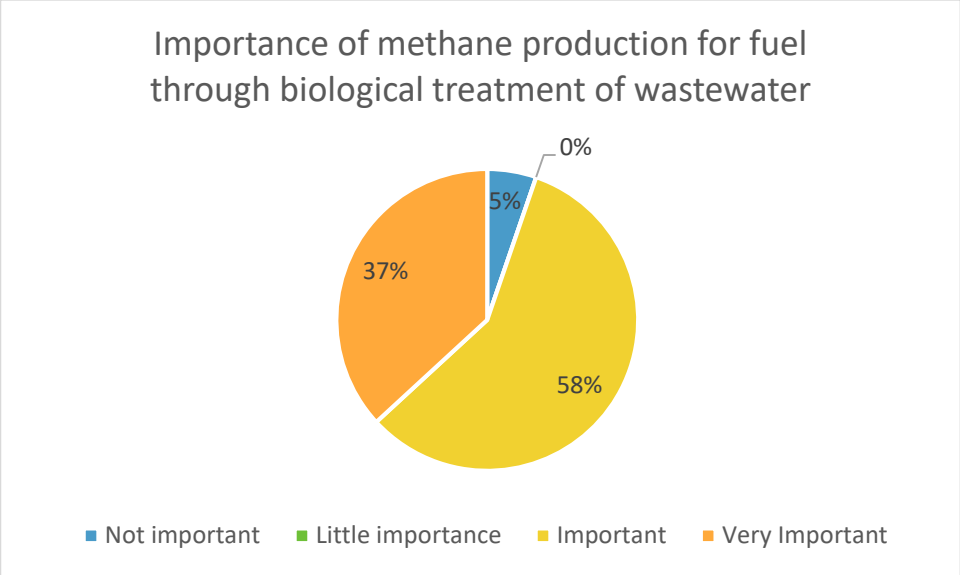

Figure 3.11 Perception of participants regarding the importance of exploitation of biologically treated wastewater for methane production for fuel purposes

In the next question, participants were asked to evaluate the importance of using treated wastewater for purposes such as irrigation of cultivations, landscape irrigation, boiler/heating, enrichment of the aquifer, industrial use and finally use for amenities/pleasure. According to their belief, exploitation of treated wastewater was more important for cultivation and landscape irrigation purposes and enrichment of the aquifer (Figure 3.12). Heating, industrial use and environmental use were not among the priorities of the participants for possible use of treated wastewater (Figure 3.12). Specifically, 74% of the respondents classified agricultural irrigation of reclaimed water as very important and important. The corresponding percentages were 68% for landscape irrigation, 66% for aquifer enrichment, 53% for boiling/heating, 38% for industrial use and 53% for amenities.

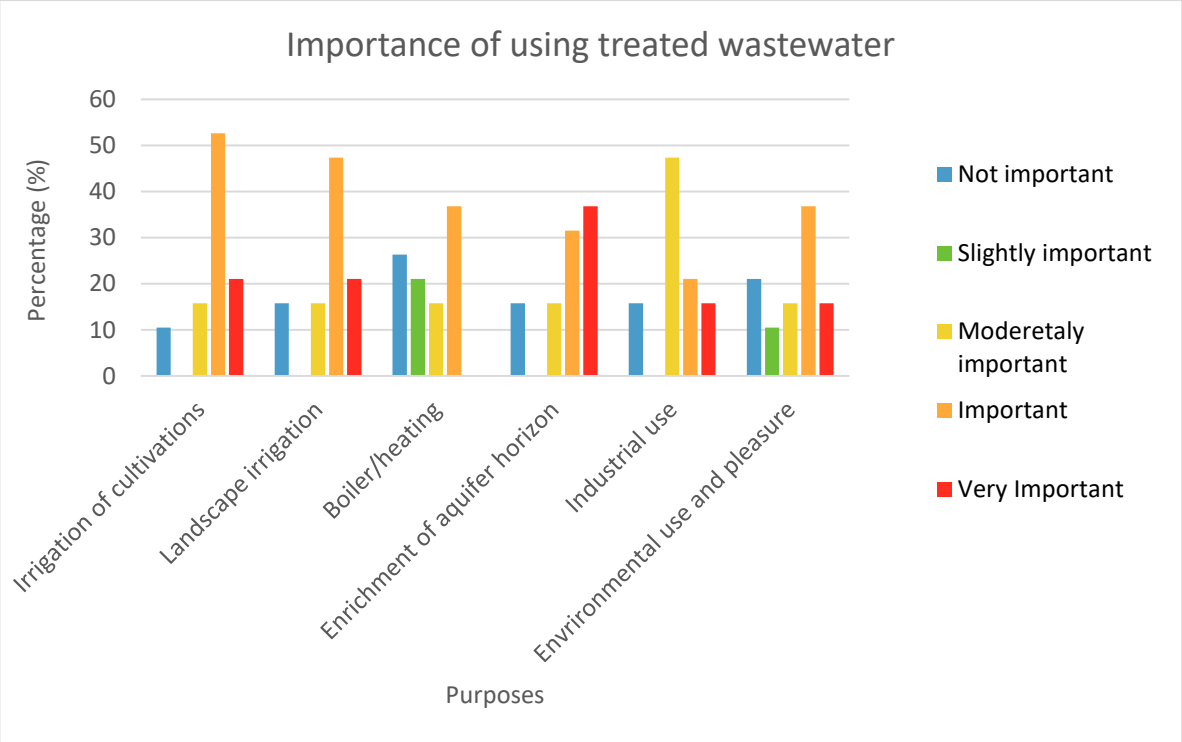

Figure 3.12 Perception of participants regarding the importance of using treated wastewater for several purposes

Aside from the above-mentioned question, participants were asked to evaluate the importance of precision irrigation. No participant stated that precision irrigation has no importance and 26% stated that it has little importance (Figure 3.13). On the other hand, 37% replied that it is important and 37% very important respectively (Figure 3.13).

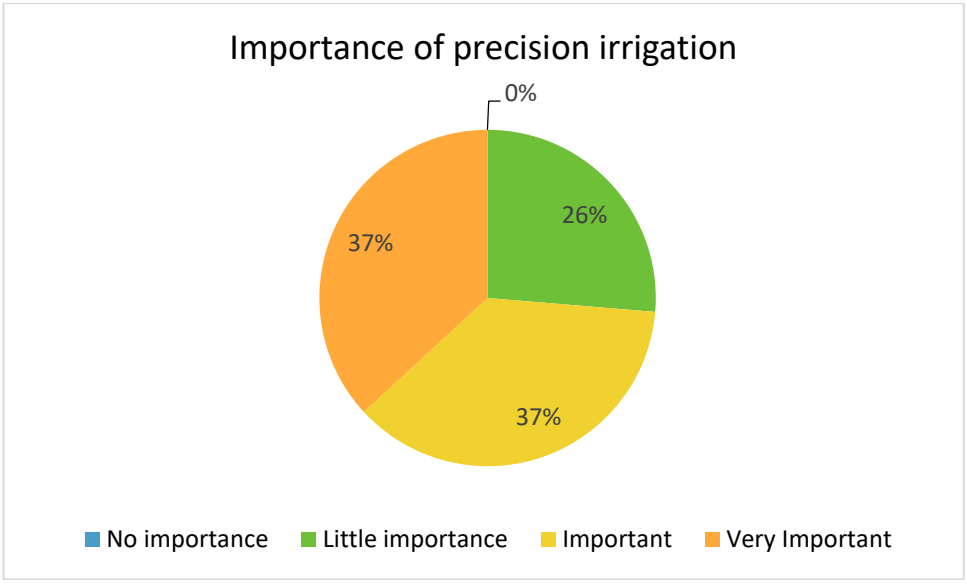

Figure 3.13 Perception of participants regarding the importance of precision irrigation

Afterwards, participants were asked to reply regarding their familiarity with the process of water monitoring, more specifically, whether they use any technology in order to monitor water quality and

quantity or not. The extracted results indicated that more than 68% of the participants did not monitor water quality and quantity with the use of any technology; while only 32% of the end-users monitored them (Figure 3.14). All participants who stated that they use any technology in order to measure water quality and quantity, mentioned that they use irrigation programming systems.

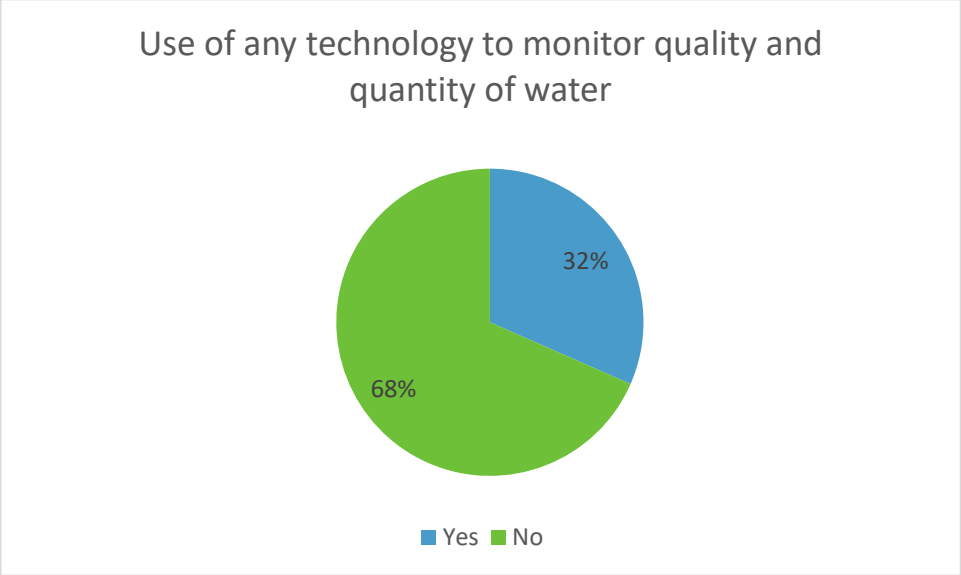

Figure 3.14 Classification of participants based on whether they use any technology in order to monitor water quality and quantity or not

General Questions – HYDROUSA development (Questions 19-21)

In the current part of the survey, participants were asked to reply to questions concerning the development of HYDROUSA. More specifically, questions orienting to the type of information related to water management, treatment, storage and transport that end-users would desire to access, the type of devices and sensors that they would desire to use for the management of this information and the reasons for using such devices.

The diverse answers of the participants indicate that they are mainly concerned about water suitability, pesticide residues and energy consumption issues at a percentage of 39%, 33% and 28% for each information respectively (Figure 3.15). Secondarily, they are concerned about the quality of processed water, as well as its effect on the plants (Figure 3.15).

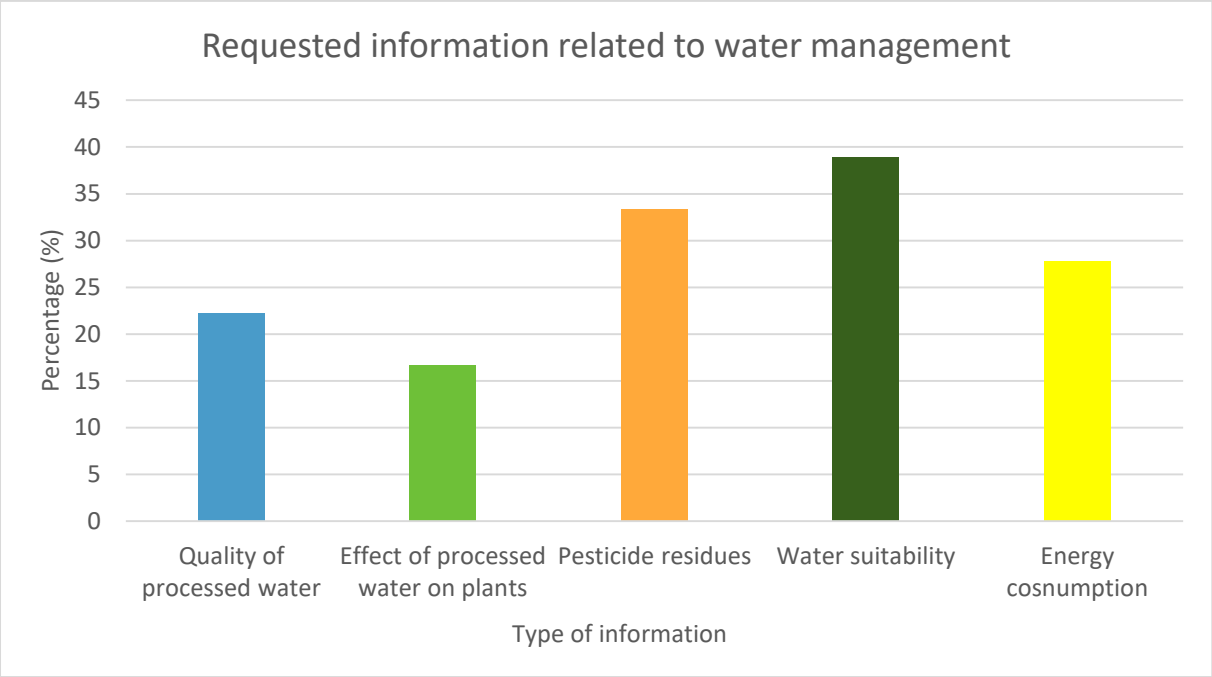

Figure 3.15 Different types of information related to water that participants declared they would like to access in the framework of the project

When asked about the type of device/sensor related to this information, that they would like to use, participants mainly replied that they would be interested in using flow meters and filters (Figure 3.16). This comes to support the hypothesis that water quality and quantity is an important factor for the residents of the island.

Next, participants were asked to state the reasons why they want to use the above-mentioned devices or sensors. Once again, water quality and quantity were the answers of the participants (Figure 3.17). More specifically, 66% of the participants mentioned that they would like to use devices and sensors, for monitoring water quality, and 17% of the participants for monitoring water quantity (Figure 3.17). The reply is in line with the reply of the previous question where the majority responded that they wanted to have filters, a device that improves water quality and some replied flow meters which is associated with water quantity. This shows that the respondents can successfully distinguish between the issues of water quality and quantity and have a good understanding of the devices that are needed to monitor water. On the contrary, the limited number of different devices suggested by the respondents, indicate potentially the lack of familiarity of the participants with modern innovative methods of water management.

The concern of the residents for water quality and quantity is reasonable and expected due to the water issues that the island faces. In the Cyclades Islands (where Tinos and Mykonos belong) water scarcity and poor water quality issues are long-encountered issues. Recent research suggests that water resources in Lesbos are also under significant stress due to natural and anthropogenic factors (P. Simha et al., 2017). This leads to high water vulnerability risk index for the island.

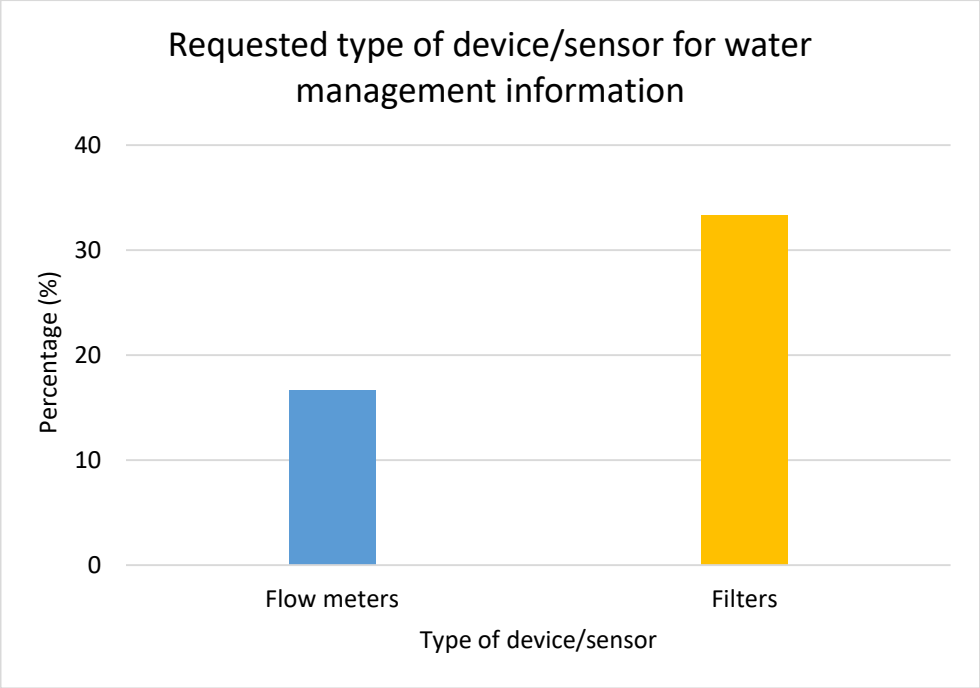

Figure 3.16 Type of device/sensor related to the information of the project, which participants stated they would like to use

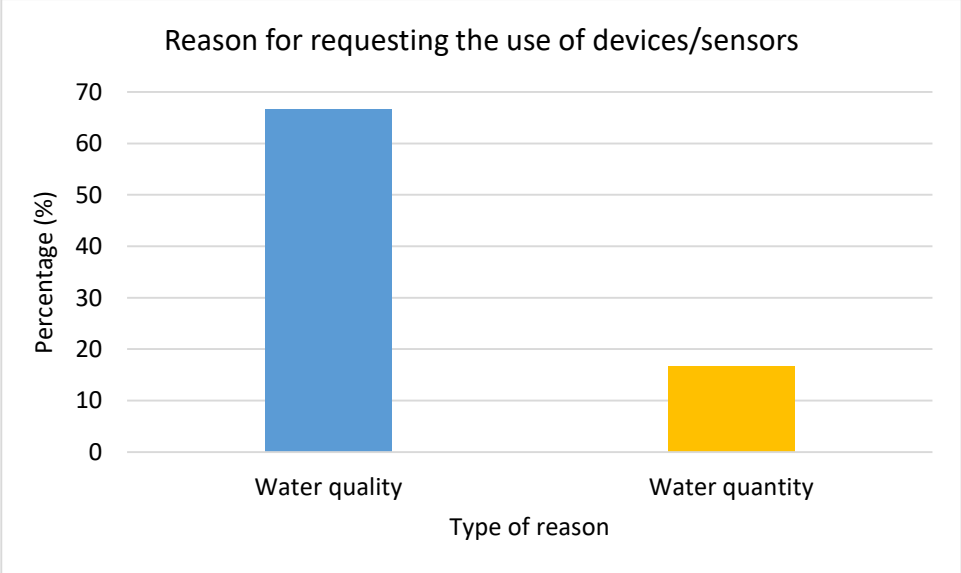

Figure 3.17 Reasons why participants consider as important the use of devices and sensors in the current water management system

Hardware of the project HYDROUSA (Questions 22-30)

In this part of the questionnaire, participants were asked to reply to questions concerning the hardware of HYDROUSA. More specifically, questions regarding:

- The importance of monitoring each system part, the parameters related to water quality and quantity measurements, the development of low-cost sensors for monitoring water quality and quantity, and whether they would prefer a ready solution or a conFigureurable system as a sensor.

- If the installation of a sensor would cause functional and visual disturbance in the surrounding area.
- Information related to the network of the system and the parameters measured by the sensors.
- The importance of energy dependent systems in water management.

Regarding the importance of the monitoring parts of the system, participants were asked to evaluate the importance of monitoring several system parts such as water consumption, water production, water flow, water processing, water saving, energy consumption, operating systems, meteorological phenomena and soil moisture for agriculture. Participants stated that the most important system parts to be monitored were water consumption, water production, meteorological phenomena and soil moisture for agriculture (Figure 3.18). Water flow, water processing, water storage, energy consumption, and operating systems were not very significant for the participants (Figure 3.18). More specifically, 58% of the end-users, characterized monitoring water consumption as important/very important, 42% characterized monitoring water production as important/very important, 21% characterized monitoring water flow as important/very important, 26% characterized monitoring water processing as important/very important, 22% characterized monitoring water storage as important/very important, 31% characterized energy consumption as important/very important, 21% characterized monitoring operating systems as important/very important, while 48% and 63% characterized monitoring meteorological phenomena and soil moisture respectively, as important/very important (Figure 3.18).

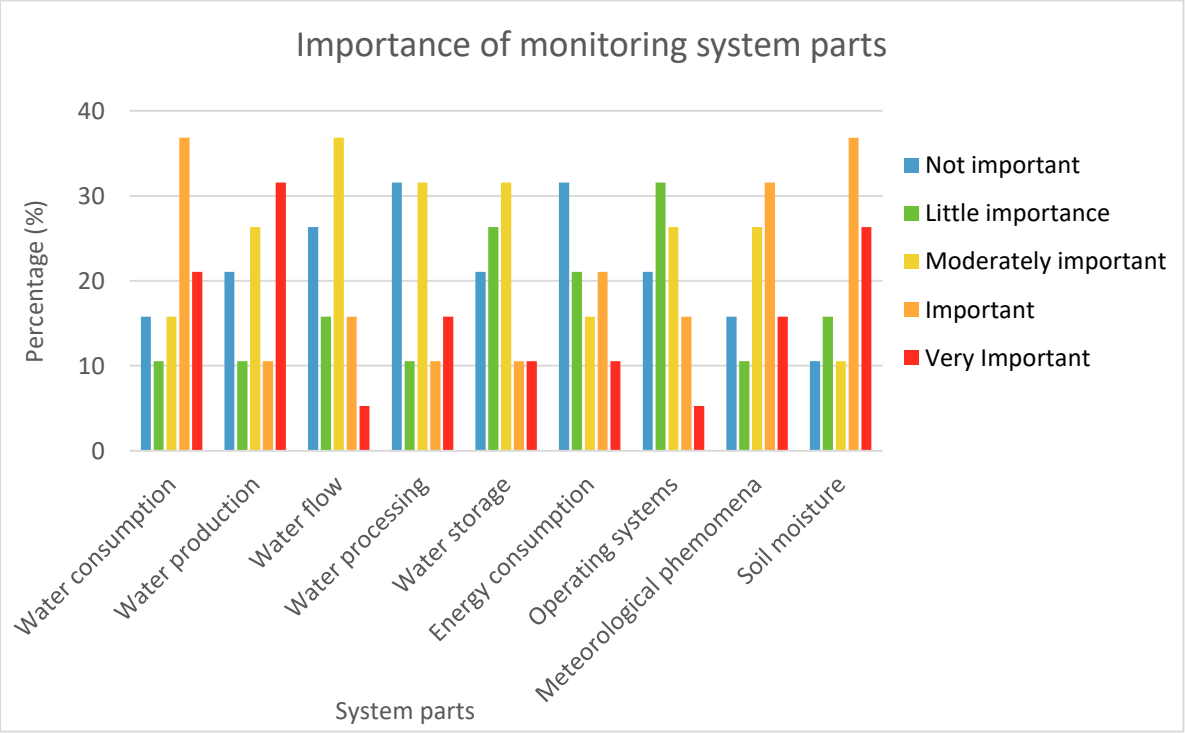

Figure 3.18 Opinion of the end-users regarding the importance of monitoring each system part

Subsequently, participants were asked about the existence of any possible suggestion parameter/sensor related to water quality and quantity measurements, based on their perception. All

participants stated that they have no possible suggestion for further parameter/sensor development related to water quality and quantity. This result indicates that the developed system parts, possibly covers their needs and that end-users consider the system parts to be sufficient for the ongoing progress of the project.

In the next stage of the current section, participants were asked to choose whether they would be interested in the development of a low-cost sensor in order to monitor water quality and quantity, or not. As expected, almost 68% of the end-users considered such a development as an interesting aspect (Figure 3.19).

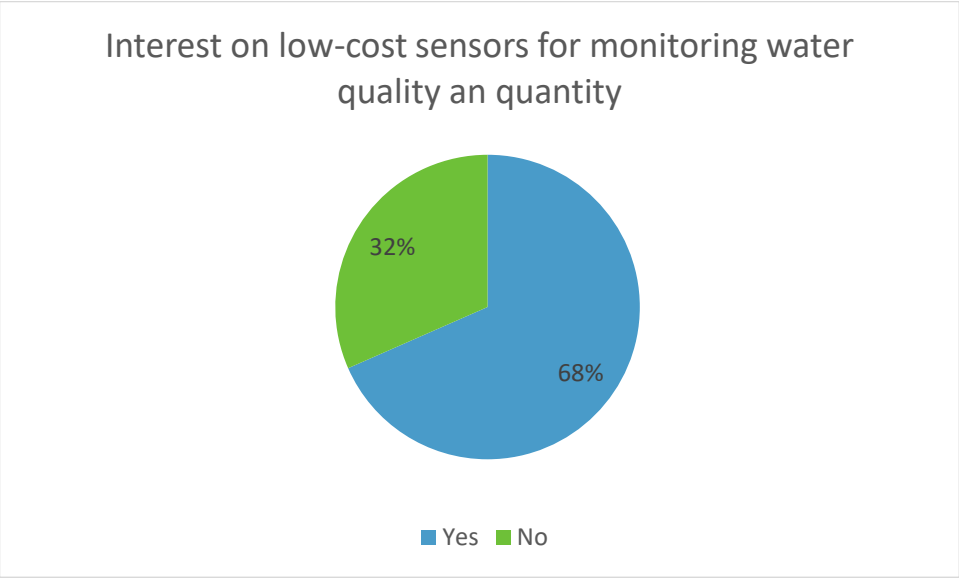

Figure 3.19 Interest of the end-users in the development of low-cost sensors for measuring and monitoring water quality and quantity

Regarding the structure of the available systems, end-users prefer existing solutions than conFigureurable systems (83%) (Figure 3.20). This may possibly be attributed to the willingness of the participants to avoid any possible problems regarding the use of the sensors.

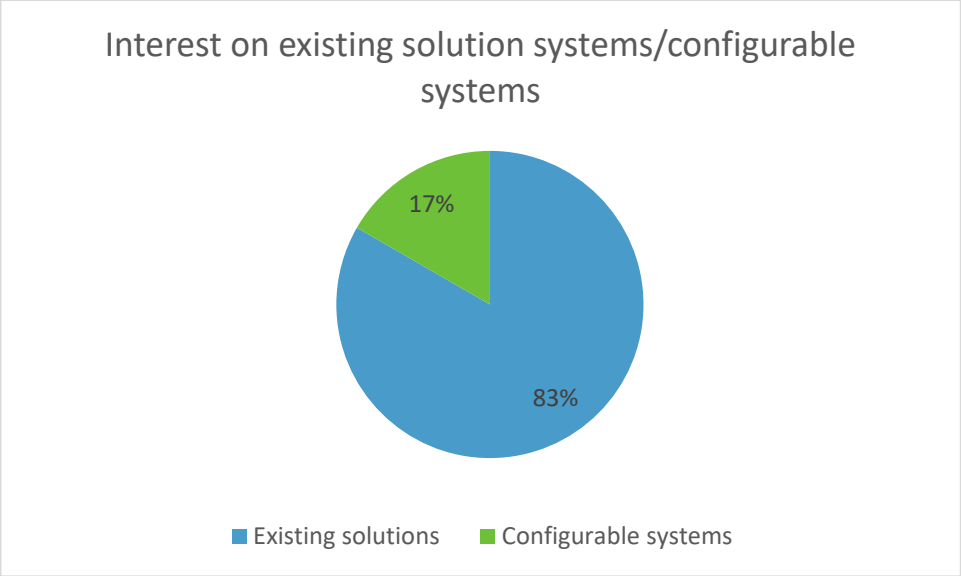

Figure 3.20 Classification of participants based on their preference and interest on ready solutions or conFigureurable systems

Participants were also asked about the potential functional and visual disturbance in the surrounding area of the sensor. The results indicated that two out of three participants (63%) do not consider that the installation of the sensors will cause significant disturbance, which proves their willingness to embrace such devices and the project (Figure 3.21).

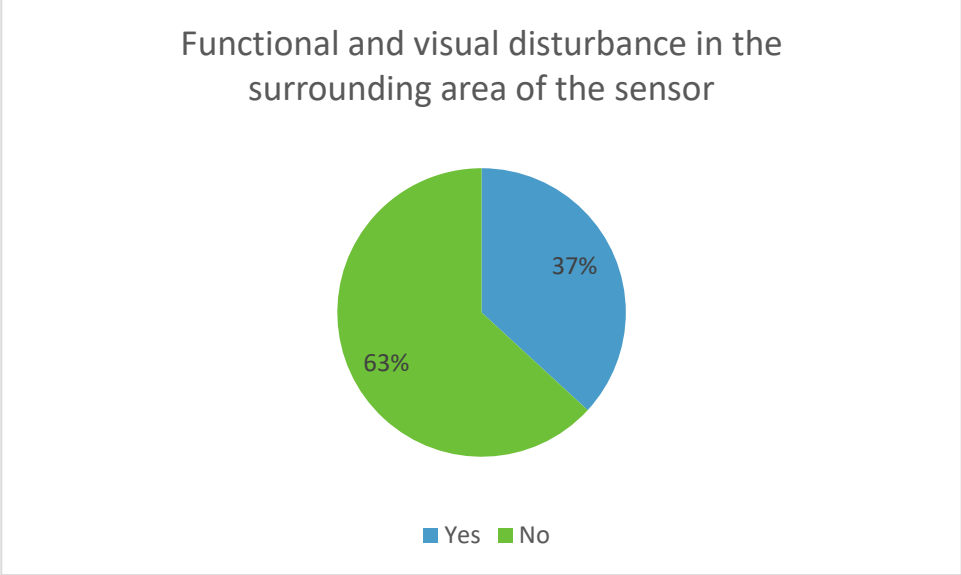

Figure 3.21 Opinion of the end-users regarding the possible functional and visual disturbance caused by the installation of sensors in their surrounding area

In terms of the structure of the network supporting the sensors, 79% of the end-users mentioned that they would prefer to have access to a public network, while only 21% of the end-users would prefer using a private network (Figure 3.22), which possibly demonstrates the perspective of the participants that the municipality as well as the water supplier are responsible for such initiatives.

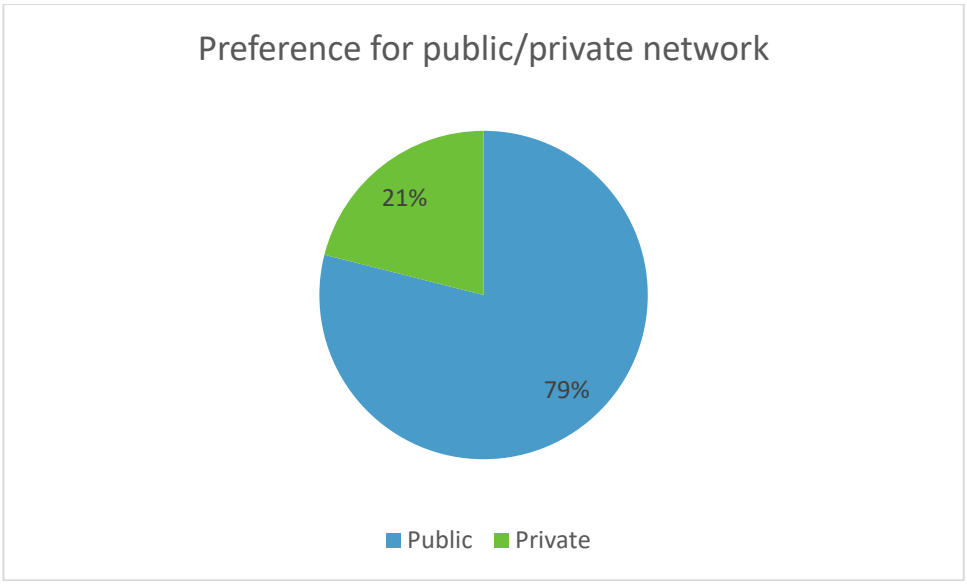

Figure 3.22 Preference of end-users regarding the type of the network, public or private

Then, end-users were asked to report the useful measurements of the system, based on their opinion and needs. Their answers varied, with the water salinity being the most dominant answer amongst many different opinions (Figure 3.23). Almost one out (42%) of two participants stated that water salinity is the measurement they are interested in. Water pH and the microorganism content of water were aspects that concerned significantly (>30%) the end users (Figure 3.23). Turbidity and heavy metals were also reported by end users as important parameters for water, but at a much lower percent the participants. This shows that the participants show some understanding of the qualitative problems related with water use since salinity and microbial contamination are common reasons for low water quality in the island.

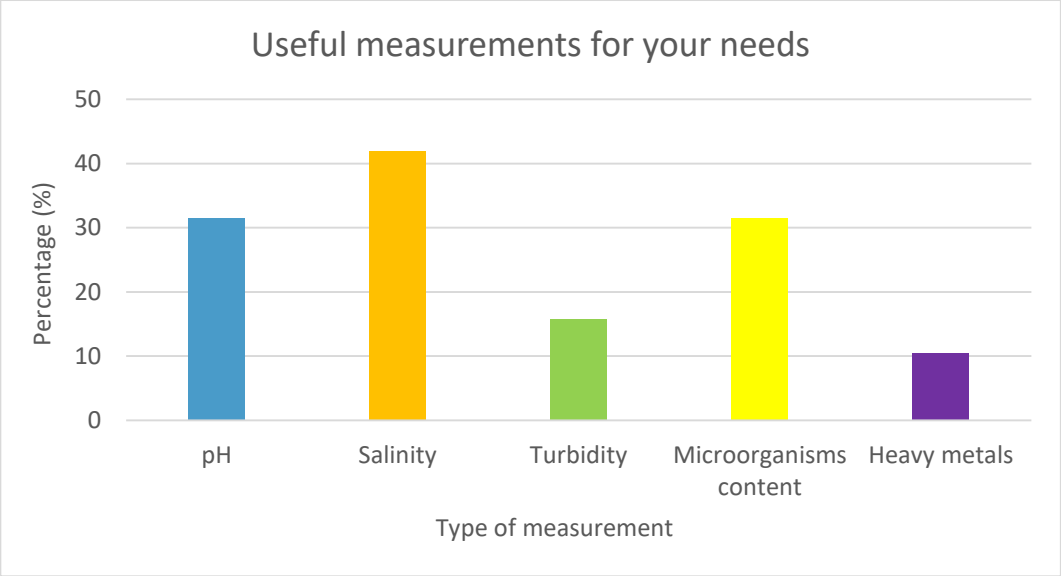

Figure 3.23 Usefulness of several measurements related to water characteristics based on the opinion of the end-users

Concerning the importance of developing energy autonomous systems to monitor water treatment and management, 63% of end-users stated that it is slightly important to develop energy autonomous systems, while only around 16% considered that energy autonomy of systems is important and 21% that it is not important (Figure 3.24). This probably relates to the fact that the cost of electricity for agricultural activities is very low and therefore it is not a high concern for the stakeholders.

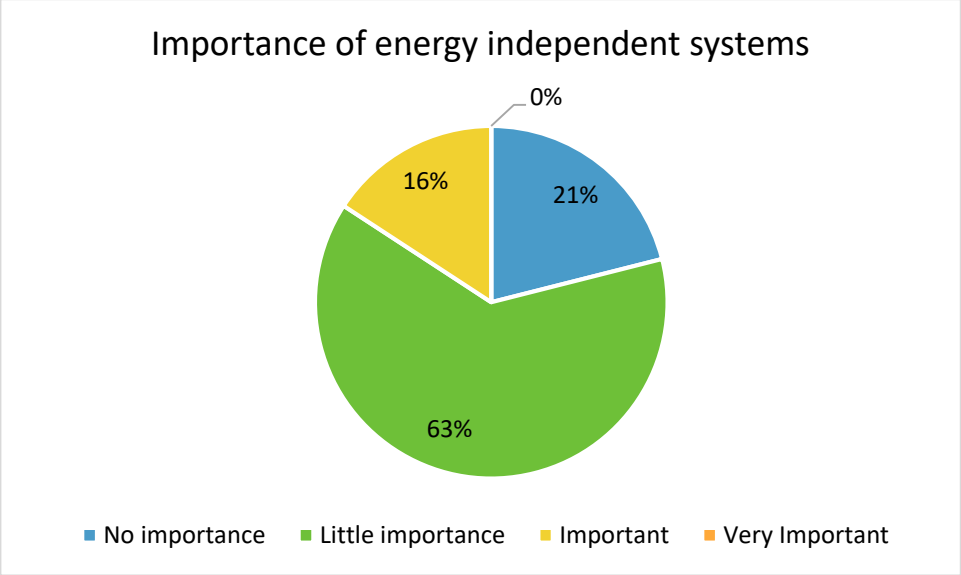

Figure 3.24 Importance of energy autonomous systems based on the perception of the end-users

Platform of HYDROUSA (Questions 31-38)

In this part of the survey, participants were asked on aspects covering HYDROUSA platform. More specifically, these include the following:

- To determine the type of device they prefer to use in order to access HYDROUSA information, to determine the type of alert and notifications they prefer to receive and their optimum frequency, as well as to evaluate the ability to customize the notifications received by the system.
- Interest in the development of custom irrigation algorithms and to evaluate the importance of information displayed by the system.
- About their preferable format for the exported files by the system and state their willingness to have access to historical data of the system.

At the first part of the current section, end-users were asked to indicate the device they would prefer to use in order to access HYDROUSA information. Available answers were a personal computer, a tablet, a smartphone or having no internet access at all. More than 80% of the participants stated that they would prefer to use a smartphone device to access HYDROUSA information (Figure 3.25). Almost 35% replied that they would like to use a personal computer (Figure 3.25). These results highlight the wide use of smartphones in every-day life.

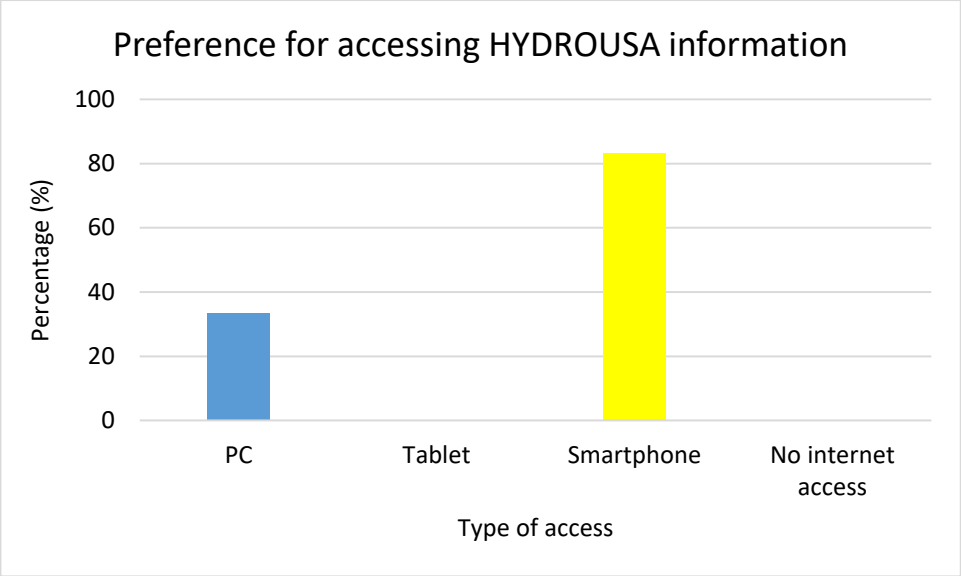

Figure 3.25 Preferred device for accessing HYDROUSA information

The ability to customize the notifications received was the next evaluated aspect, where only 16% of the end-users declared they would like to be able to customize their notifications (Figure 3.26). Apart from the ability to customize notifications, end-users were asked about the type of alert and notification they prefer to receive. One out of two participants responded that they prefer via email (Figure 3.27). The some of the replies for SMS and email do not add up to 100% as some respondents did not reply.

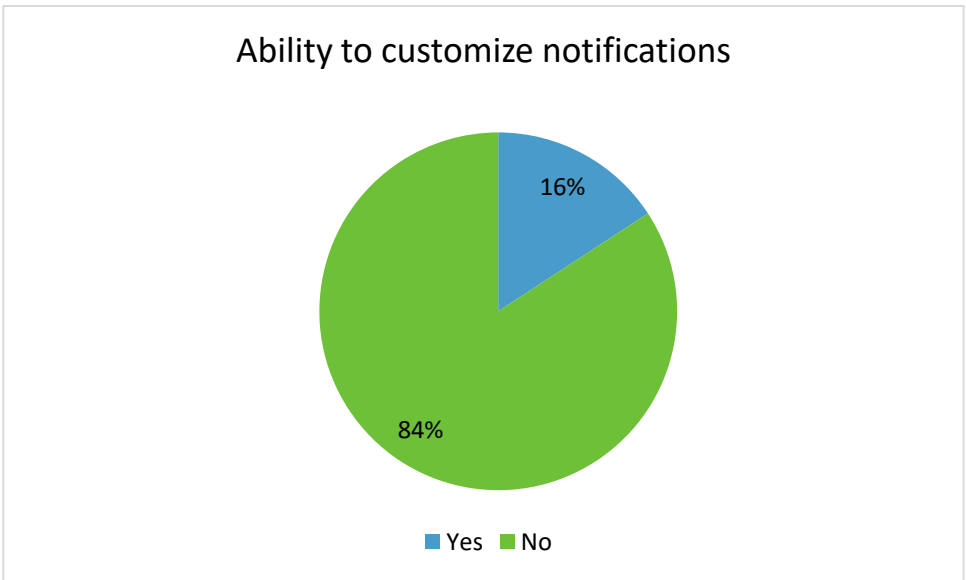

Figure 3.26 Classification of end-users based on their willing to have the ability to customize the notifications received by the system

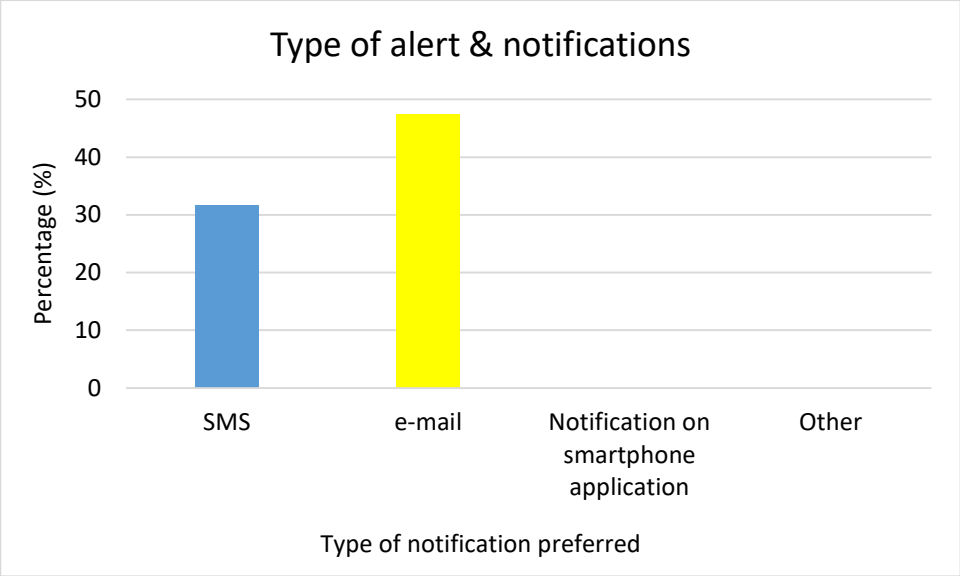

Figure 3.27 Preferred type of alert/notification by the end-users for accessing HYDROUSA information

End-users were also asked to determine their possible interest in the development of custom irrigation algorithms. In this question, 74% of the participants replied that they would not be interested in having such functionality, and 26% replied positively (Figure 3.28).

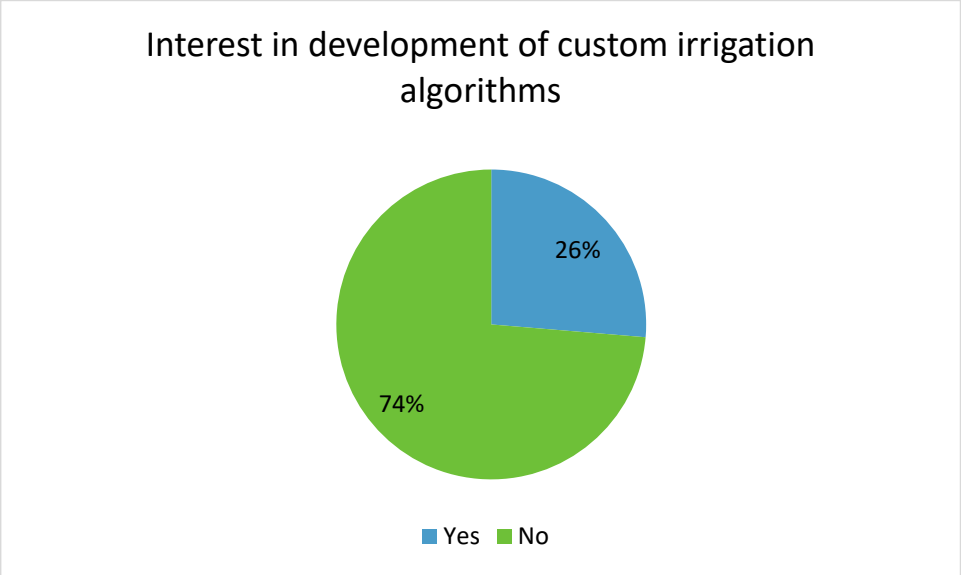

Figure 3.28 Expression of interest by the end-users for the development of custom irrigation algorithms

In the next part of the survey, participants were asked to evaluate the importance of displaying several types of information. Reports, statistics and notifications were more significant than maps and diagrams for the end-users (Figure 3.29). 58% and 53% of the respondents characterized notifications and statistics respectively as important/very important. 27% and 25% of the participants characterized reports and diagrams respectively as important/very important. Only 15% of the participants characterized maps as important/very important.

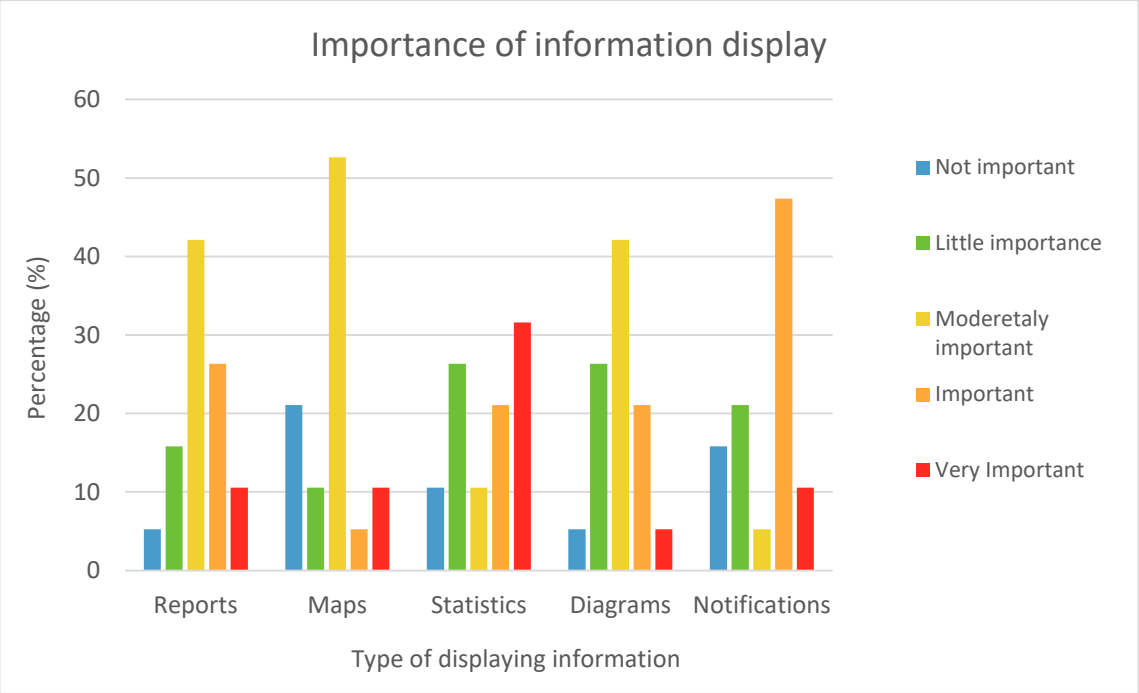

Figure 3.29 Importance of information display based on the type of information

Regarding the type of exported file by the system, TEXT and CSV were the most preferable format, while only a small number of participants stated that SHAPEFILE is their preferred format for exporting files (Figure 3.30).

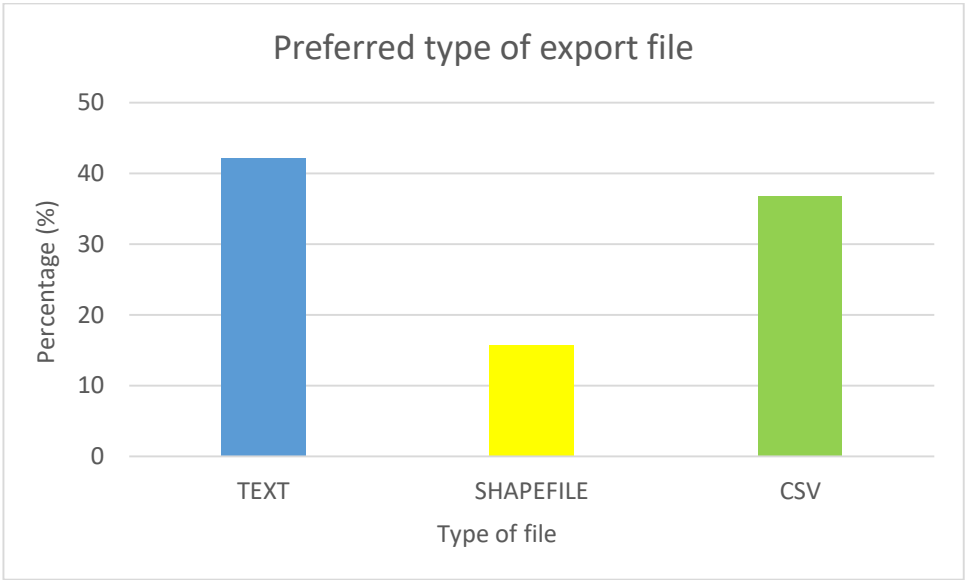

Figure 3.30 Different types of file format that end-users selected for exported files by the system

In respect of the optimum frequency receiving alerts, participants were given certain possible choices, such as every 15 minutes, every 30 minutes, every hour, every 3 hours and every day. One out of three (37%) of the participants replied they would prefer to receive alerts on a daily basis and 26% stated that the optimum frequency is every 3 hours (Figure 3.31). Alerts in a more frequent basis than every 3 hours were not amongst the first preferences of the participants, with a percentage of 11% of the

participants for every 15 minutes option, 16% for every 30 minutes option and 11% for every hour option respectively (Figure 3.31).

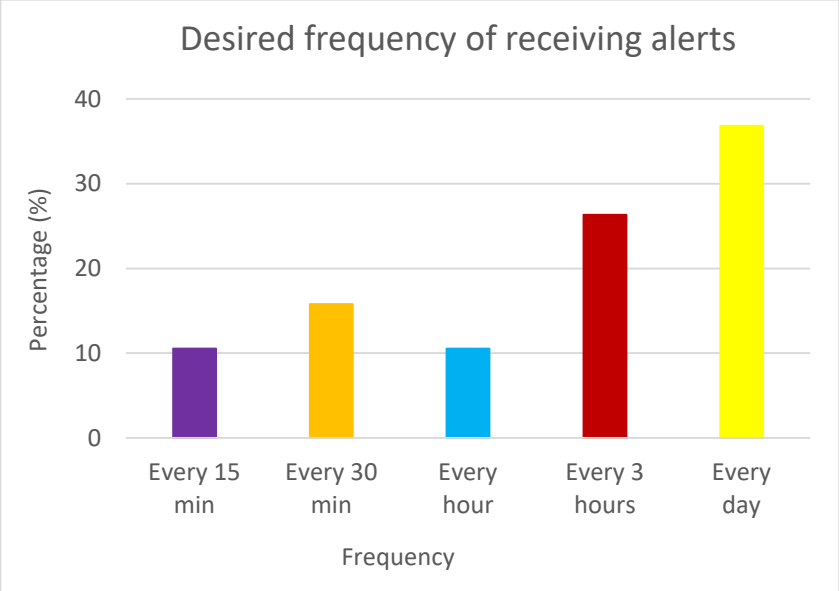

Figure 3.31 Desired frequency for the end-users to receive alerts by the system

The final question for the current section of the survey referred to the evaluation of the ability to access historical data in the system. Only 21% of the participants replied that they would like to be able to access historical data, while 79% not interested (Figure 3.32). This is reasonable since access to historical data does not present high added value to the end user who is usually "lost" in such endless data. If historical data is not complemented with visualization trends of the historical data and with meaningful correlations that can support the systems operation, they are basically meaningless to the end user.

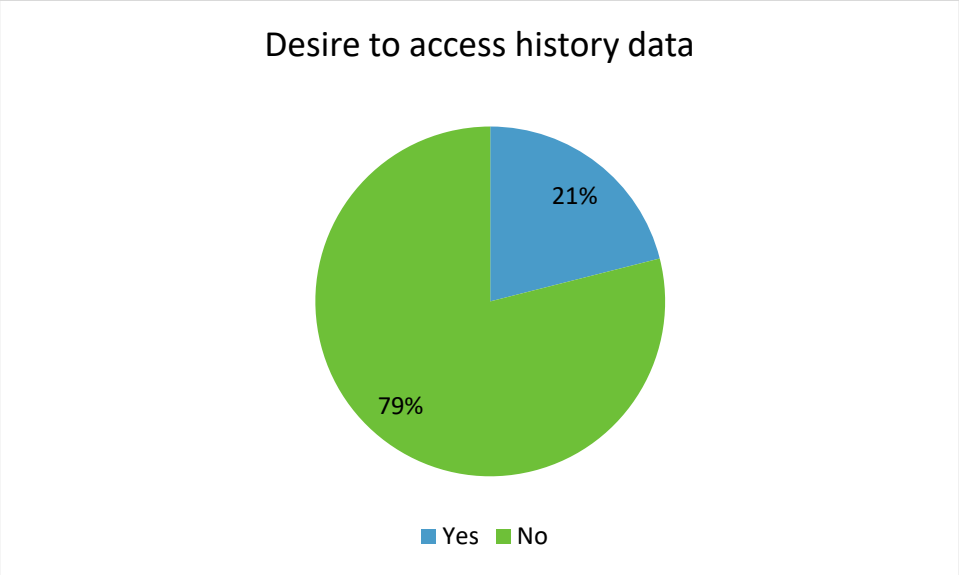

Figure 3.32 Desire of participants to have access to historical data of the system

Importance of HYDROUSA (Question 39)

At the end of the survey, the end-users were asked to express their opinion regarding the importance of the project. More specifically, they were asked to answer whether HYDROUSA has the ability to solve the water deficiency problem of the island during the summer touristic period, or not.

In this final question of the survey, 63% of the end-users stated that HYDROUSA does not have the ability to solve water deficiency of the island, while 37% if the end-users stated that it has (Figure 3.33). Participants appeared to be skeptical about the ability of the project to solve water shortage. This may be attributed to their unawareness of new technologies and methods of sustainable cyclic use of water, as one out of three of the participants stated that precision irrigation is not important for them and almost half of the participants attached little importance to reusing water. **The unfamiliarity of the end-users with innovative technologies** is supported by the extracted result that only one out of three is using technological devices in order to monitor water quality and quantity**.** These questionnaires were completed at the stage of the project when the demonstration sites are not yet operational to provide evidence on the potential solution. The water scarcity issues of the island are long encountered and have deteriorated the last years due to the touristic and economic development. Consequently, the inhabitants and skeptic in whether a project addressing new systems, technologies and solutions can bring forward solutions.

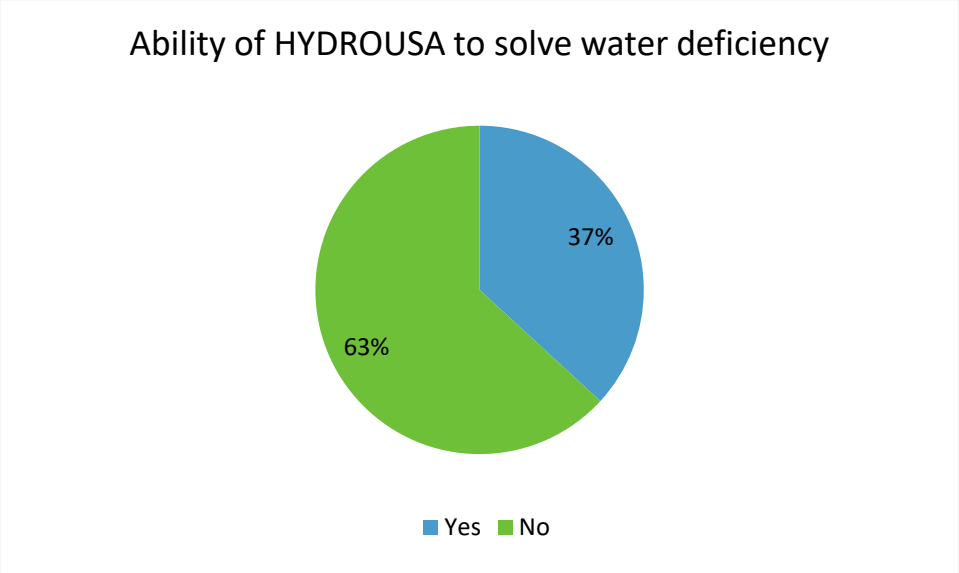

Figure 3.33 Opinion of the participants regarding the ability of HYDROUSA project to solve water deficiency of the island especially during the summer touristic period

Summary of HYDRO1 and HYDRO2 questionnaire

After the evaluation of the results extracted by the answers of the end-users, a summarizing list was created in order to properly highlight the needs of the end-users and correlate them with the initially determined requirements and specifications. In this way, requirements from all demonstration islands can be interpreted to functionalities during the development of the platform and the establishment of the project. User requirements for Lesbos Island are summarized in Table 3.1.

During the initial determination of requirements and specifications for each separate component of the system, stakeholders that participated, were specialized in the field. Thus, the initial determination of specifications was very diversified and targeted to certain technologies. However, the end-users

participated in eliciting the updated specifications, apparently did not have such specialized knowledge. As a result, several specifications that were initially set by the stakeholders such as water pressure sensors in pre-filter pipeline and influent pipeline, ammonia at the inlet and treated effluent, nitrate at the treated effluent and solenoid valves and stepper motor of the system, were not addressed by the end-users in the updated monitoring.

Nevertheless, all requirements initially addressed were also addressed in the updated determination. The participants showed that they have some understanding of the important water quality problems since microorganism content and salinity were ranked high in terms of the required water quality network. Based on the respondents' data, the most important parameters for water quality is the pH. Although, there are usually no issues related to inadequate pH of water resources, this is a common parameter, well known to the public which is measured in water and particularly in swimming pools and desalinated water. So, probably this is the reason why we received frequents replies on pH being an important parameter. Furthermore, flow meter, turbidity sensor, and recording of meteorological phenomena and soil moisture were addressed by the end-users regarding sensors. Regarding systems and irrigation, participants stated that they would like to use treated wastewater in aromatic plants cultivation and they were positive towards the establishment of an agroforestry bio community that will exploit the treated wastewater. Finally regarding software, end-users stated both web and mobile interfaces as desirable specifications.

Table 3.1 End-user specifications and requirements for each component in Lesbos Island

Components	Requirements	End-user specifications
Sensors	Water quality, quantity and conductivity	Flow meter
		Turbidity sensor
		pH sensor
		TDS sensor
	Irrigation related	Meteorological phenomena
		Soil moisture
Systems	Support of different processes	Use of treated wastewater in aromatic plants cultivation
Irrigation	Water flow types	Establishment of an agroforestry biocommunity for exploitation of treated wastewater
Software	User interaction with devices	Web interface
		Mobile interface

3.2 HYDRO3 and HYDRO4 – Mykonos Island

For Mykonos Island a survey for the investigation of user requirements was performed through a questionnaire with a total of 14 participants. All participants were residents of the Island. The survey was conducted during the middle of September 2020, as the workshop was not held due to COVID19 restrictions.

The questionnaire constituted of 39 questions concerning 6 basic representative subject categories: demographics data of the participants, personal general questions, general questions about HYDROUSA development, questions about the hardware of HYDROUSA project, questions about HYDROUSA platform and finally about the importance and efficacy of HYDROUSA project. The questionnaire was developed aiming to outline in the most proper way the user requirements.

Demographics (Questions 3-8)

In the current part of the questionnaire, participants were asked about their age, gender, level of education, their access on the internet and their representative category (i.e., domestic, agricultural, commercial user etc).

Based on the results extracted by the questionnaire regarding the age of the participants, the majority of them belongs to an age group ranging from 35-44 years old (Figure 3.34), which demonstrates that the results of the survey were mainly generated from young people. Only 1 participant was belonging to the age group 18-34 and 1 to the age group 45-55; while 3 participants were 55-64 years old and 2 were over 65 years old (Figure 3.34). It considered to be a representative sample of the island based on the last census of 2011 in Greece. According to this census, Mykonos Island has one the youngest population amongst all the other regional units, with the average age of the residents being 37 years old (Hellenic Statistical Authority, 2014).

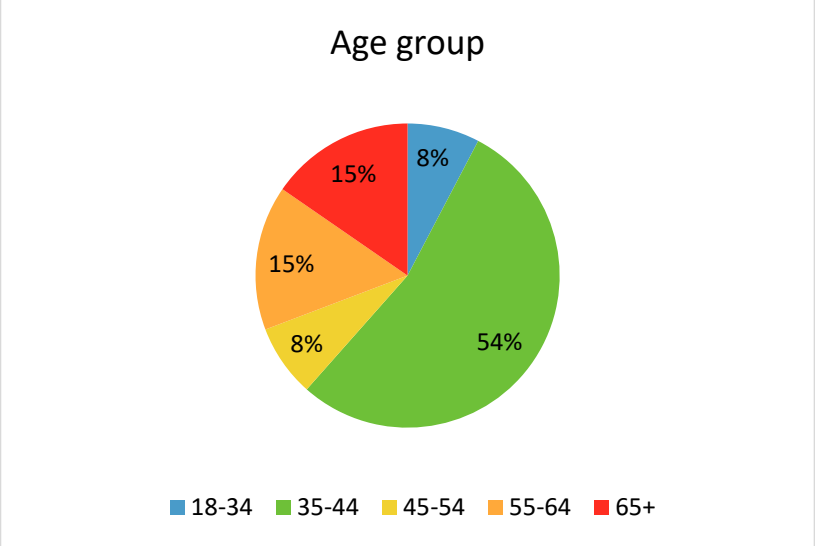

Figure 3.34 Investigation of the age of the participants based on 5 age groups

Concerning the gender of the participants, 57% were men and 43% women (Figure 3.35).

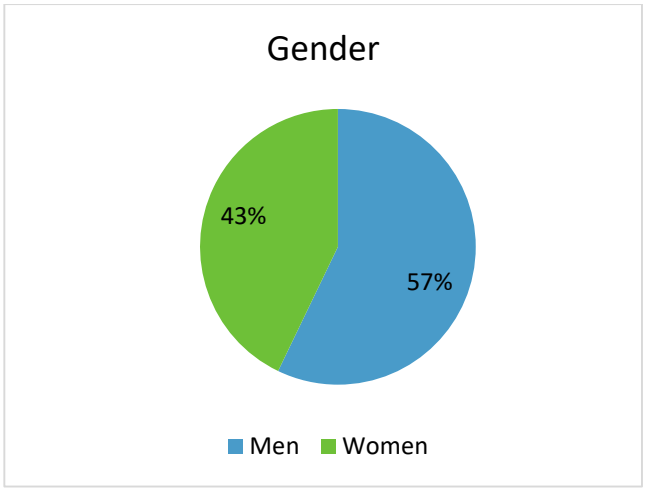

Figure 3.35 Classification of participants based on their gender

The level of education of the participants was also monitored based on a classification in 4 representative categories: primary education, secondary education, graduate and post-graduate/PhD. Based on the results, no participants were belonging neither to the primary education category, nor the post graduate/PhD category. The majority of the participants (57%) were categorized in secondary education level and 43% of the participants in graduate level (Figure 3.36), which indicates that there were no uneducated or highly educated individuals among the end-users.

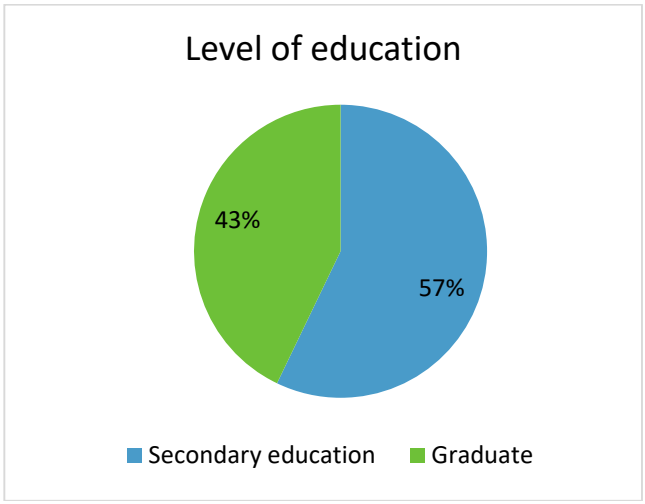

Figure 3.36 Classification of participants based on their level of education

Subsequently, participants were asked to point out their representative category, depending on their use of water. More than one third (36%) of the participants were categorized as domestic users, 29% as agricultural users, 29% as commercial users, 29% as public services and no participants were categorized as water suppliers and/or irrigation system units (Figure 3.37).

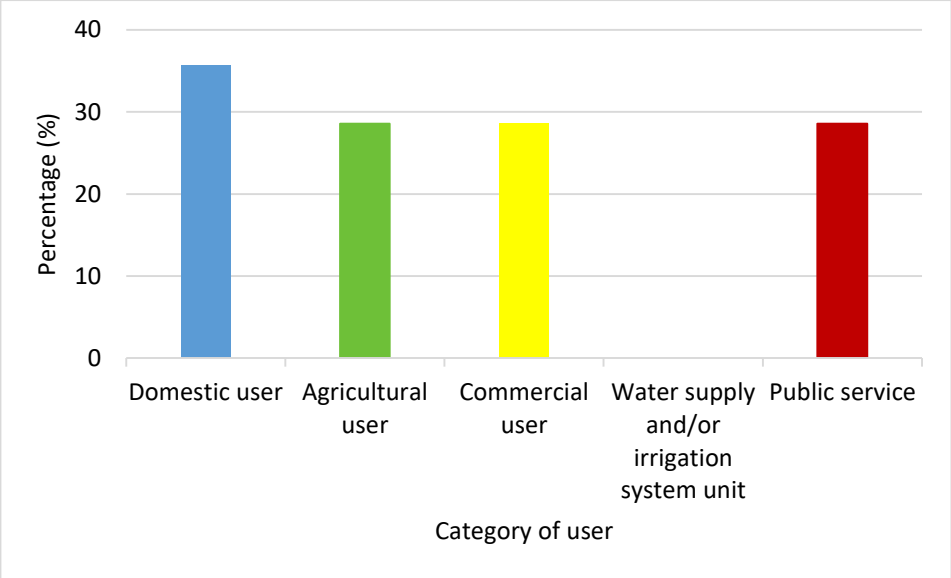

Figure 3.37 Classification of participants based on the way they use water

Afterwards, participants were asked to reply regarding the device they use in order to access the internet, with possible replies being a variety of devices such as a personal computer (desktop), a tablet, or a smartphone and the scenario of having no internet access at all. The analysis of their answers highlighted that the vast majority of the participants accessed the internet via a personal computer/desktop, and secondarily by using a smartphone, while only 14% of the participants were using a tablet to access the internet (Figure 3.38). 14% of the users declared they have no internet access at all and can be explained by their old age (Figure 3.38).

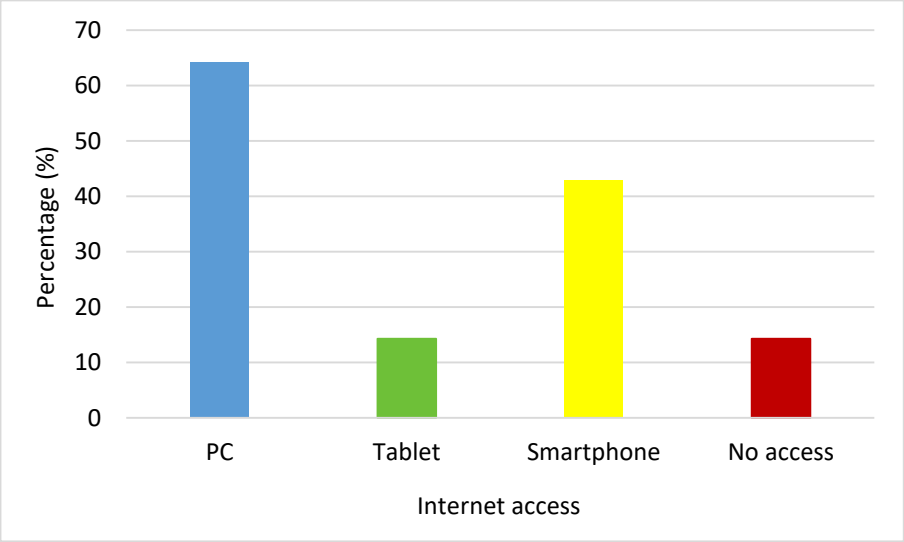

Figure 3.38 Type of device used by the participants for accessing the internet

General Personal Questions (Questions 9-18)

In the current part of the report, participants were asked to reply to questions about their perception regarding the importance of saving water, the importance of measuring the quantity and quality of water, the importance of rain harvesting for irrigation purposes, the importance of using collected rain water for irrigation in herb cultivation and the importance of harvesting rain water for covering personal needs. They also asked to reply to question regarding their perception on the significance of

precision irrigation in the frame of sustainable water management, and their interference with monitoring technologies for measuring the quality and quantity of water.

The analysis of the questions of the participants indicated that all participants attached importance to the process of saving water to a certain extent. More specifically, the majority of the end-users, in a percentage exceeding 70%, declared they consider water saving as very important and 29% of the participants as important (Figure 3.39). This may probably be attributed to the fact that water shortage is a severely existing issue in many Greek Islands of Cyclades such as Mykonos, especially during the summer touristic period. Not a single one participant considered the process of saving water as insignificant or of little importance. This comes to enhance, support and strengthen the above-mentioned perception. The opinion of the residents of Mykonos reflects their respect and valuation of water that derives from the water shortage on the island (ekathimerini, 2018).

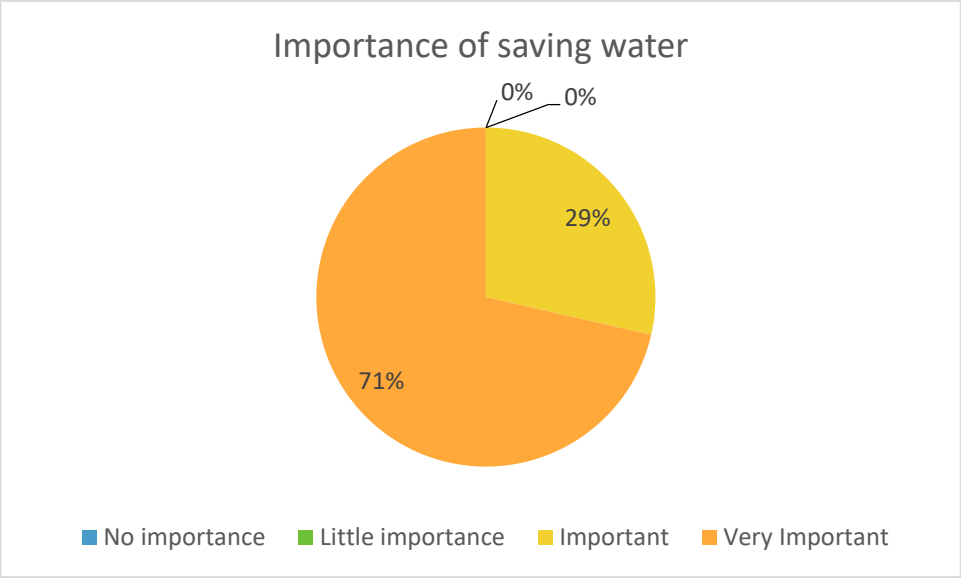

Figure 3.39 Perception of participants regarding the importance of saving water

Regarding the perception of participants on the importance of measuring the quality and quantity of water, no participants answered that they consider it as not important or being of little importance. On the contrary, 64% considered measuring quality of water as very important, and 36% as important (Figure 3.40). Despite the concern of the residents about water quality, previous studies have indicated that the chemical status of water reservoirs of the island can be considered acceptable (G. Pavlidis,2018). However, it is suggested that constant monitoring should be implemented in order to investigate the establishment of good water quality.

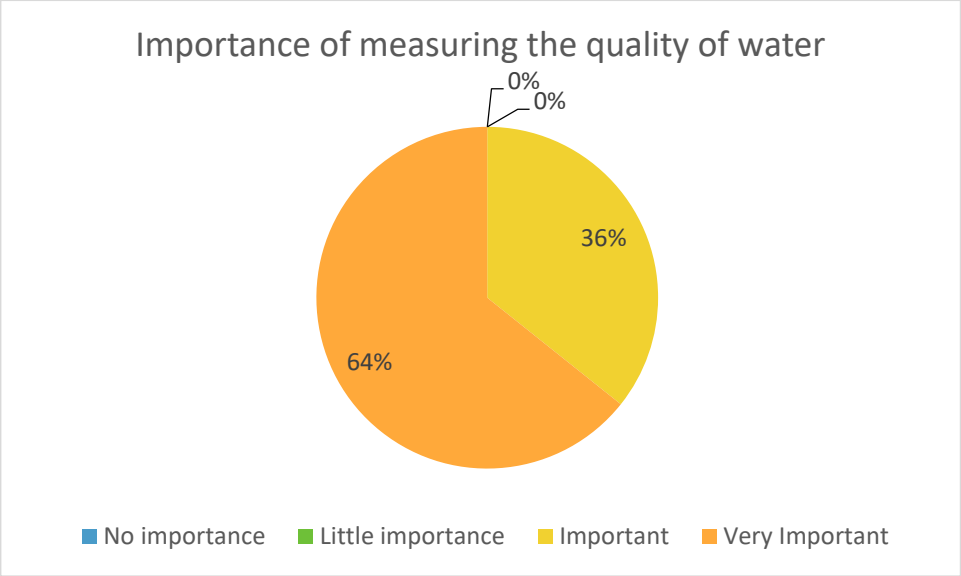

Figure 3.40 Perception of participants regarding the importance of measuring the quality of water

In addition to that, measuring the quantity of water was also considered important, with 57% of participants declaring that they consider it being very important and 43% of them of being important (Figure 3.41). During the past years, the water availability of the island (which is directly related to the water quantity) has been one the parameters that have been investigated to a certain extent, due to possible water shortage (E. Ploumistou and Ch. Petalas, 2015).

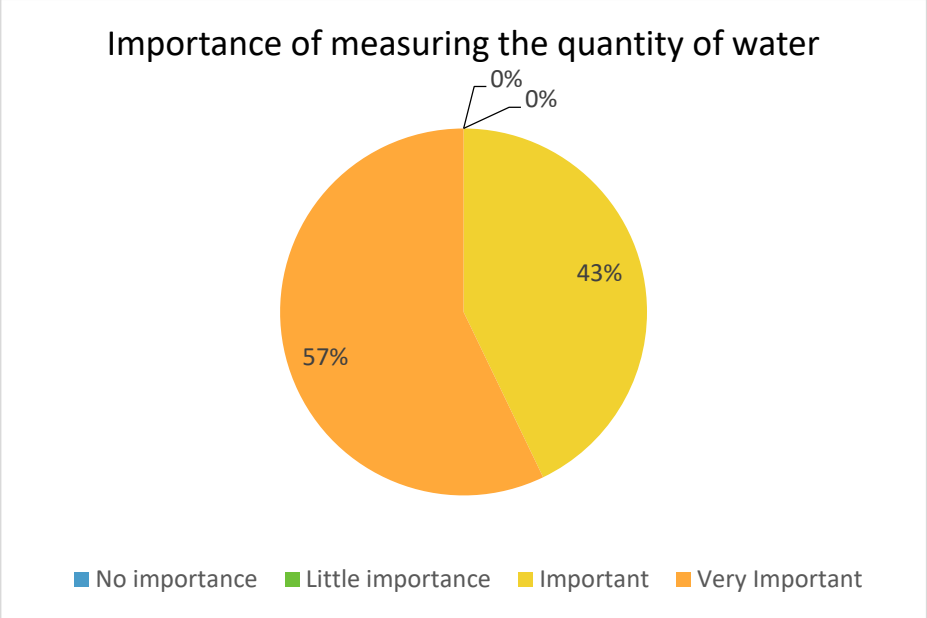

Figure 3.41 Perception of participants regarding the importance of measuring the quantity of water

Apart from the need for measurements on the water quantity and quality, the end-users were asked about their perception on the importance of using rainwater for irrigation and once again the majority indicated that they consider it as important to a certain degree. More precisely, 57% of the participants characterized the use of rainwater for irrigation as important, 36% as very important and only 7% as

slightly important (Figure 3.42). Remarkable is the fact that none of the participants characterized it as not important.

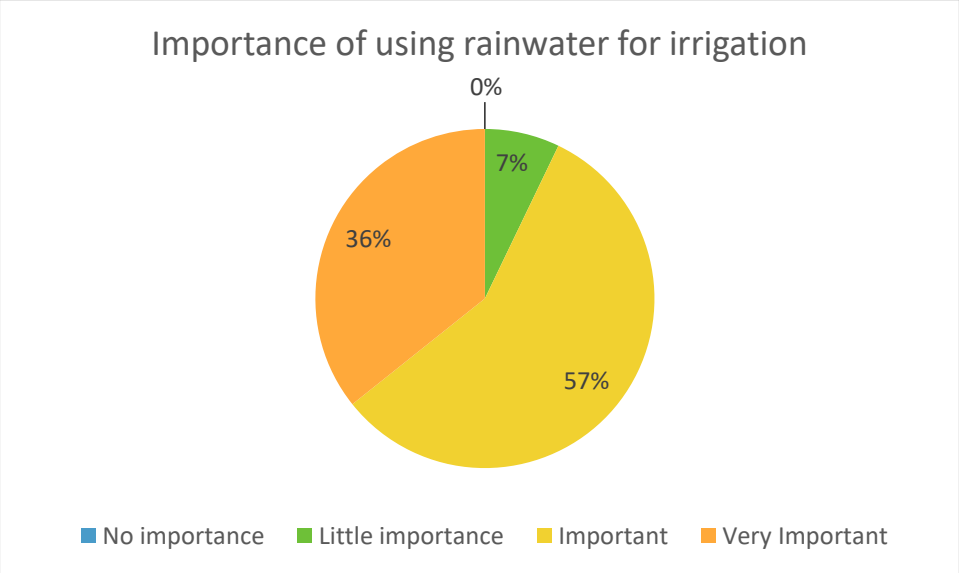

Figure 3.42 Perception of participants regarding the importance of using rainwater for irrigation

When asked about the importance of using rainwater in herb cultivation, participants' opinion varied, with approximately one out of three (36%) considering it as important (Figure 3.43). Approximately one out of two considered it as not important or with little importance (21% not important and 29% slightly important), whereas only 14% considered it as very important (Figure 3.43). The above-mentioned water shortage may urge the residents to adopt new irrigating habits, and exploit rainwater for irrigation. In Greece, herbs are often grown without any irrigation water. This may explain the response of participants on considering rainwater for irrigation as important and on the other hand assigning little or no importance to rainwater for herb cultivation.

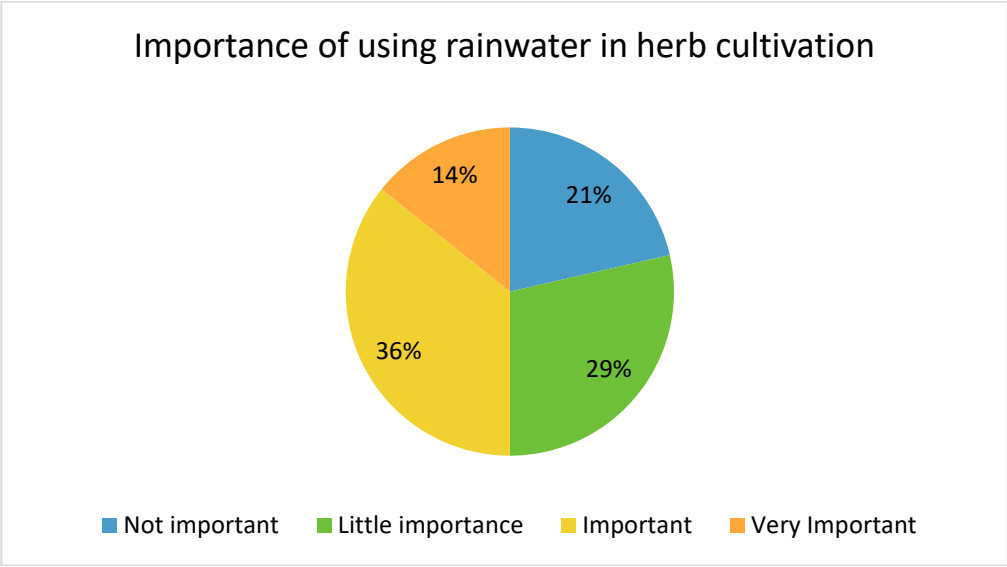

Figure 3.43 Perception of participants regarding the importance of using rainwater in herb cultivation

The next aspect of the current part of the survey referred to the importance of collecting rainwater to cover personal needs and several domestic uses. Based on the analysis of the results, more than 85% of the participants characterized as important or very important the process of collecting rainwater in order to cover personal (i.e. domestic) needs, and only 14% characterized it as not important or slightly important (Figure 3.44). This comes to point out the willingness of the end-users to exploit collected rainwater in order to cover personal needs.

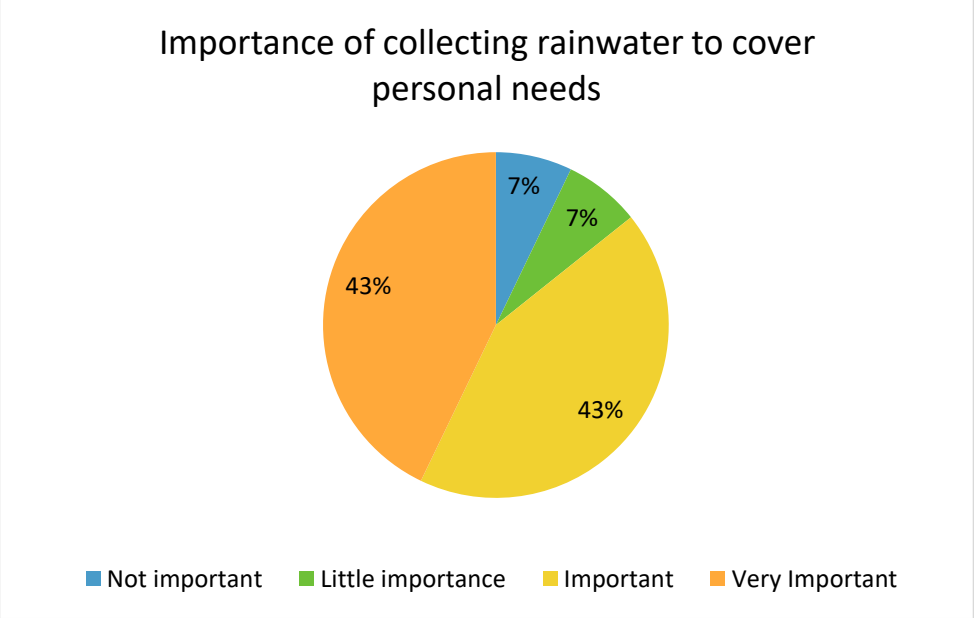

Figure 3.44 Perception of participants regarding the importance of collecting rainwater in order to cover personal needs

The potential domestic purposes that were addressed for evaluation to the end-users, were the following: personal shower, face washing, dish washing, clothes washing, boiler/heater and toilet. According to their belief, collection of rainwater was more important for domestic use relevant to purposes that do not involve direct personal contact with the rainwater, such boiler/heater and toilet. In respect to purposes that involve more direct contact with their body/skin/face, such as personal shower, face washing, dish washing and clothes washing their perception was differently shaped, pointing to weaker opinion regarding the importance of collecting rainwater (Figure 3.45). Nevertheless, participants declared to a certain degree the importance in collecting rainwater for domestic use.

More specifically, 55% of the end-users characterized the collection of rainwater for shower and face washing as important/very important, while only 14% as not important/slightly important. Regarding collecting rainwater for dish washing, 72% of the participants characterized it as important/very important, while only 7% characterized it as not important/slightly important. Regarding collecting rainwater for clothes washing, 55% characterized it important/very important, while only 7% characterized it as not important/slightly important. 78% of the end-users, characterized collecting rainwater for boiler/heater and toilet purposes as important/very important, and no end-users characterized it as not important/slightly important.

All domestic uses (apart from direct potable use which was not examined) received more than 50% of the response as important/very important showing their willingness to valorize harvested rainwater.

The replies reflect the long-encountered problem of seawater intrusion into the aquifer which results in the groundwater characterized by elevated salinity concentrations. Furthermore, in the past, the surface water which was treated by the water treatment plant face some taste and odour problems due to the presence of geosmin.

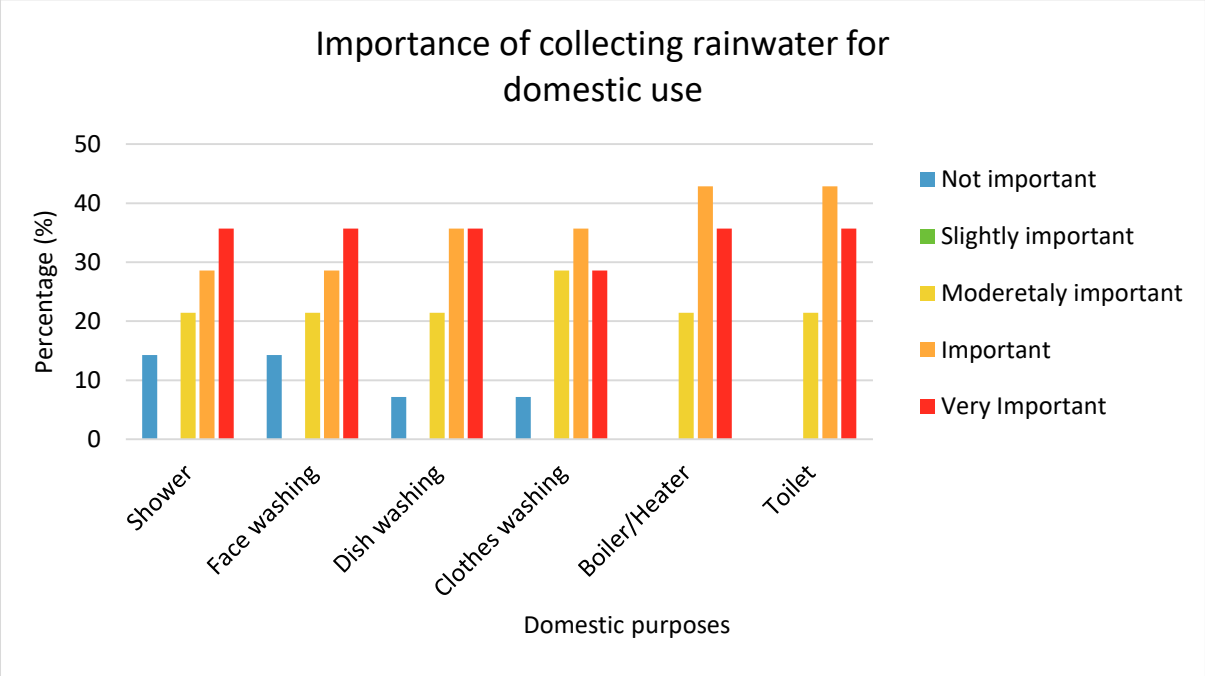

Figure 3.45 Perception of participants regarding the importance of collecting rainwater for several domestic purposes

Aside from the importance of collecting rainwater for personal and domestic purposes, end-users were also asked about their opinion regarding the importance of precision irrigation. None of the participants replied that precision irrigation is of not important. Almost 80% replied that it is very important or at least important, while only 21% of them replied that precision irrigation is of little importance (Figure 3.46).

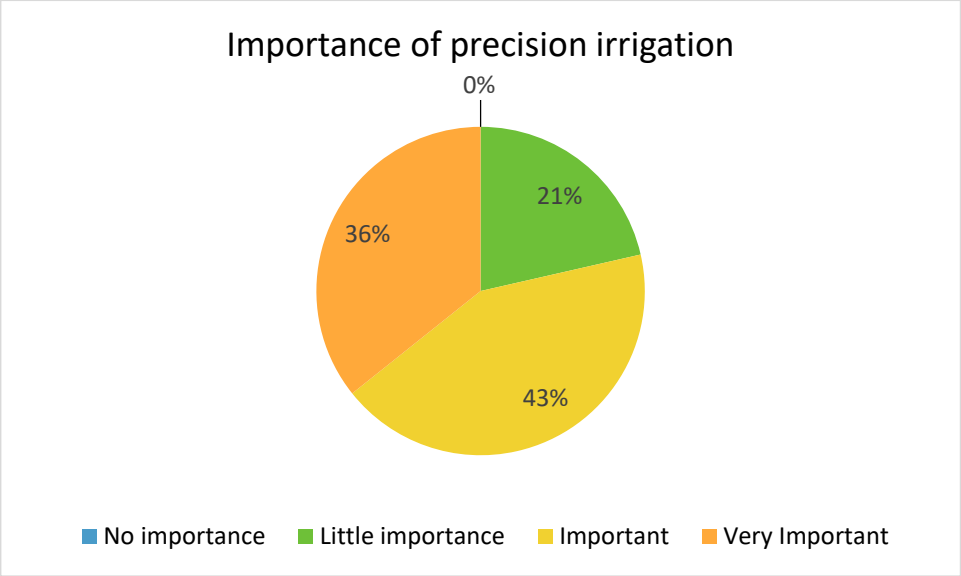

Figure 3.46 Perception of participants regarding the importance of precision irrigation

Afterwards, participants were asked to reply regarding their familiarity with the process of water monitoring, more specifically, whether they use any technology in order to monitor water quality and quantity or not. The results indicated that more than 90% of the participants did not monitor water quality and quantity with the use of any technology, while only 7% monitored them (Figure 3.47). Their specific reply fully aligns with their perception regarding the significance of measuring water quality and quantity (Figures 3.40 & 3.41). The reasons behind not monitoring water, may vary, with the lack of familiarization with new innovative technologies and devices, and cost issues being amongst the most possible explanations.

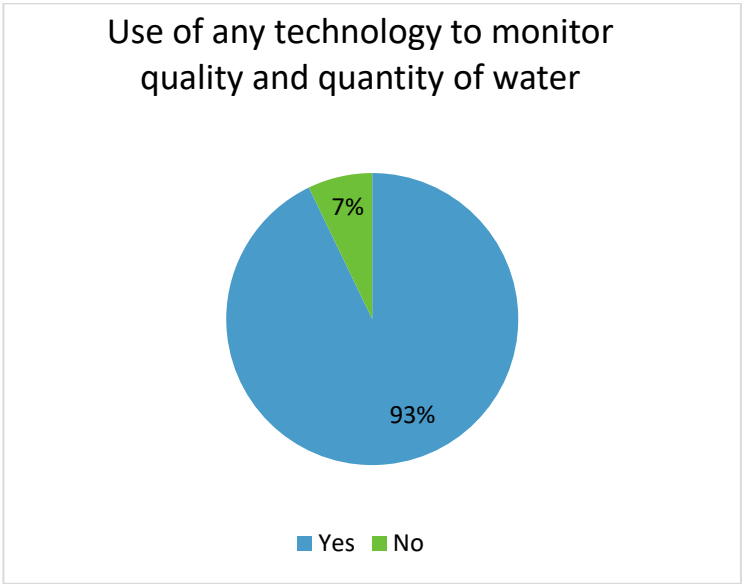

Figure 3.47 Classification of participants based on whether they use any technology in order to monitor water quality and quantity or not

All participants belonging to this group, had previously highlighted the significance of measuring water quality and quantity (Figures 3.40 & 3.41) and significance of collecting rainwater for every type of domestic purposes and personal use (Figure 3.45).

General Questions – HYDROUSA development (Questions 19-21)

In the current part of the survey, participants were asked to reply to questions concerning the development of HYDROUSA. More specifically, questions orienting to the type of information related to water management (treatment, storage, transport) that end-users would desire to access, the type of devices and sensors that they would desire to use for the management of this information and the reasons for using such devices.

Out of the 14 participants, 21.4% ranked as first priority the possibility to access information related to water quality and quantity and information on treatment harvesting and distribution (Figure 3.48). Other information that was introduced as desired to be accessible by the participants but to a less degree, were the information related to water storage, water loss during the process of water management and exploitation of brine in the framework of the activities of the project (Figure 3.48).

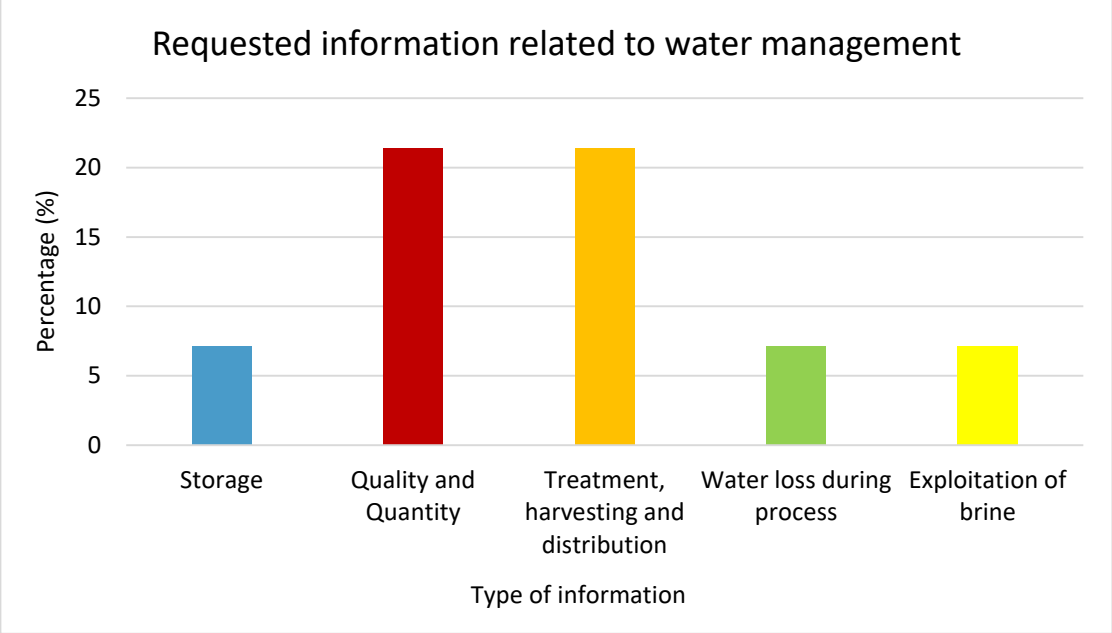

Figure 3.48 Different types of information related to water that participants declared they would like to access in the framework of the project

When asked about the type of device/sensor that they consider important in water management, participants mainly replied that they would be interested in having small devices and applications (Figure 3.49). Apart from this, participants mentioned as important, the development of sensors for monitoring water quality, water conductivity and salinity sensors (Figure 3.49).

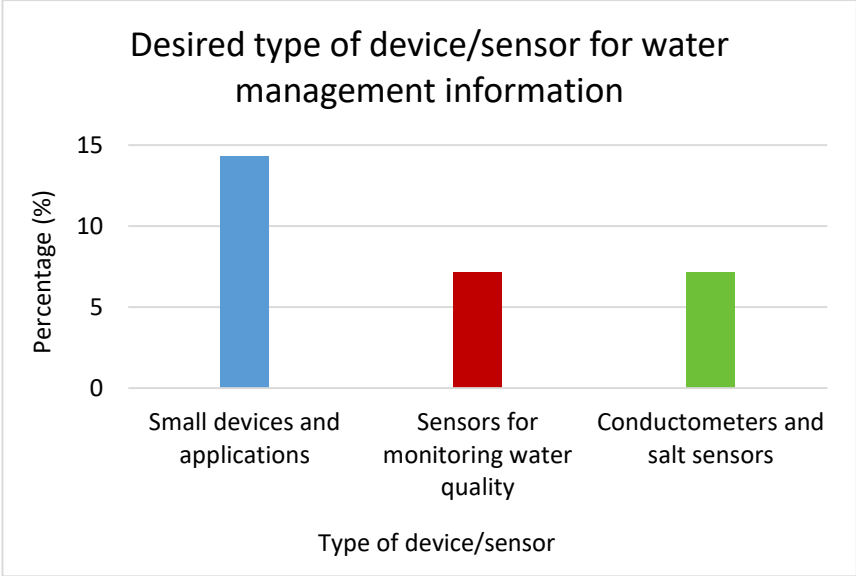

Figure 3.49 Desired type of device/sensor for water management information

In the next step of the current part of the survey, participants were asked to mention the reasons why they want to use the above-mentioned devices/sensors. Once again, water quality and the use of water was their first choice. This can be linked with the shortage of water that the island suffers from. Other aspects mentioned were the fate of stored water, the exploitation of natural resources, the poor quality of the existing water and the discarding of brine (Figure 3.50).

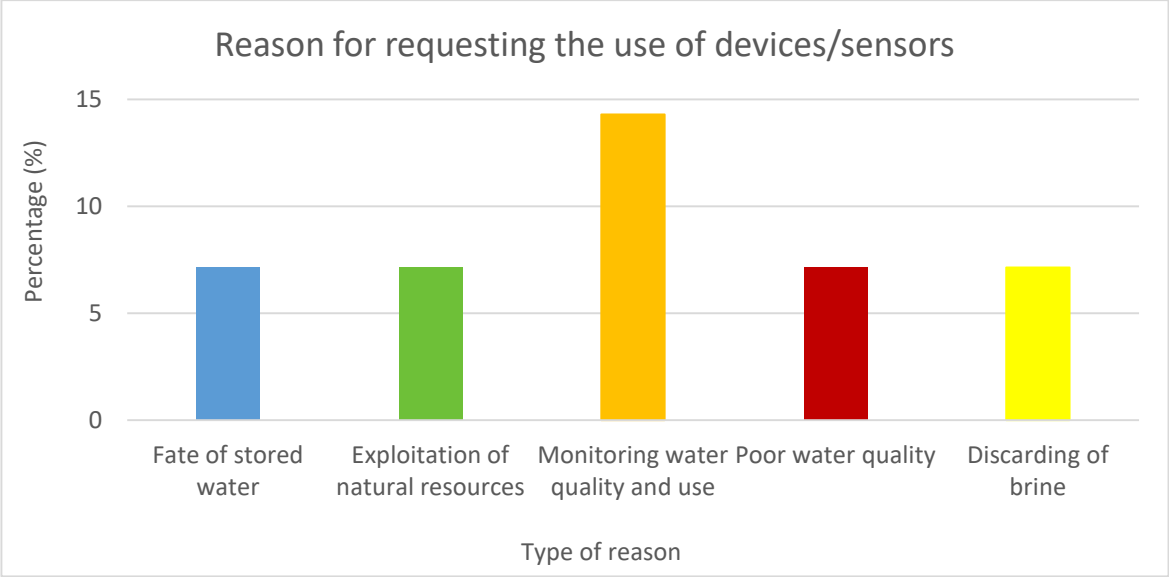

Figure 3.50 Reasons why participants consider as important the use of devices and sensors in the current water management system

Hardware of the project HYDROUSA (Questions 22-30)

In this part of the report, participants were asked to reply to questions concerning the hardware of HYDROUSA. More specifically, questions:

- Regarding the importance of monitoring each system part, the parameters related to water quality and quantity measurements, the development of low-cost sensors for monitoring

water quality and quantity, and whether they would prefer a ready solution or a conFigureurable system as a sensor.

- If the installation of a sensor would cause functional and visual disturbance in the surrounding area.
- Regarding the network of the system and the parameters measured by the sensors.
- To evaluate the importance of energy dependent systems in water management.

Regarding the importance of the monitoring parts of the system, participants were asked to evaluate the importance of monitoring several system parts such as water consumption, water production, water flow, water processing, water saving, energy consumption, operating systems, meteorological phenomena and soil humidity for agriculture. Water consumption was considered by 86% of the respondents as very important / important; water flow, water processing and energy saving were considered above 70% of the respondents as very important / important. Water production and saving was considered as very important/important by 64% of the participants. All participants stated that monitoring all the proposed system parts was important to a certain degree (Figure 3.51). Not important, slightly important and moderately important were not amongst the most frequent replies given. The same pattern was identified for the answer very important, which was not the dominant answer (Figure 3.51). This comes to support the fact that the end-users consider all the aspects and the parts of the system to be important up to a certain degree, which may constitute a powerful and reasonable state to prove their willingness to embrace such a project.

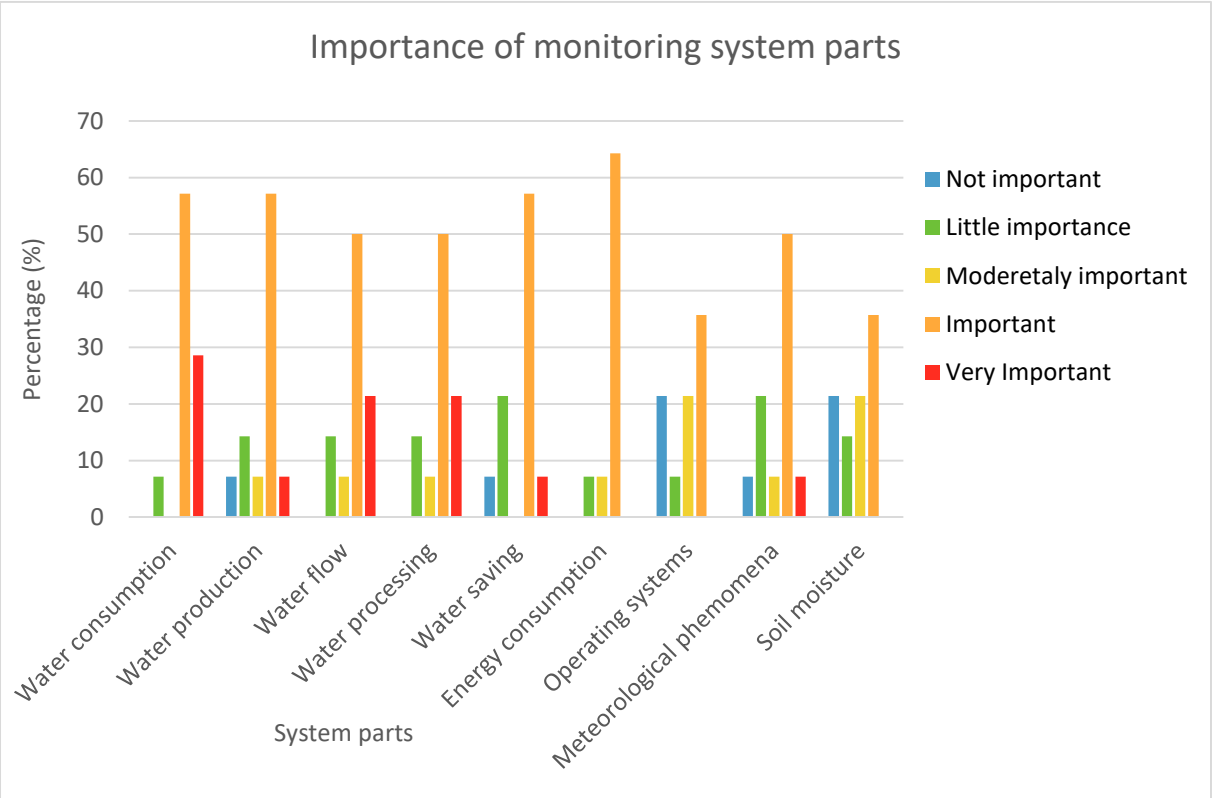

Figure 3.51 Opinion of the end-users regarding the importance of monitoring each system part

Subsequently, participants were asked about the existence of any possible suggestion parameter/sensor related to water quality and quantity measurements, based on their perception. More than 85% of the participants, did not suggest other parameters/sensors to be included in the project (Figure 3.52), which indicates that the developed system parts, cover their needs and that end-users consider the system parts to be sufficient. Alternatively, the lack of response may be due to the fact that the respondents are not aware of these parameters. However, given their replies in previous questions this is considered to be unlikely.

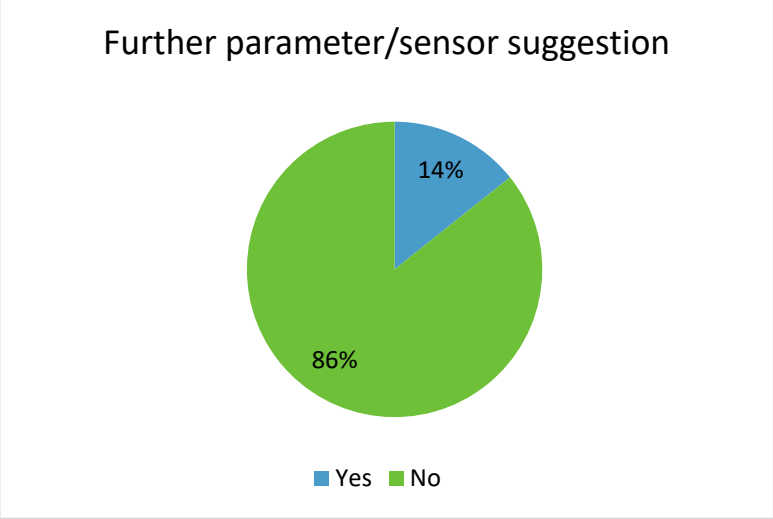

Figure 3.52 Possibility for further parameter/sensor suggestion by the end-users

14% of the end-users that replied positively, mentioned that they would suggest a parameter or a sensor. This fact, confirms the outcome extracted by the previous section of the questionnaire, that participants express a concern regarding water quantity and quality. It is clear that water quality and quantity is of high priority and importance for the end-users.

In the next stage of the current section, participants were asked to choose whether they would be interested in the development of a low-cost sensor in order to monitor water quality and quantity. As expected, almost 64% of the end-users considered such a development as an interesting aspect (Figure 3.53).

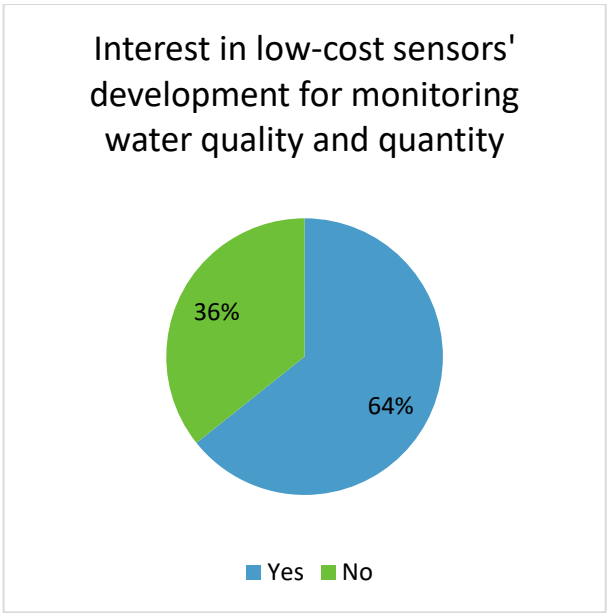

Figure 3.53 Interest of the end-users in the development of low-cost sensors for measuring and monitoring water quality and quantity

Regarding the structure of the available systems, end-users tend to prefer conFigureurable systems rather than existing solutions (Figure 3.54), probably due to possible further ability to control and exploit the system in a better way based on their perception. On the other hand, the 14% difference between the two groups is not significant, which indicates that the type of the structure of the system, may not be of paramount interest for the end-users, who may be willing to use both an existing solution and a conFigureurable system.

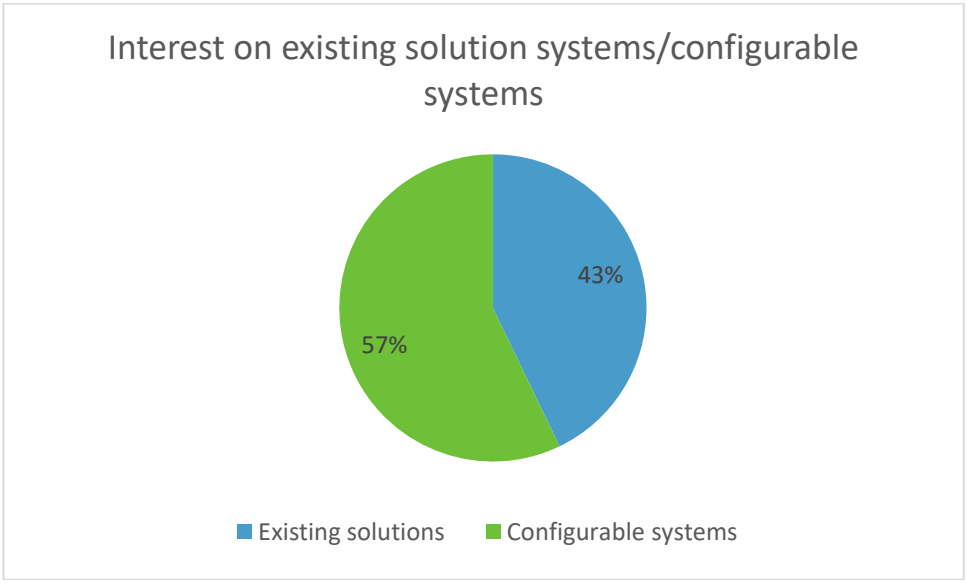

Figure 3.54 Classification of participants based on their preference and interest on existing solutions or conFigureurable systems

The significance of the maintenance of the beautiful island scenery, is highly depicted in the percentage of participants who stated that the installation of sensors, would cause a functional and visual disturbance in the surrounding area. Approximately one out of three participants (37%)

appeared to be skeptical about the potential disturbance by the installation of the sensors, while 63% of the participants considered that the installation of the sensors would not cause functional and visual disturbance in the area (Figure 3.55).

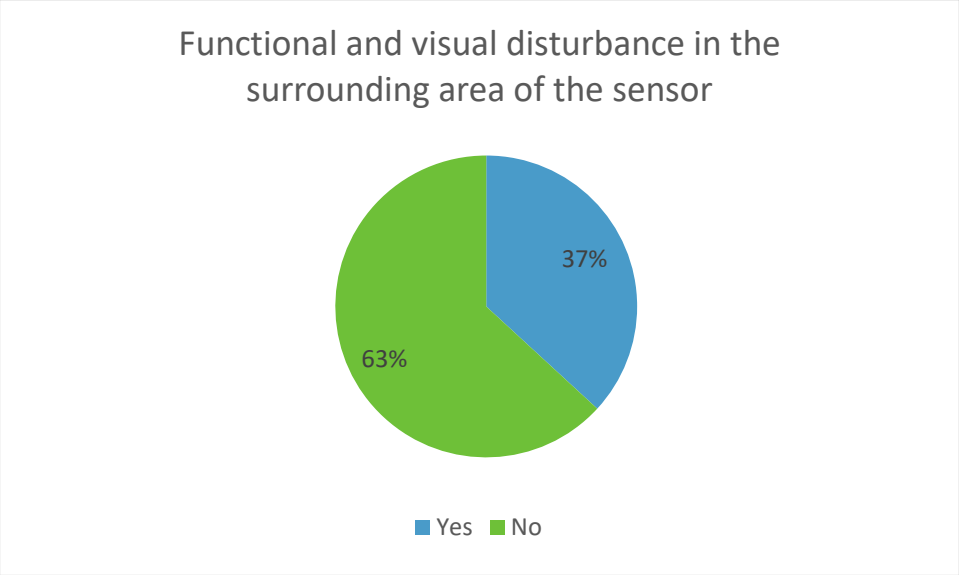

Figure 3.55 Opinion of the end-users regarding the possible functional and visual disturbance caused by the installation of sensors in their surrounding area

In terms of the structure of the network supporting the sensors, end-users mentioned that they would prefer to have access to a private network (Figure 3.56). Approximately two out of three participants expressed their preference on a private network, possibly due to their concern about others being able to see data that they may consider to be personal. In the past, Mykonos Island has suffered from odour and taste issues of potable water due to the presence of geosmin, an organic compound that can be found in surface water due to the growth of algae.

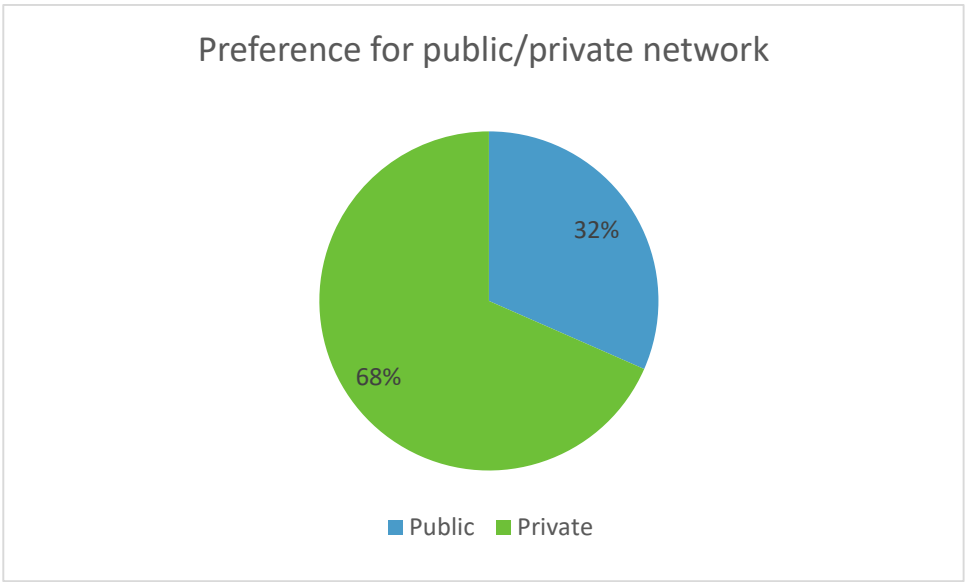

Figure 3.56 Preference of end-users regarding the type of the network, public or private

Then, end-users were asked to report the useful measurements of the system, based on their opinion and needs. The answers varied, with the water salinity being the first choice amongst the different options (Figure 3.57). One out of five participants stated that water taste and odour, and water pH is the measurement he/she is interested in; these were the second most frequent reply. Water color, microorganism content, turbidity, electric conductivity, hardness and purity of the water, were the other aspects that concerned the end-users (Figure 3.57).

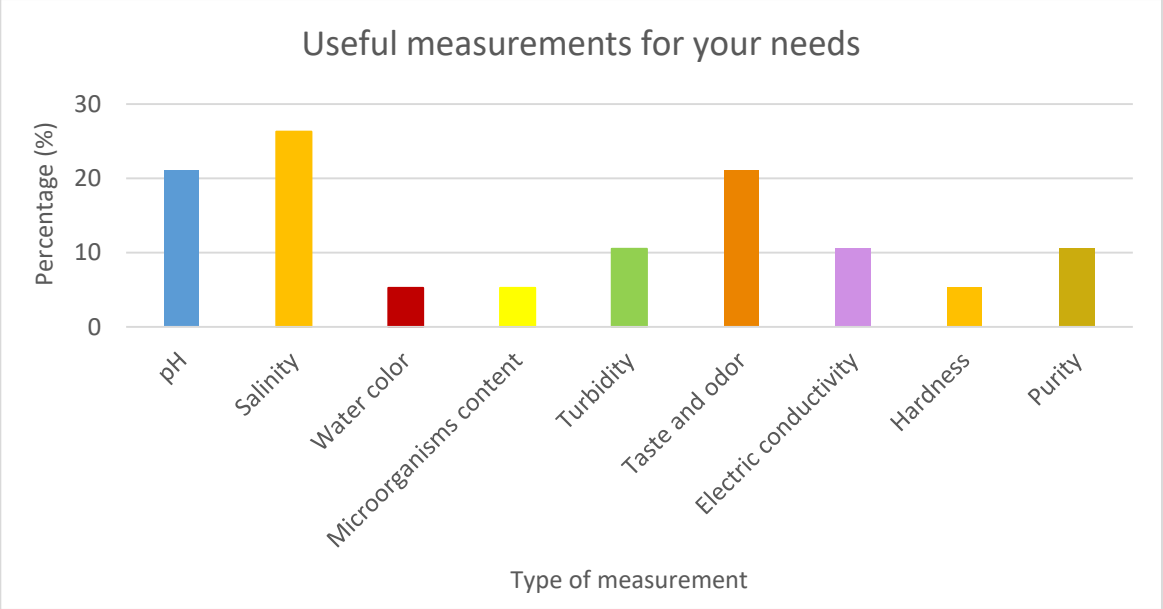

Figure 3.57 Usefulness of several measurements related to water characteristics based on the opinion of the end-users

Concerning the importance of developing energy autonomous systems to monitor water treatment and management, almost 80% of end-users stated that is important or very important to develop energy autonomous systems, while only around 20% considered that energy dependence of systems in not important or slightly important (Figure 3.58). This may be attributed to the environmental consciousness of the end-users, and to the possibility that they have adopted environmentally friendly practices in order to support sustainability.

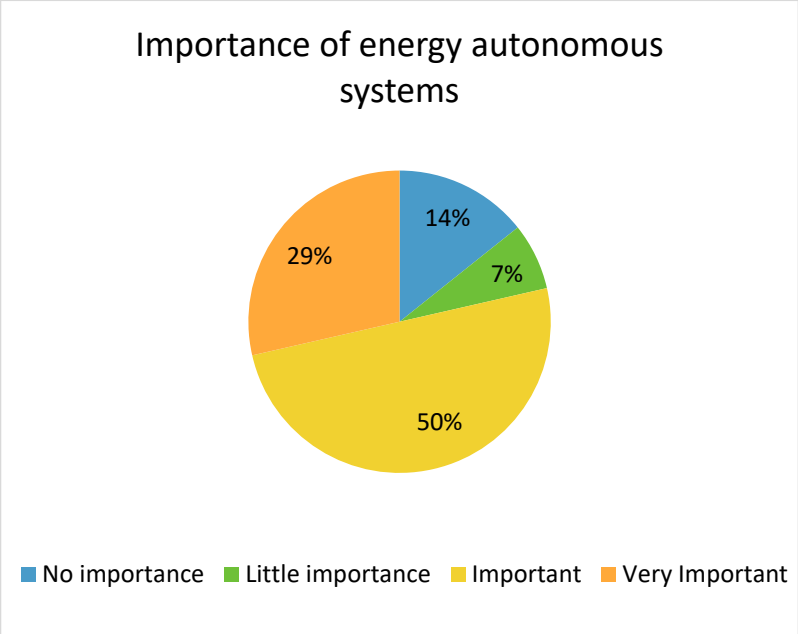

Figure 3.58 Importance of energy autonomous systems based on the perception of the end-users

Platform of HYDROUSA (Questions 31-38)

In the current part of the report, participants were asked to cover aspects regarding HYDROUSA platform. More specifically:

- To determine the type of device they prefer to use in order to access HYDROUSA information, the type of alert and notifications they prefer to receive and their optimum frequency, as well as to evaluate the ability to customize the notifications received by the system.
- To express their interest in the development of custom irrigation algorithms and to evaluate the importance of information displayed by the system;
- Regarding their preferable format for the exported files by the system and state their willingness to have access to historical data of the system.

At the first part of the current section, end-users were asked to indicate the device they would prefer to use in order to access HYDROUSA information. Potential answers included personal computer, tablet, smartphone or having no internet access at all. More than one out of two participants (57%) stated that would prefer to use a smartphone device to access HYDROUSA information (Figure 3.59). Almost 15% replied that they have no internet access at all, while personal computer and tablet had a percentage around 30% each (Figure 3.59). Results highlight the wide use of smartphones in every-day life.

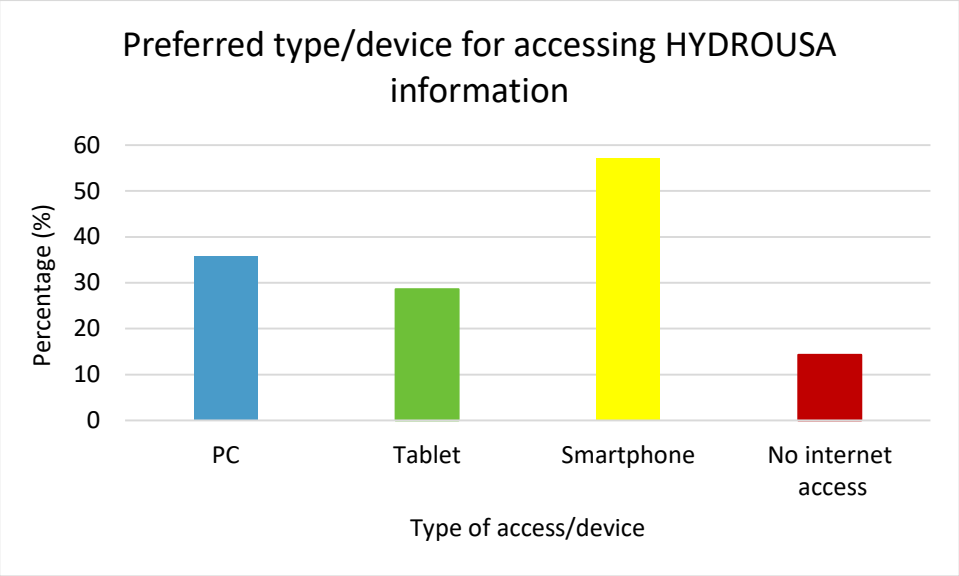

Figure 3.59 Preferred device for accessing HYDROUSA information

The ability to customize the notifications received was the next evaluated aspect, where 57% of the end-users declared they would like to be able to customize their notifications (Figure 3.60). Apart from the ability to customize notifications, end-users were asked about the type of alert and notification they prefer to receive, with the dominant answer being for one out of two participants via email (Figure 3.61). Other possible answers were via SMS and via smartphone application notification, which represented around 30% of the end-user's preference each one respectively (Figure 3.61).

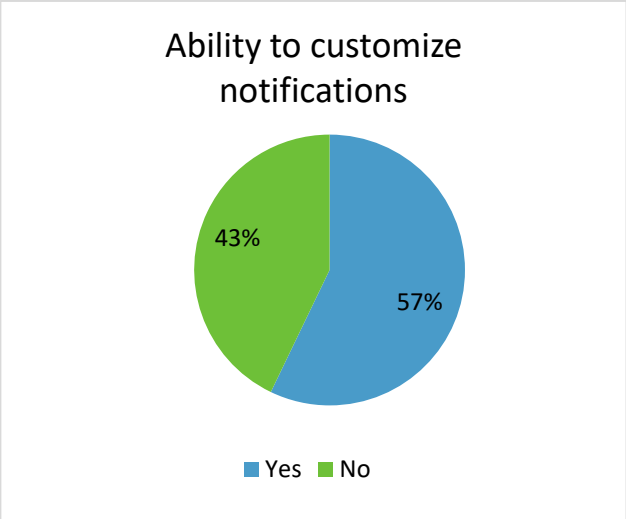

Figure 3.60 Classification of end-users based on their willing to have the ability to customize the notifications received by the system

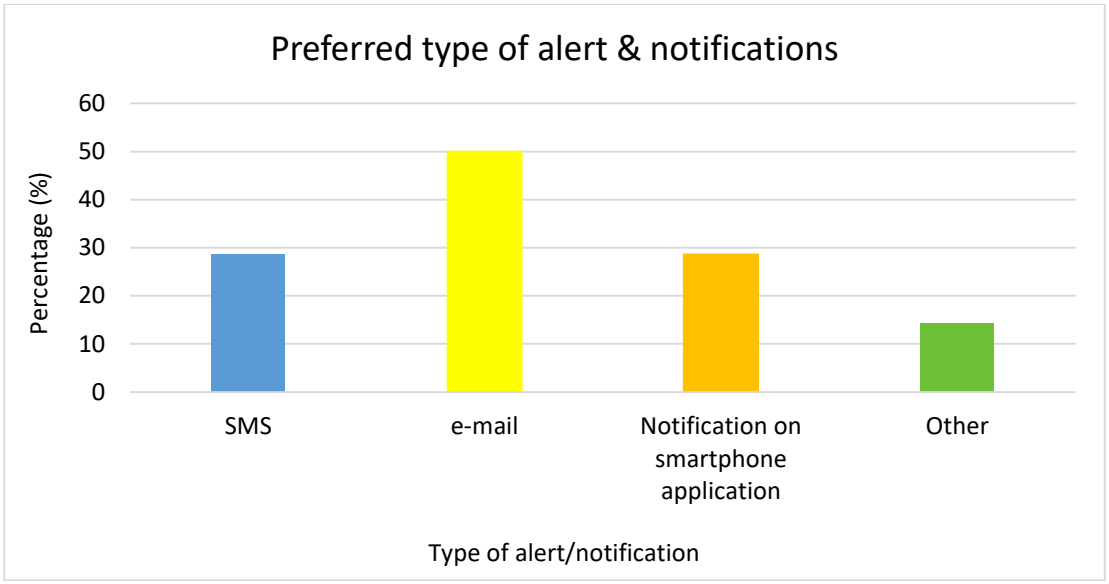

Figure 3.61 Preferred type of alert/notification by the end-users for accessing HYDROUSA information

End-users were also asked to determine their possible interest in the development of custom irrigation algorithms. In this question, the majority of the participants replied that they would not be interested in such a development. More specifically, around 80% of the participants expressed no interest in the development of custom irrigation algorithms, while only 21% expressed interest (Figure 3.62).

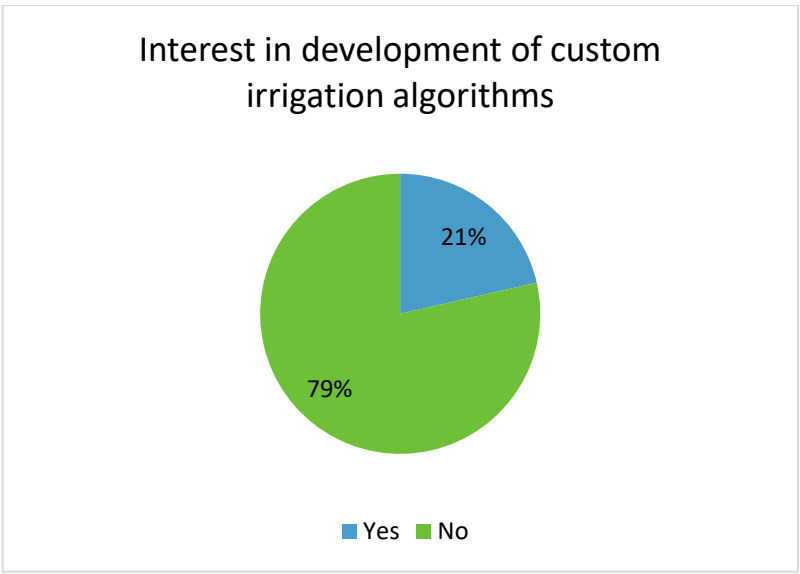

Figure 3.62 Expression of interest by the end-users for the development of custom irrigation algorithms

In the next part of the section of the survey, participants were asked to evaluate the importance of displaying several types of information. Reports, statistics and notifications were the most significant information to be displayed, according to the end-users. Display of maps and diagrams was not equally important for the participants (Figure 3.63).

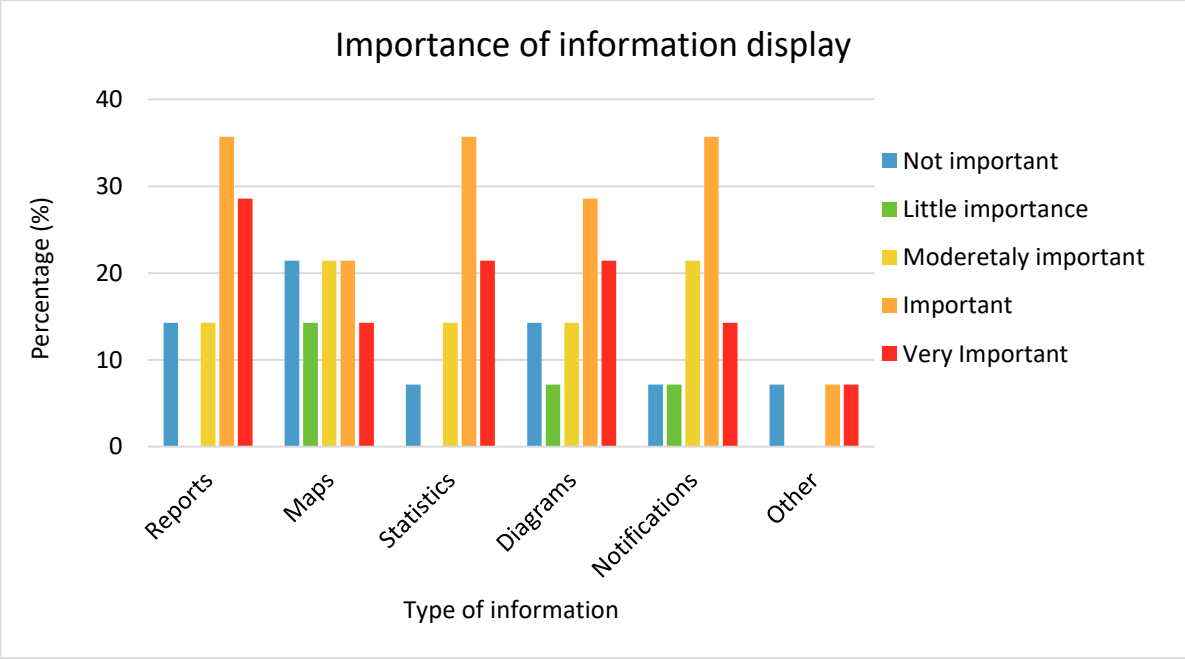

Figure 3.63 Importance of information display based on the type of information

Specifically, 63% of the participants characterized display of reports as important/very important, and 14% as not important/slightly important. 36% characterized display of maps as important/very important, and another 36% as not important/slightly important. Regarding display of statistics, 57% of the participants characterized it as important/very important, while only 7% characterized it as not important/slightly important. Additionally, one out of two participants (50%) characterized display of diagrams as important/very important, and 21% characterized it as not important/slightly important. Finally, 60% of the participants, characterized notification display as important/very important, and 14% of the participants characterized it as not important/slightly important.

Regarding the type of exported file by the system, around one out of two participants replied that they would prefer TEXT file format, and a small part of the participants selected SHAPEFILE and CSV file format (Figure 3.64).

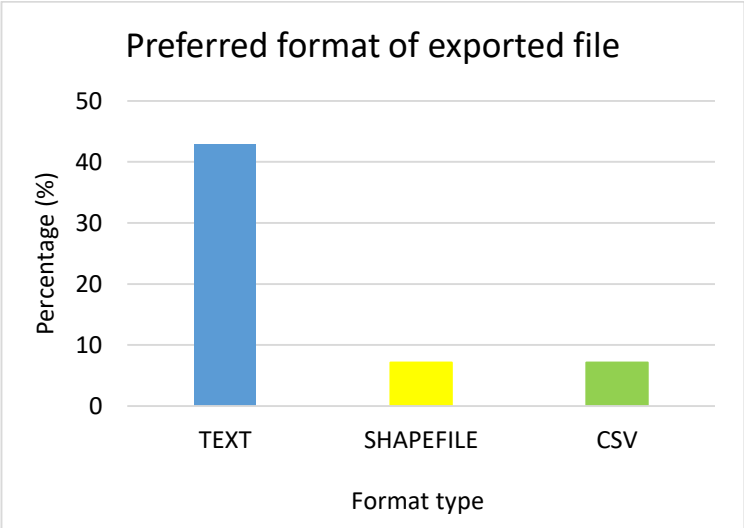

Figure 3.64 Different types of file format that end-users selected for exported files by the system

With respect to the optimum frequency receiving alerts, participants were given certain possible choices, such as every 15 minutes, every 30 minutes, every hour, every 3 hours and every day. No participants chose the options related with very frequent alerts (every 15 and 30 minutes) (Figure 3.65). Less than 10% of the participants opted for hourly and every 3 hours alerts and around 35% opted for daily alerts (Figure 3.65). Nevertheless, one out of two participants replied that the choices given did not reflect their opinion. Among this 50% of the end-users, approximately one out of two, stated that the optimum frequency for receiving alerts was on a weekly base, while 15% of them opted for alerts every two weeks and another 15% opted not to receive any notifications at all (Figure 3.66).

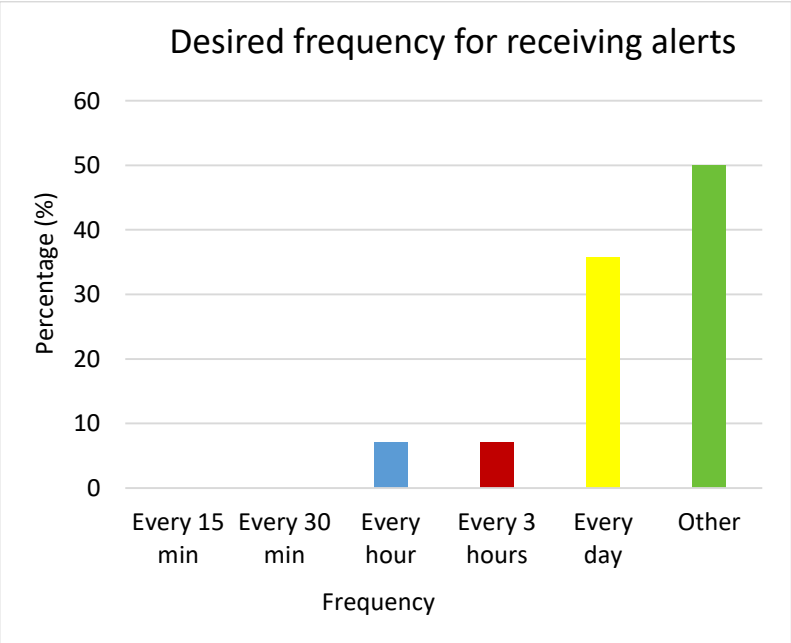

Figure 3.65 Desired frequency for the end-users to receive alerts by the system

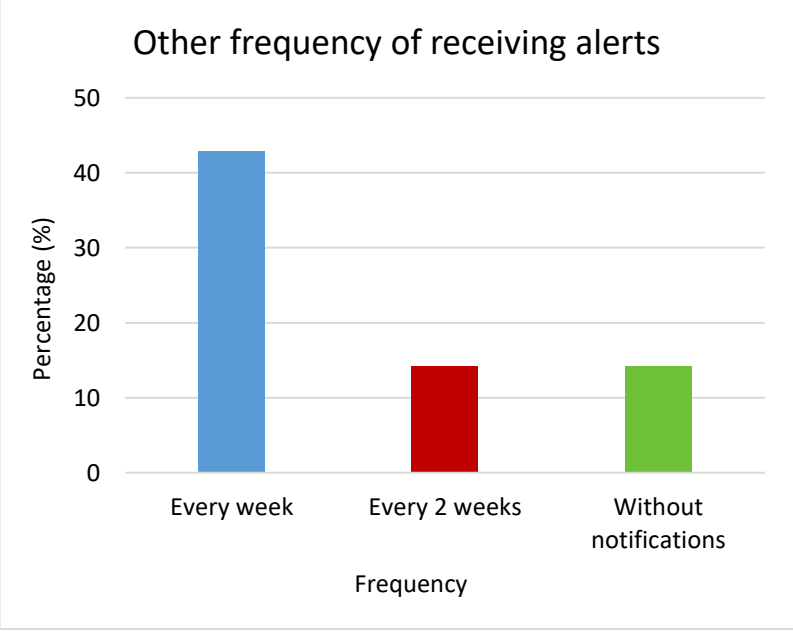

Figure 3.66 Other replies by the end-users about the optimum frequency for receiving alerts

The final question for the current section of the survey referred to the evaluation of the ability to access historical data in the system. A significant percent of the participants (64%) replied that they would like to be able to access historical data, while 36% that they do not (Figure 3.67). This may reflect the willingness of the end-users to compare present with past data, in order to better understand the evolution of the current situation regarding water management.

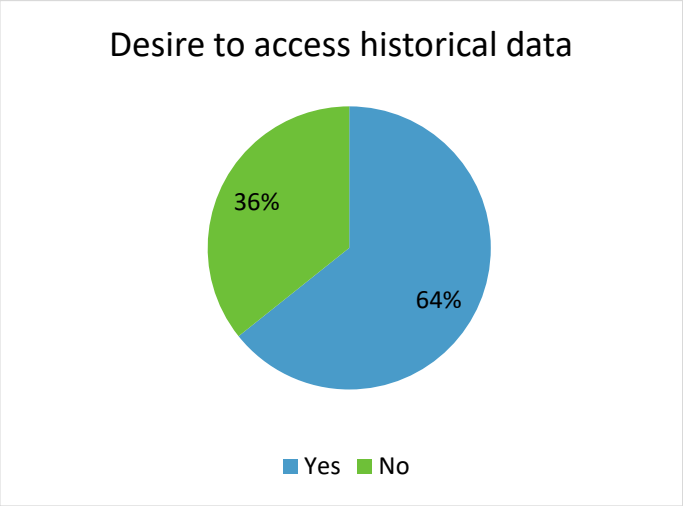

Figure 3.67 Desire of participants to have access to historical data of the system

Importance of HYDROUSA (Question 39)

At the end of the survey, end-users were asked to express their opinion regarding the importance of the project. More specifically, they were asked to answer whether HYDROUSA has the ability to solve the water deficiency problem of the island during the summer touristic period, or not.

In this final question of the survey, the opinion of the end-users was divided, with the majority (57%) replying that HYDROUSA project is not able to solve water shortage problem of the island during the touristic period, whereas, 43% of the end-users considered HYDROUSA able to solve them (Figure 3.68).

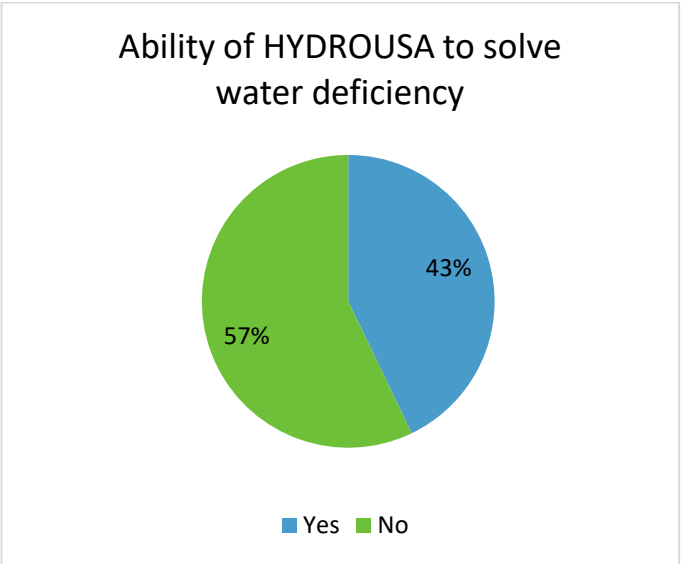

Figure 3.68 Opinion of the participants regarding the ability of HYDROUSA project to solve water deficiency of the island especially during the summer touristic period

This perception of the participants, may be attributed to several reasons and may have been influenced by various factors. The hesitation to accept something new, as the current project, especially in a small local community, may play a key role in the formation of an opinion. In addition to that, as water shortage is in fact an existing and ongoing for several years issue for the island, residents may experience an anxiety regarding its solution. As a result, they may express their worry as an insecurity and cautiousness towards any possible suggested innovative alternative. Finally, it may be necessary for them to ascertain by themselves some results in order to be convinced about the possibility of the project's ability to solve water deficiency problem. Nevertheless, it should not be neglected that almost one out of two participants (43%) expressed confidence regarding the project's efficacy.

Summary of HYDRO3 and HYDRO4 questionnaire results

After the evaluation of the results extracted by the answers of the end-users, a summary list was created in order to properly highlight the needs of the end-users and correlate them with the initially determined requirements and specifications. In this way, requirements from all demonstration islands can be interpreted to functionalities during the development of the platform and the establishment of the project. User requirements for Mykonos Island are summarized in Table 3.2.

During the initial determination of requirements and specifications for each separate component of the system, stakeholders that participated were specialized in the field. Thus, the initial determination of specifications was much diversified, while also targeted to certain technologies. However, the end-users participated in eliciting the updated specifications, apparently did not have such specialized knowledge. As a result, several specifications that were initially set by the stakeholders, were not addressed by the end-users in the updated monitoring. Nevertheless, all requirements initially addressed, were also addressed in the updated determination, especially those referring to sensors. Regarding sensors, end-users mentioned conductivity sensors (related to salinity issues), flow meter, turbidity sensor, pH sensor, and weather station use in addition with soil moisture monitoring. Concerning systems, end-users mentioned the development of systems for rainwater collection and irrigation systems. Finally regarding software, end-users stated both web and mobile interfaces as desirable specifications.

Table 3.2 End-user specifications and requirements for each component in Mykonos Island

Components	Requirements	End-user specifications
Sensors	Water Quality and Quantity measurement	Conductivity meter
		Flow meter
		Turbidity sensor
		pH sensor
	Irrigation related sensors	Weather station
		Soil moisture sensor
Systems	Support of different processes	Systems with rainwater collection
Irrigation	Water flow types	Irrigation system
Software	User interaction with devices	Web interface
		Mobile interface

3.3 HYDRO5 and HYDRO6 – Tinos Island

For Tinos Island a survey for the investigation of user requirements was performed through a questionnaire with a total of 27 participants. All 27 participants were residents of the Island. The survey was conducted and the questionnaires were delivered by the participants on 22th of November 2019.

The developed questionnaire constituted of 39 questions concerning 6 basic representative subject categories: demographics data of the participants, personal general questions, General questions about HYDROUSA development, questions about the hardware of HYDROUSA project, questions about HYDROUSA platform and finally about the importance and efficacy of HYDROUSA project. The questionnaire was developed aiming to outline in the most proper way the user requirements.

Demographics (Questions 3-8)

In the current part of the report, participants were asked about their age, gender, level of education, their access on the internet and their representative category (i.e., domestic, agricultural, commercial user etc).

Based on the results extracted by the questionnaire regarding the age of the participants, 17% of the participants belong to the group of 35-44 years old, which constitutes the most multitudinous group. 19% of the participants belong to the age group 18-34 years old, 26% to the age group 45-54 years old and only 18% are older than 55 years old (Figure 3.69).

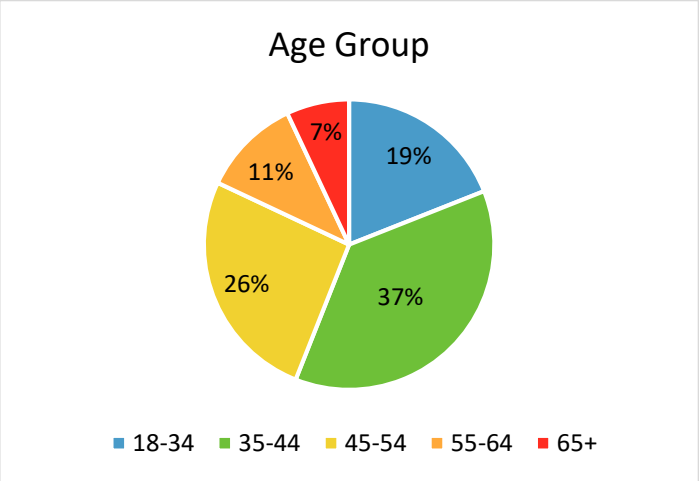

Figure 3.69 Age of participants based on 5 distinct age groups

Regarding the gender of the participants, the majority of them were men (63%), while 33% were women and the remaining 4% did not reply (Figure 3.70).

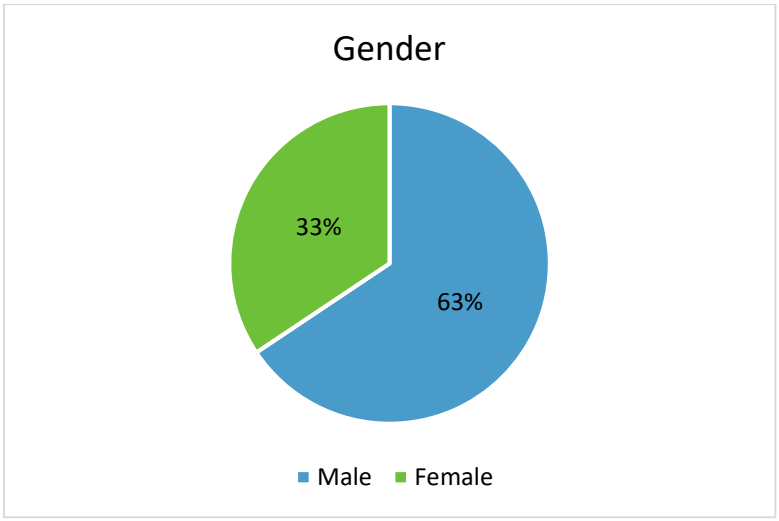

Figure 3.70 Classification of participants based on their gender

The level of education of the participants was also monitored based on a classification in 4 representative categories: primary education, secondary education, graduate and post-graduate/PhD. Based on the results, one out of three participants is graduate and another one out of three participants is post graduate (Figure 3.71). Only 11% of the participants have primary level education and 15% secondary respectively (Figure 3.71).

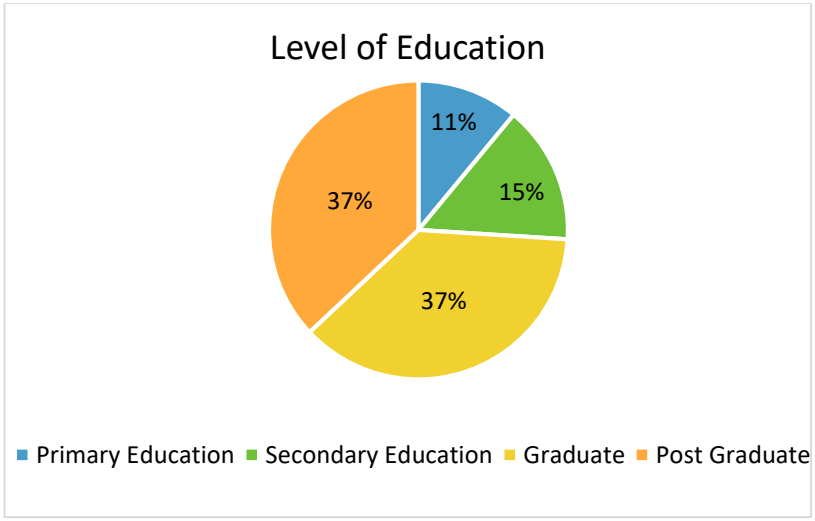

Figure 3.71 Classification of participants based on their level of education

In the next part of the survey, participants were asked about their representative category based on the way they use water, with possible answers being domestic user, agricultural user, commercial user, provider of water systems and irrigation systems and finally, public organization. The vast majority of the participants (70%) are domestic users, 19% are agricultural users, and only 7% are commercial users, 4% are water system and irrigation providers and 4% public organizations (Figure 3.72).

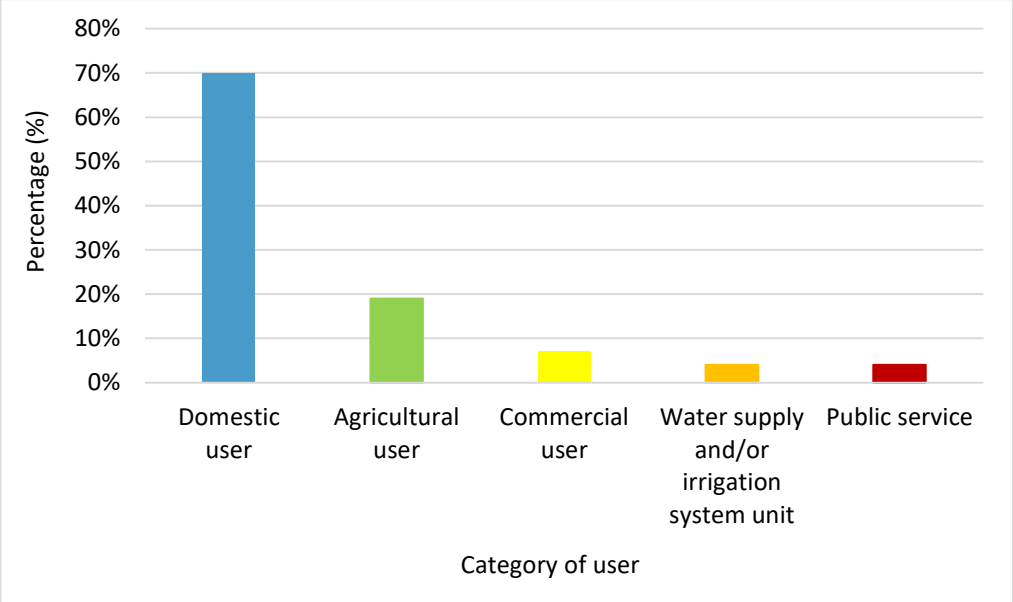

Figure 3.72 Classification of participants based on the way they use water

In the last question of the current section, participants were asked to reply regarding the device they use in order to access the internet, with possible replies being a variety of devices such as a personal computer (desktop), a tablet, or a smartphone and the scenario of having no internet access at all. The analysis of their answers indicates that around 75% of the participants use a personal computer to access the internet, 70% use a smartphone, 11% use a tablet and another 11% have no internet access at all (Figure 3.73).

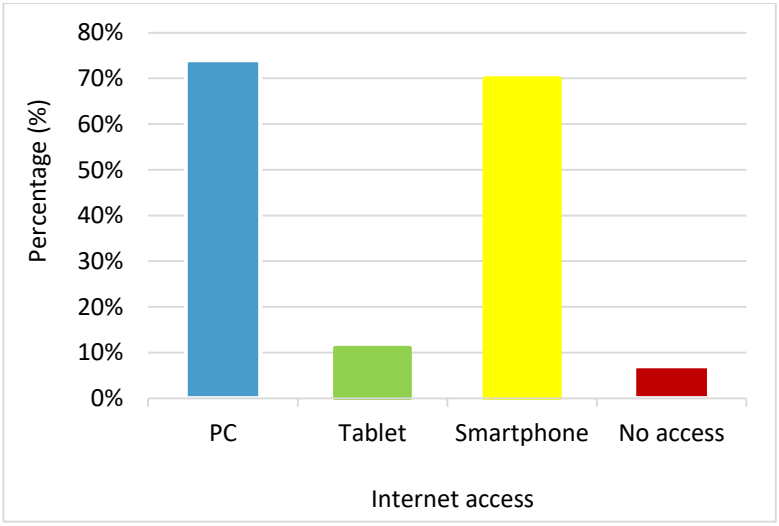

Figure 3.73 Type of device used by the participants for accessing the internet

General Personal Questions (Questions 9-18)

In the current part of the report, participants were asked to reply to questions:

- About their perception regarding the importance of saving water, the importance of measuring the quantity and quality of water, the importance of precision irrigation, the importance of collecting rainwater for reuse and the importance of desalination and water treatment.
- To evaluate the importance of clean water in food production chain and in several domestic uses.
- Whether they use any technology in order to monitor water quality and quantity, or not; and if yes, which type of technology.

The analysis of the results, suggests that all participants attach to a certain extent, some importance to saving water. Specifically, 11% of the participants consider water saving as important, while 89% as very important (Figure 3.74).

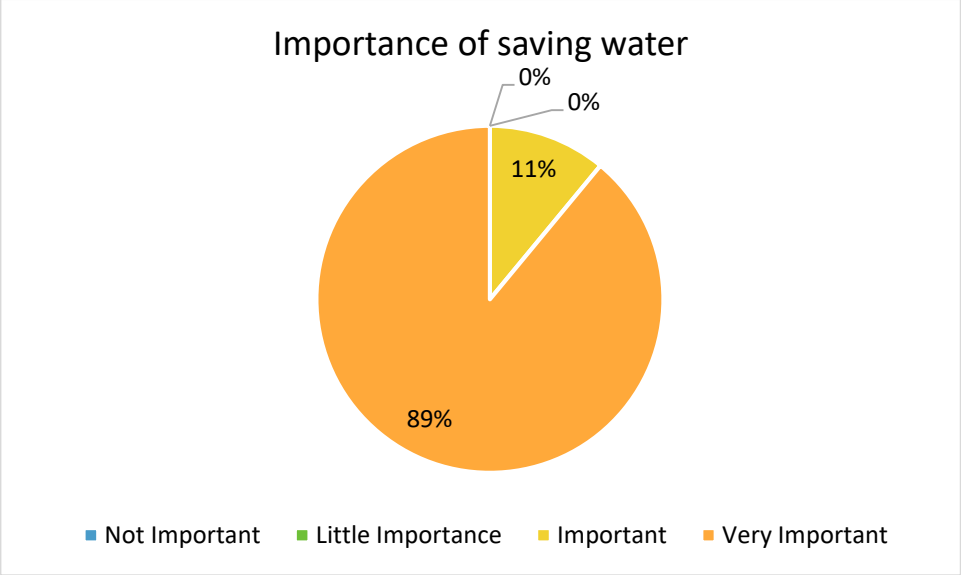

Figure 3.74 Perception of participants regarding the importance of saving water

Regarding the perception of the participants on the importance of desalination and water treatment, 82% of the participants attached importance, with 52% characterizing it as important, and 30% as very important (Figure 3.75). On the other hand, 11% attached minor importance and 7% stated they consider it as not important (Figure 3.75).

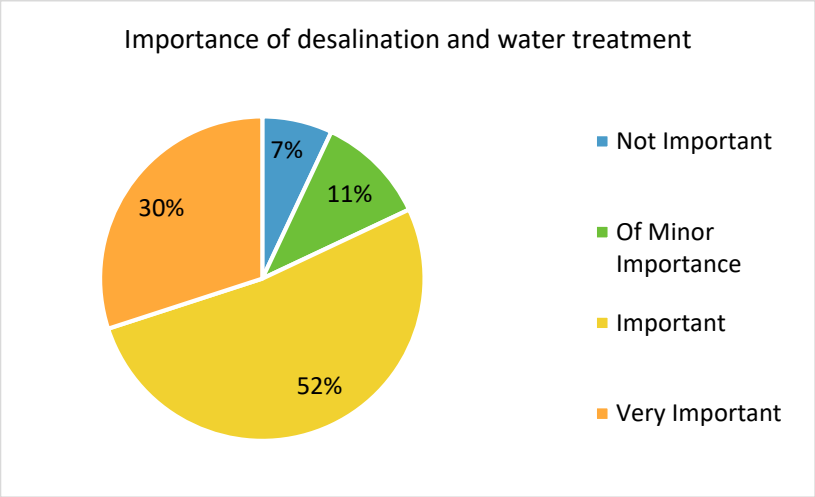

Figure 3.75 Perception of participants regarding the importance of desalination and water treatment

As expected, participants also characterized as significant the collection of rain water. A small percentage of participants (11%) characterized it as important and 89% as very important (Figure 3.76), which highlights their opinion on the value of water. The existing desalination system makes the residents more familiar with this kind of methods and they can trust its results. The fact that rain levels throughout the year are high and can support this kind of systems, covering the needs of the users, especially in high-season periods, makes rainwater collection system important. Also, the fact that the island is a holiday destination makes these kind of water sources very popular to the inhabitants but also to those that will visit Tinos and will stay in facilities that exploit such sources.

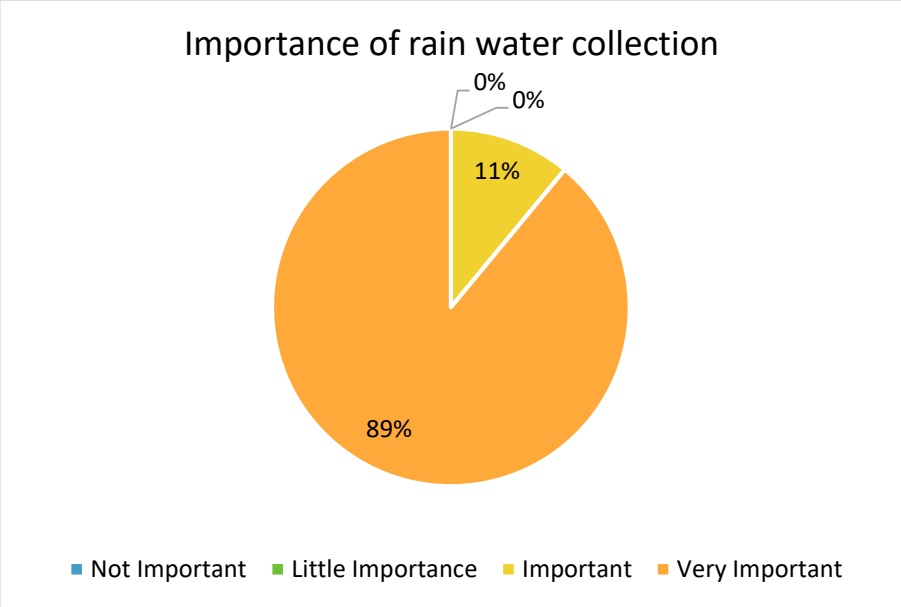

Figure 3.76 Perception of participants regarding the importance of collecting rain water

Concerning the opinion of end-users about the significance of monitoring water quality and quantity, both quality and quantity are very important factors for the participants. The majority of the participants (88%) considers measuring water quantity as very important, 22% as important and only 15% as slightly important (Figure 3.77).

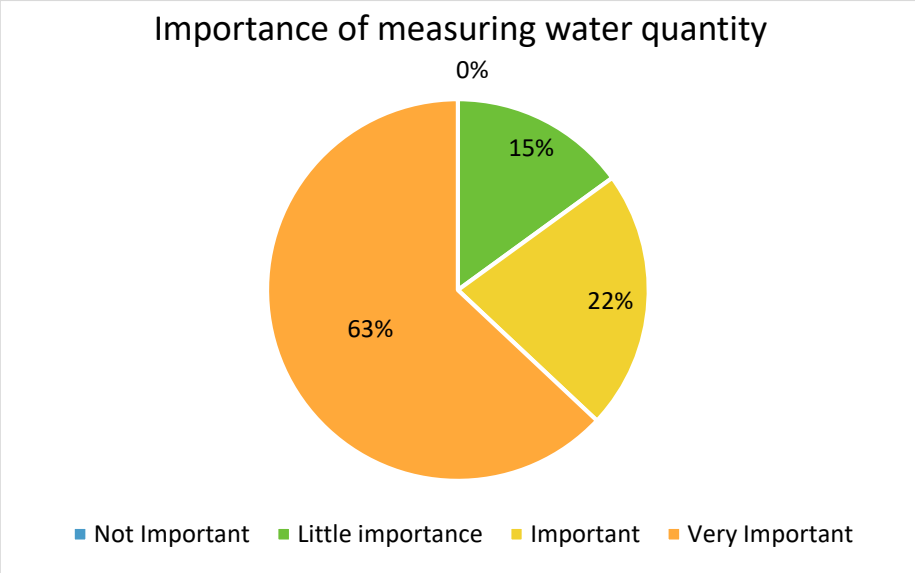

Figure 3.77 Perception of participants regarding the importance of measuring water quantity

The water quality is considered as very important by the 81% of the end-users, while 15% consider it as important and the rest (4%) as slightly important (Figure 3.78). From the aforementioned results, it is concluded that both water quality and quantity are very significant for the residents of the island.

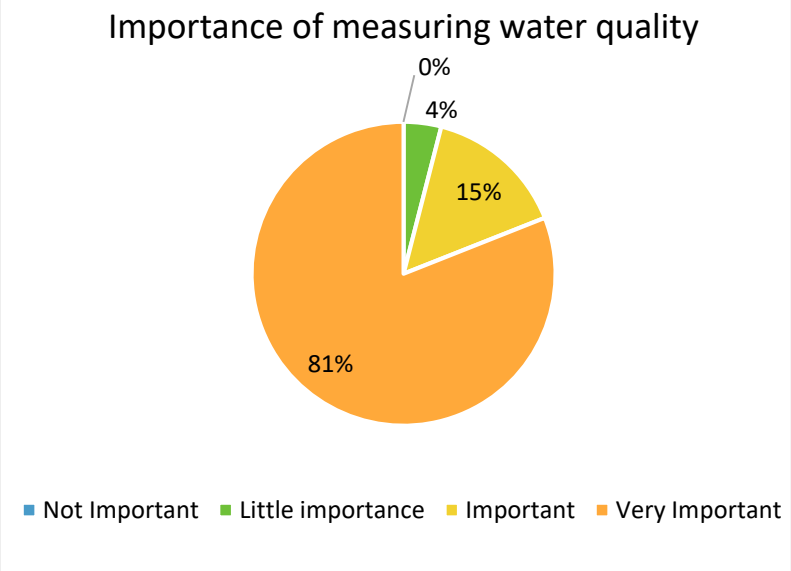

Figure 3.78 Perception of participants regarding the importance of measuring water quality

The significance of water quality and quantity for the participants is also proved by their perception on the significance of using clean water in plant cultivation and consequently in food production chain. Two out of three (67%) stated that it is very important to use clean water, 30% that it is important and only 4% that it is not important (Figure 3.79). Apparently, they believe that the nutrients that the clean water contains and the absence of harmful microorganisms can lead to safer food production.

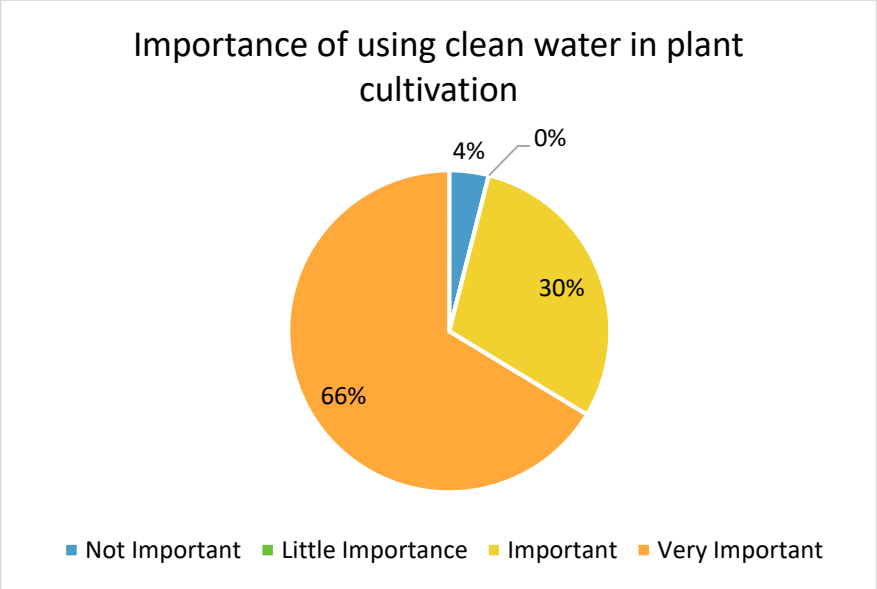

Figure 3.79 Perception of the participants regarding the importance of using clean water in plant cultivation

As mentioned above water is very important in Tinos because of its low quantity and high demand. Precision irrigation is underlined as very important by 63% of the participants, while 30% of the participants believes that is important. Only 4% attached slight importance and 4% no importance at all respectively (Figure 3.80).

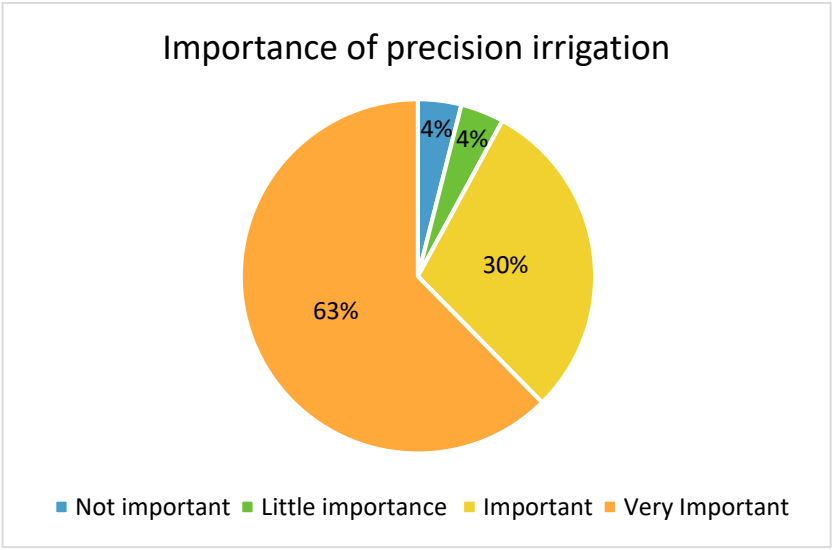

Figure 3.80 Perception of participants regarding the importance of precision irrigation

In the next question of the current part of the survey, participants were asked to evaluate the significance of using clean water for several domestic purposes such as drinking water, washing the dishes, washing clothes, face washing, shower and flush. Participants stated that they consider the use of clean water significant for all domestic purposes, apart from flush (Figure 3.81). Drinking water and face washing were the purposes that most attracted the interest of participants, with respect to clean water, with 100% of end-users stating that using clean water for drinking purposes is very important; almost 60% of the end-users stated that using clean water for face washing is very important. Flush of

the toilet was the domestic purpose, in which the participants stated that the use of clean water is not significant, with a percentage around 50% (Figure 3.81).

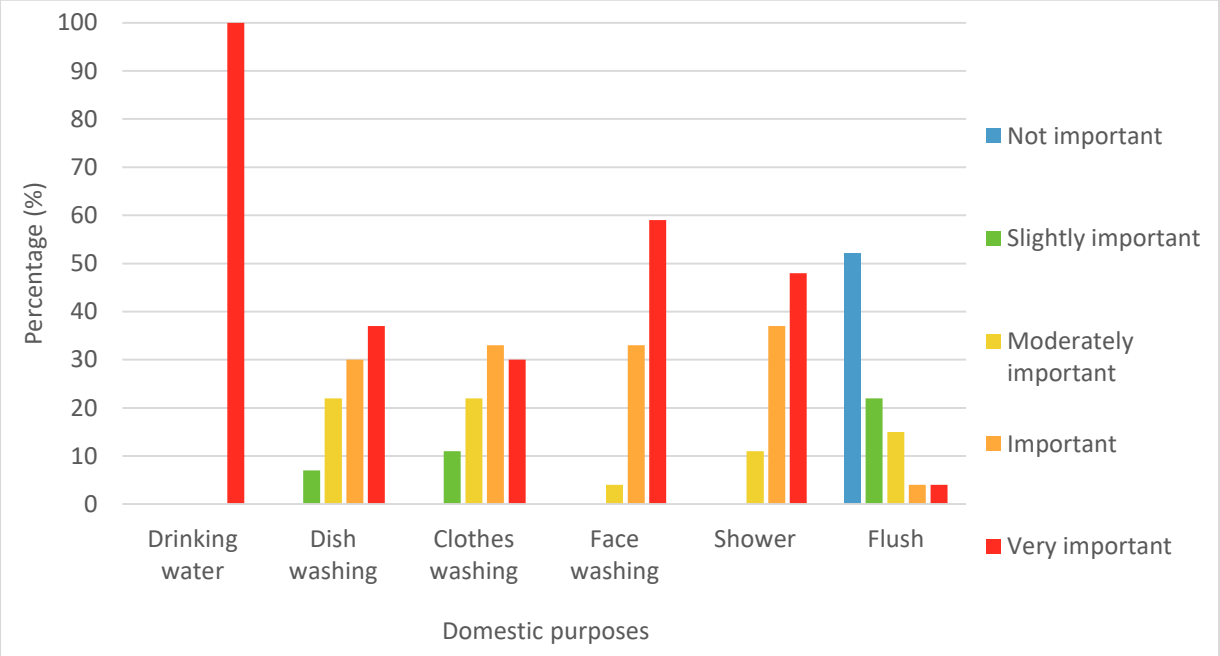

Figure 3.81 Perception of participants regarding the significance of using clean water in several domestic purposes

Afterwards, participants were asked to reply whether they use any technology in order to monitor water quality and quantity. Based on the replies of the participants, only 15% of the end-users use some kind of technology in order to monitor water quality and quantity, while 85% do not use (Figure 3.82).

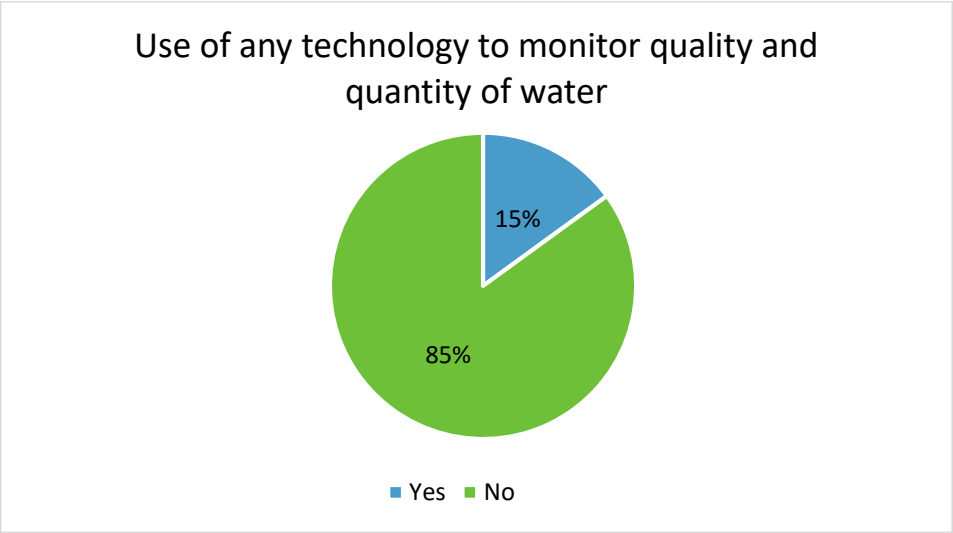

Figure 3.82 Classification of participants based on whether they use any technology in order to monitor water quality and quantity or not

This may probably be attributed to the fact that they are not familiar with this kind of technology and they may believe that, although these parameters are very important in their daily life, the

technologies needed for the measurements are expensive. The 15% of the participants who use any kind of technology for water monitoring, stated that they use chemical technology and filters for potable water. All of them use technologies to monitor water quality and not quantity. Only 33% of them use filters for potable water and 67% of them use chemical technology for monitoring water quality (Figure 3.83).

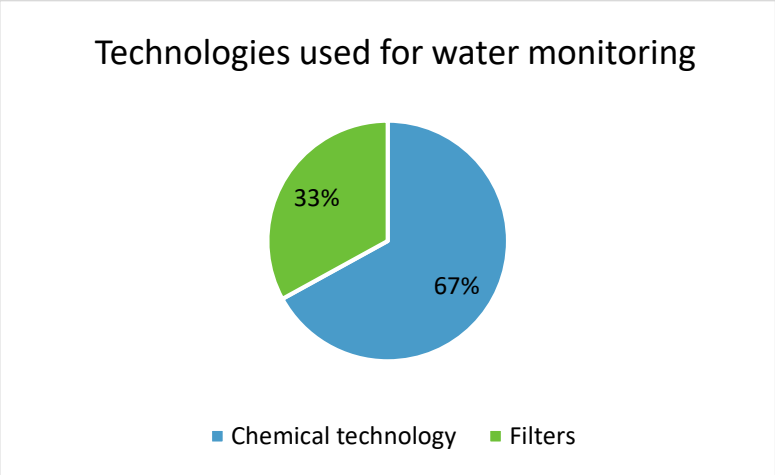

Figure 3.83 Technologies used by the participants for water monitoring

General Questions – HYDROUSA development (Questions 19-21)

In the current part of the survey, participants were asked to reply to questions concerning the development of HYDROUSA. More specifically, questions orienting to the type of information related to water management (treatment, storage, transport) that end-users would desire to access, the type of devices and sensors that they would desire to use for the management of this information and the reasons for using such devices.

In the first question of this section, participants were asked to state the type of information they would like to access in the frame of the project. Several different opinions were formulated by the end-users, with water processing and water quality being the most dominant answers with a percentage around 20% (Figure 3.84). The other answers that were given, included water storage and water distribution; whereas water use, domestic use, water filtration, potable water, cost, water wasting, water tanks and water cleaning were not so significant aspects for the participants with a percentage below 10% (Figure 3.84).

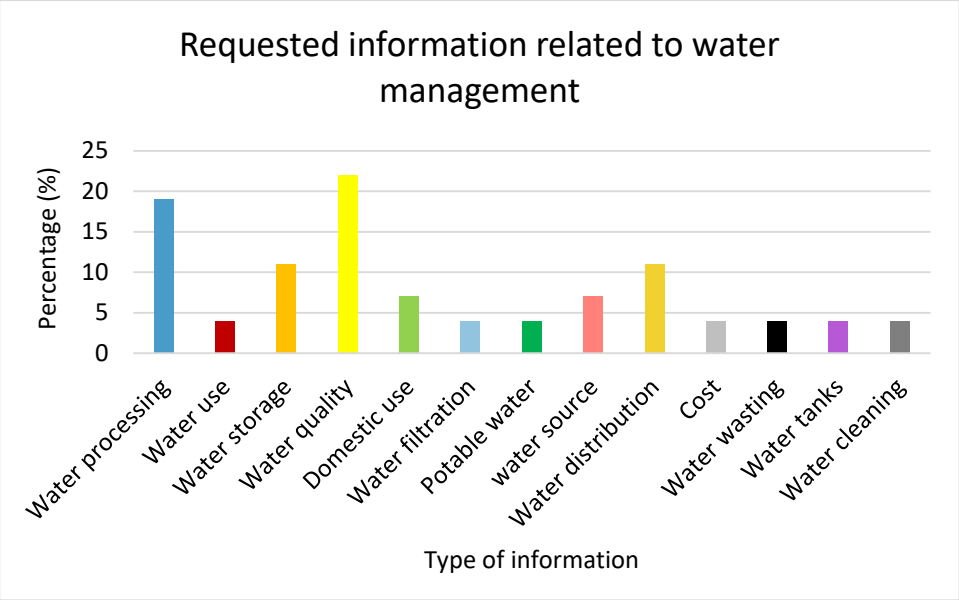

Figure 3.84 Different types of information related to water that participants declared they would like to access in the framework of the project

From this, it is clear that the residents of Tinos Island are worried about the uncontrolled use of water and express interest in the secure stocks of water. It is important for them to find alternative sources of water like rainwater and recycled water, in order to cover their needs. The alternative water sources are something that they stated as very important on previous questions about desalination systems and rainwater collection. Also, the water storage, which is on the top of the answers for the requested information, may be attributed to the lack of information regarding water storage in the island and the lack of a complete system for collection and rational water management. Additionally, information related to water management are useful for them because they probably want to know how the water is processed according to each use (domestic or agricultural).

Subsequently, participants were asked to state the type of sensors or devices related to the information they want to have access to, that they consider as valuable. The most frequent reply by the end-users was water filtration with a percentage of 15% (Figure 3.85). This comes in accordance with the result extracted by their answers in the previous question, where water quality is the most popular answer (Figure 3.84). Other sensors/devices stated as important, were sensors for water tanks, sensors for water distribution, water quality sensors, water clarity sensors, sensors for the quantity of potable water and recycled water, sensors for soil moisture and smartphone applications (Figure 3.85).

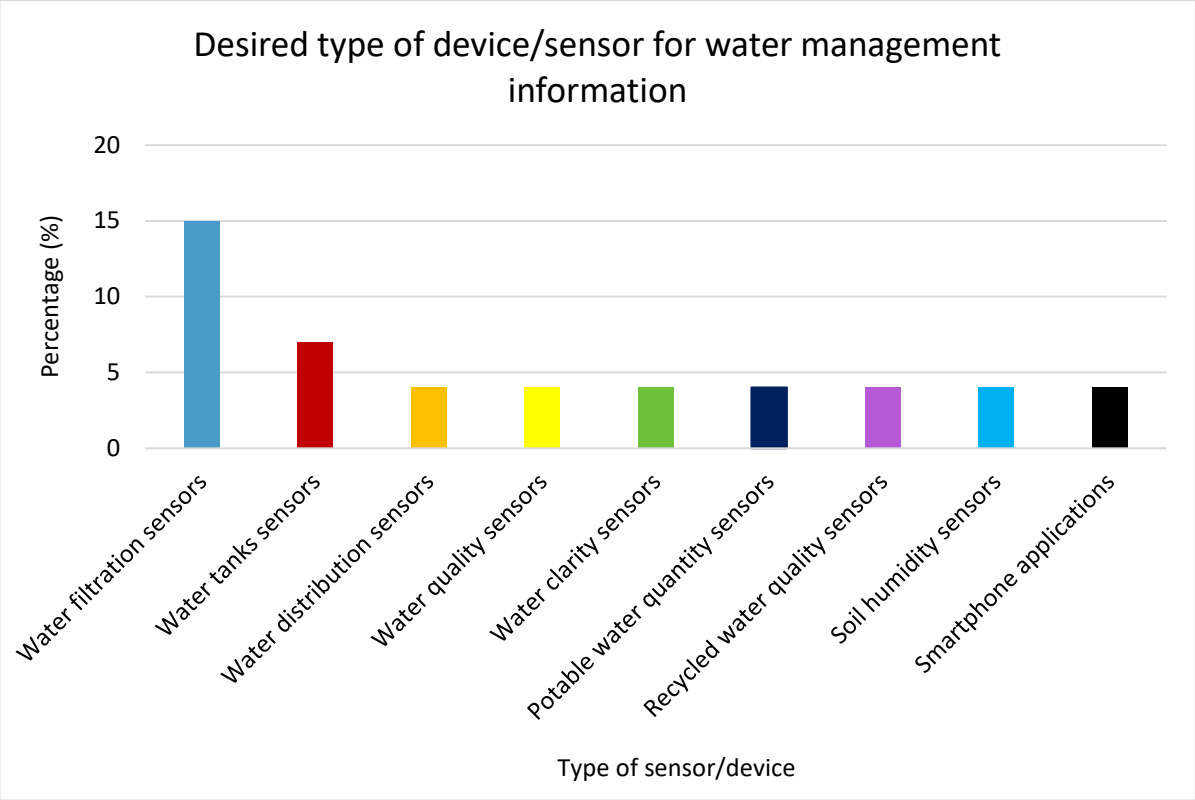

Figure 3.85 Type of device/sensor that participants stated they consider important for water management information

Afterwards, participants were asked to mention the reasons for using the above-mentioned devices/sensors. Once again, water quality dominated among the answers of the end-users. Almost one out of three (30%) of the participants stated that want to use sensors and devices for the water quality; whereas another 30% stated that they want to use them for the water quantity (Figure 3.86). Medical reasons, crop yield and potable water were ranked below the previous answers, while suitability of water for irrigation, tank level, costs and irrigation level were the last reasons according to the participants with a percentage of 10% (Figure 3.86).

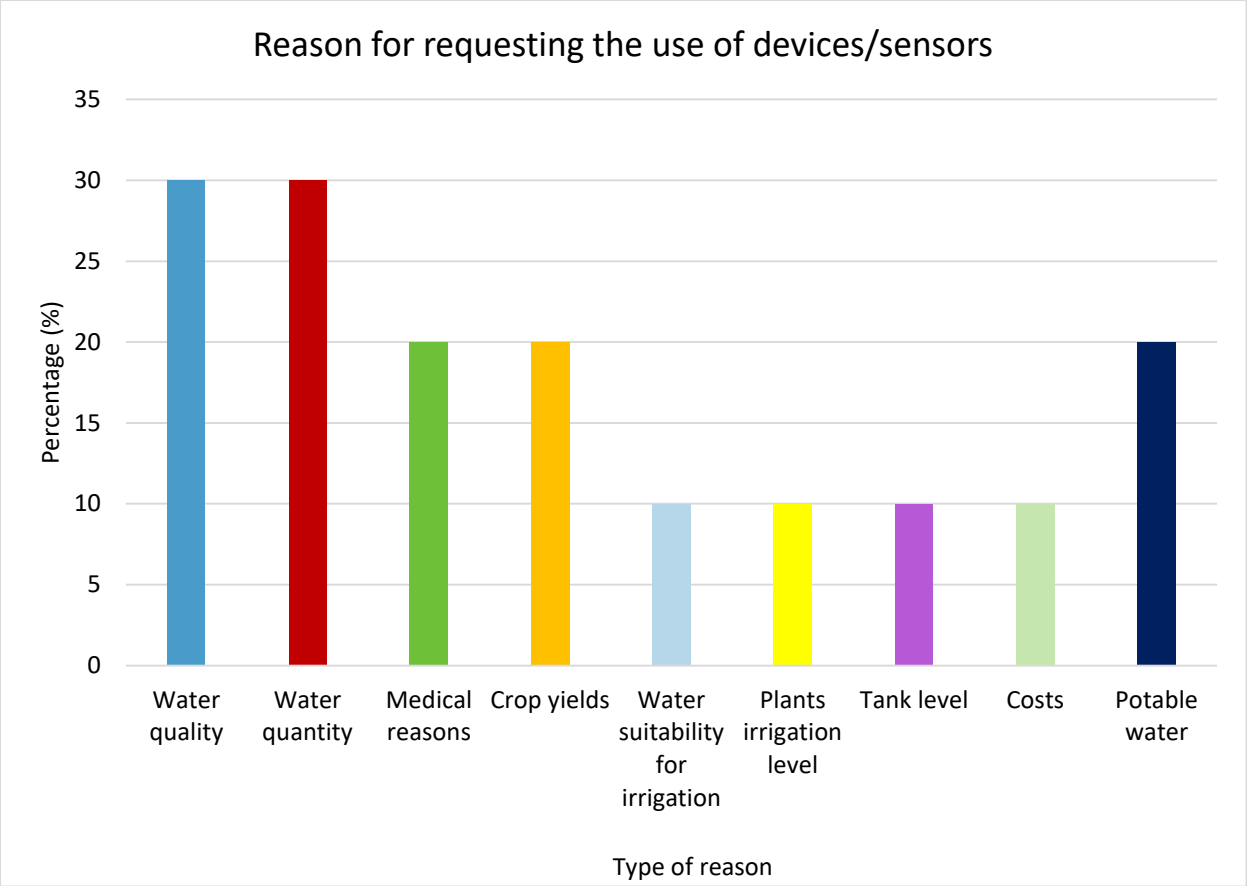

Figure 3.86 Reasons why participants consider as important the use of devices and sensors in the current water management system

Hardware of the project HYDROUSA (Questions 22-30)

In this part of the questionnaire, participants were asked to reply to questions concerning the hardware of HYDROUSA. More specifically, questions regarding:

- The importance of monitoring each system part, the parameters related to water quality and quantity measurements, the development of low-cost sensors for monitoring water quality and quantity, and whether they would prefer a ready solution or a conFigureurable system as a sensor.
- The installation of a sensor would cause functional and visual disturbance in the surrounding area
- Their opinion on the system network and the parameters measured by the sensors.
- The importance of energy dependent systems in water management.

When asked about the importance of monitoring the system components, participants stated that monitoring all system parts is important in order to ensure proper operation of the system and consequently achieve higher benefits. According to the end-users, the most important systems for monitoring are water consumption, water production and water saving (Figure 3.87).

More specifically, 81% of the participants characterized monitoring of water consumption as important/very important, and none as not important/slightly important. 86% of the participants

characterized monitoring water production as important/very important, and only 4% as not important/slightly important. 49% characterized monitoring water flow as important/very important, and 4% as not important/slightly important. 78% of the participants characterized monitoring water processing as important/very important and none as not important/slightly important. Regarding monitoring water saving, 79% of the participants characterized it as important/very important, and only 4% as not important/slightly important. 82% of the participants characterized monitoring energy consumption as important/very important, and 7% as not important/slightly important. Concerning monitoring operating systems, 60% of the participants characterized it as important/very important, and 4% as not important/slightly important. 74% of the participants characterized monitoring meteorological phenomena as important/very important, and none as not important/slightly important. Finally, 63% of the participants characterized monitoring soil moisture as important/very important, and 4% of the participants as not important/slightly important.

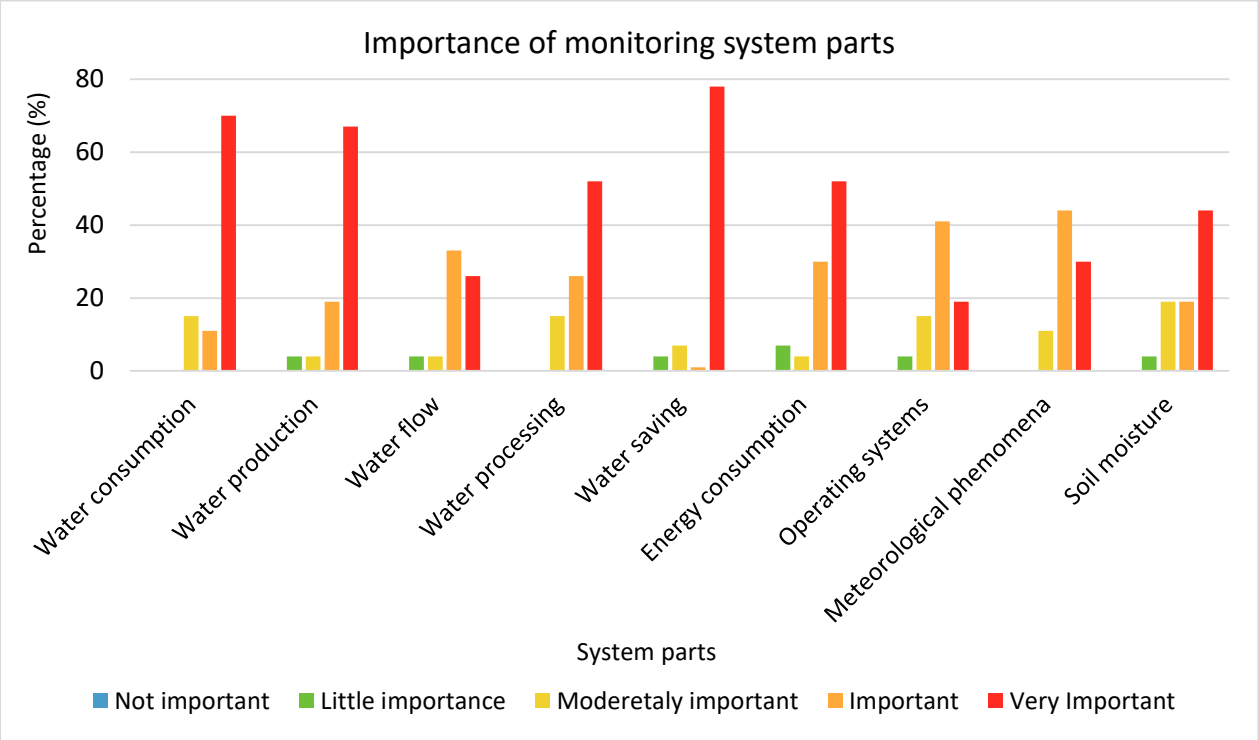

Figure 3.87 Opinion of the end-users regarding the importance of monitoring each system part

Subsequently, participants were asked whether they have any suggestion concerning other parameters/sensors related to water quality and quantity measurements. The vast majority (85%) of the participants stated that they have no further suggestions and that the developed parameters and sensors cover their needs (Figure 3.88). Only 11% of the participants stated that they have further parameters and sensors to suggest (Figure 3.88).

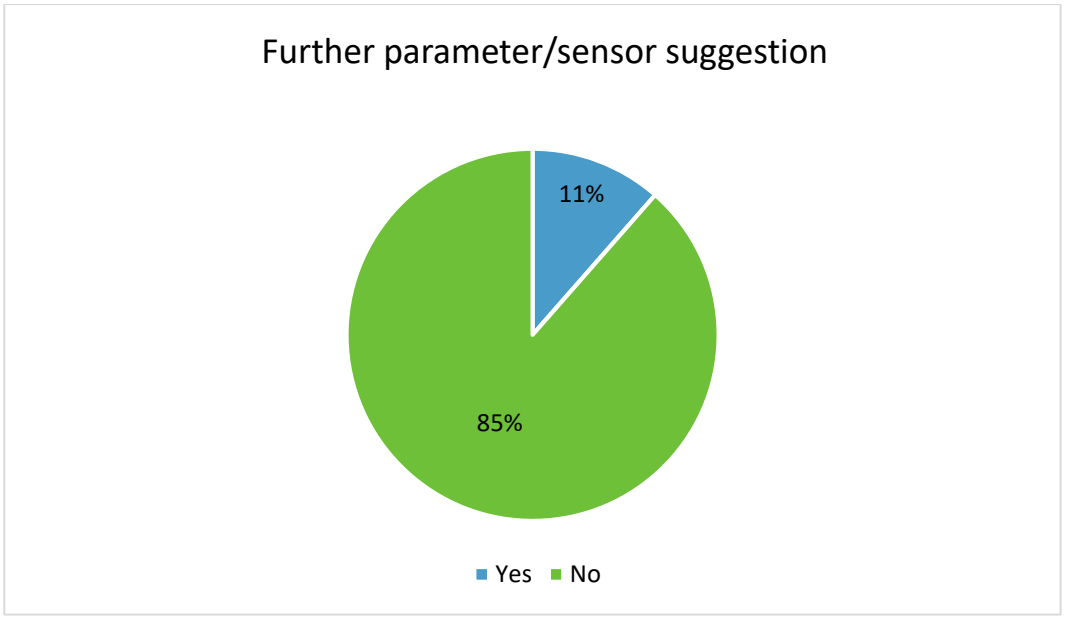

Figure 3.88 Possibility to suggest further parameters/sensors, by the end-users

The 11% of the end-users that replied positively, suggested that they would introduce measurements for the quantity of potable water consumed and the quality of water regarding microbial content and heavy metal content. It is clear for one more time that water quality and quantity are very essential parameters for the residents of Tinos Island.

In the next part of the survey, participants were asked about their possible interest in the development of low-cost sensors for monitoring water quality and quantity. The majority of the participants (81%) replied positively, that they would be interested in the development of low-cost sensors for monitoring water quality and quantity, while only 11% replied negatively (Figure 3.89).

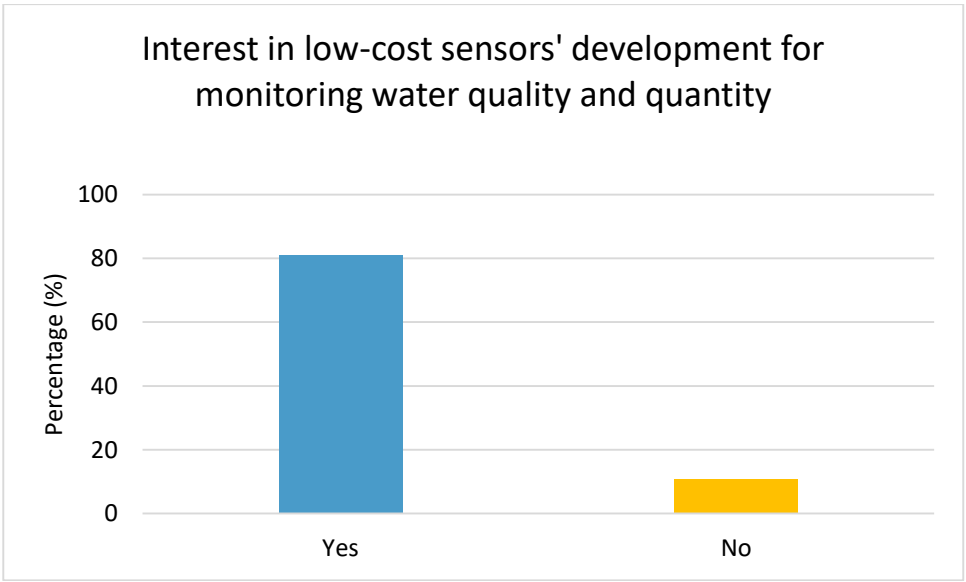

Figure 3.89 Interest of the end-users in the development of low-cost sensors for measuring and monitoring water quality and quantity

Regarding the ability to conFigure the system and intervene, 44% of the participants replied that they want existing solutions with no interfering ability and 41% of the participants stated that they prefer conFigureurable systems (Figure 3.90).

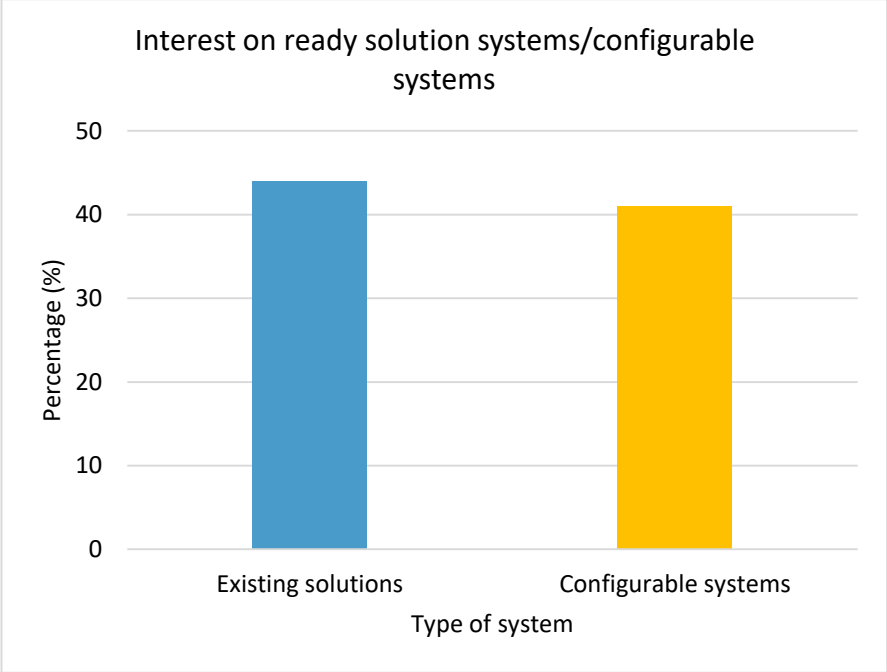

Figure 3.90 Classification of participants based on their preference and interest in ready solutions or conFigureurable systems

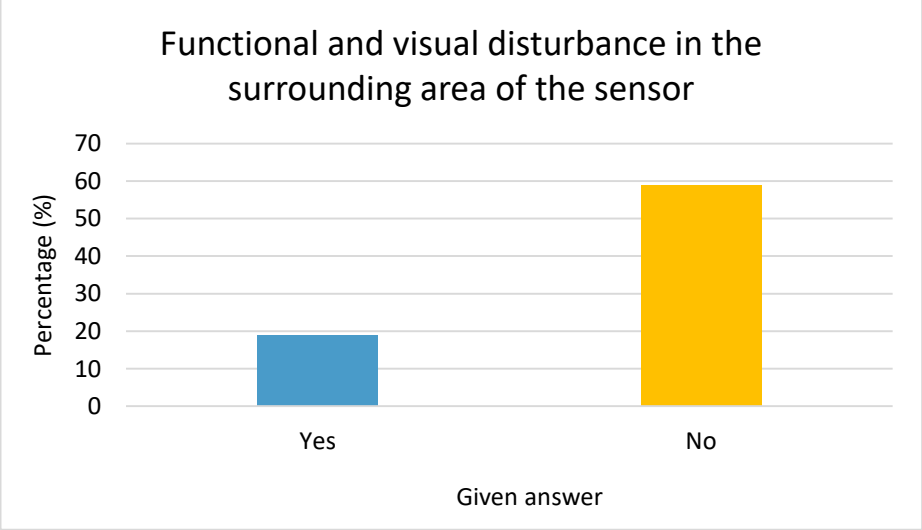

Figure 3.91 Opinion of the end-users regarding the possible functional and visual disturbance caused by the installation of sensors in their surrounding area

The next aspect of the survey referred to the possible functional and visual disturbance in the surrounding area of the sensor. The vast majority of the participants stated that the installation of the sensors does not cause disturbance in the surrounding area. Namely, 59% of the participants answered

that no disturbance is caused and only 19% of the participants stated that the installation of the sensors disturbs the surrounding area (Figure 3.91).

Apart from the possible disturbance provoked by the installation of the sensors, participants were asked about the structure of the network of the project. More specifically, whether they would prefer a public, or a private network. Almost 60% of the end-users stated that they would prefer a public network, while 22% a private one (Figure 3.92).

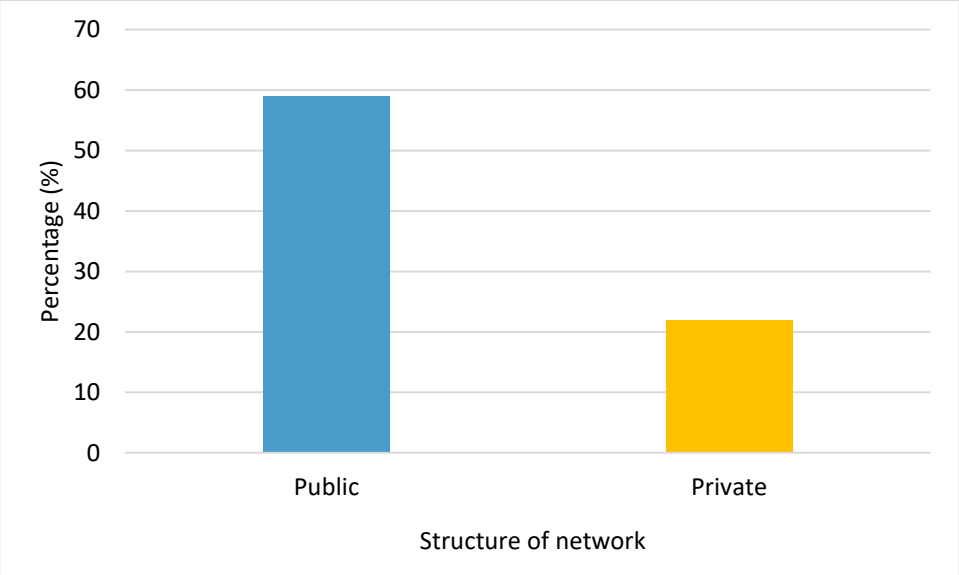

Figure 3.92 Preference of end-users regarding the type of the network, public or private

Participants were also asked about the measurements they consider to be useful for the system development and functionality. In Mykonos and Lesbos cases, the most useful measurement for the local end-users, were water salinity and the pH of the water with a percentage ranging from 30%-50% (Figure 3.23 & Figure 3.57). Replies of the end-users in Tinos Island, indicate the same pattern, as salinity is the most useful measurement for 41% of the end-users, and water pH followed with 32% (Figure 3.93). Participants also indicated as useful (but less frequently), measurements concerning clarity of water, and with less importance measurements such as water temperature, mineral compounds, heavy metals, potable use of water, bacterial contamination, other contamination in particular and chemical impurities, and microbiological analysis (Figure 3.93). It is apparent that salinity and pH of the water are very essential parameters for the residents of Tinos Island, both for domestic and agricultural purposes, as the majority of the participants in Tinos are domestic uses in a percentage around 70% (Figure 3.72).

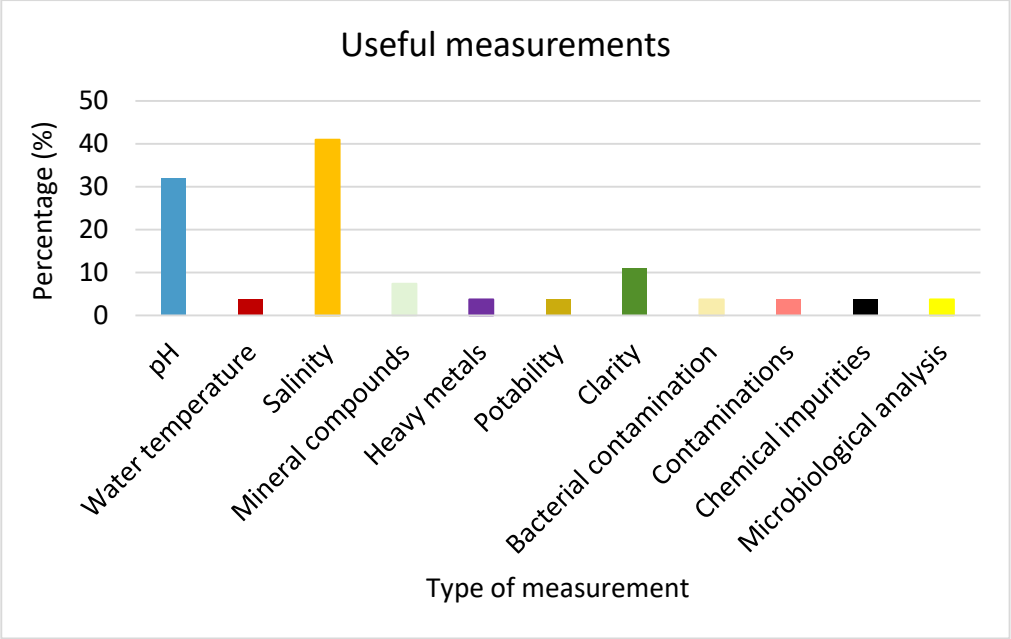

Figure 3.93 Usefulness of several measurements related to water characteristics based on the opinion of the end-users

In the last question of the current section of the survey, participants were asked to evaluate the significance of the energy autonomy of the system developed. More specifically, how important is according to their belief, the development of autonomous and energy autonomous systems. The result extracted by the responses of the participants, indicate that the energy autonomy of the system is a very significant factor for the end-users. Around one out of two participants (52%) characterized it as very important, 43% as important and only 5% characterized it as slightly important (Figure 3.94). Not a single participant characterized it as not important.

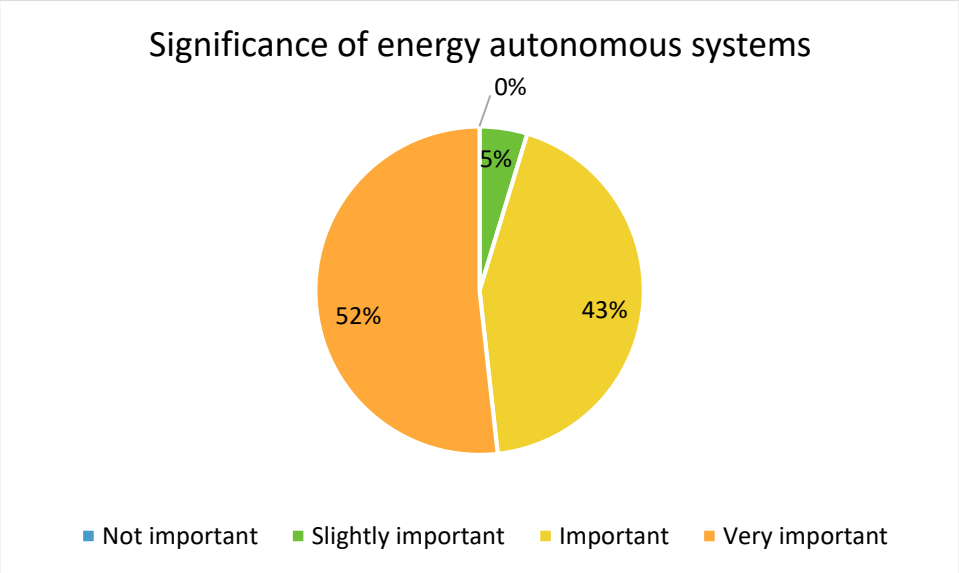

Figure 3.94 Significance of energy autonomous systems based on the perception of the end-users

Platform of HYDROUSA (Questions 31-38)

In the current part of the report, participants were asked to cover aspects regarding HYDROUSA platform. More specifically:

- To determine the type of device they prefer to use in order to access HYDROUSA information, the type of alert and notifications they prefer to receive and their optimum frequency, as well as to evaluate the ability to customize the notifications received by the system.
- To express their interest in the development of custom irrigation algorithms and to evaluate the importance of information displayed by the system.
- About their preferable format for the exported files by the system and state their willingness to have access to historical data of the system.

In the first section of the present part of the survey, participants were asked to mention the device they prefer to use in order to access HYDROUSA information. Possible answers included personal computer (PC)-desktop, tablet, smartphone and lack of internet connection. The majority of the participants prefer to access information of the project using a smartphone in a percentage close to 70% (67%), while second choice is the use of a personal computer with a percentage of 48%. Only a 4% of the participants stated that they have no internet access at all (Figure 3.95).

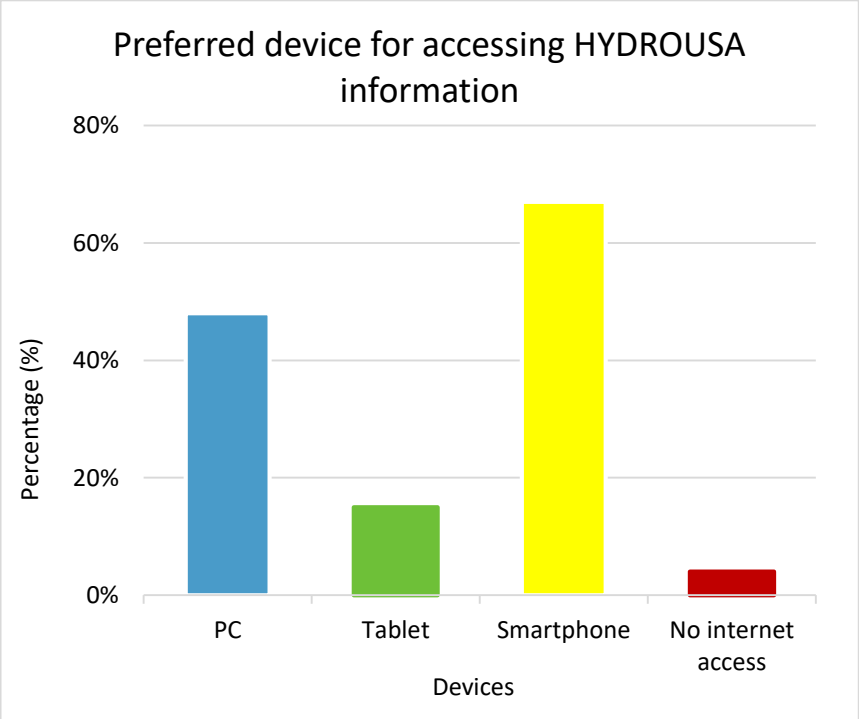

Figure 3.95 Devices that end-users prefer to use in order to access HYDROUSA information

Regarding the type of notification and ability to customize notifications received by the system, participants replied that they prefer to receive notifications via email in a percentage around 80% (Figure 3.96), while only 7% of the participants stated that they would prefer to receive notification through a mobile application (Figure 3.96). Furthermore, 74% of the participants would like to have the ability to customize the notifications received (Figure 3.97).

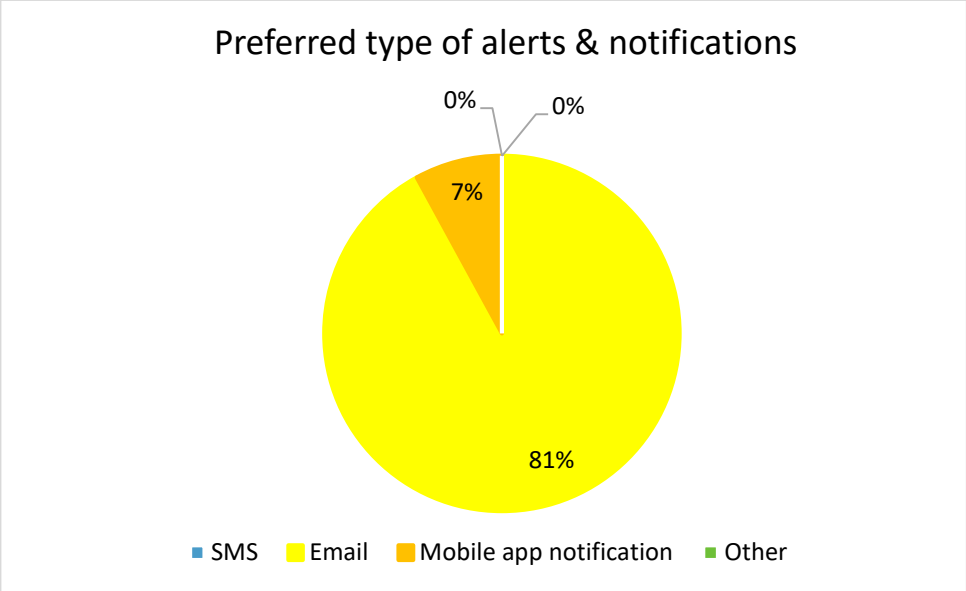

Figure 3.96 Preferred type of alert/notification by the end-users for accessing HYDROUSA information

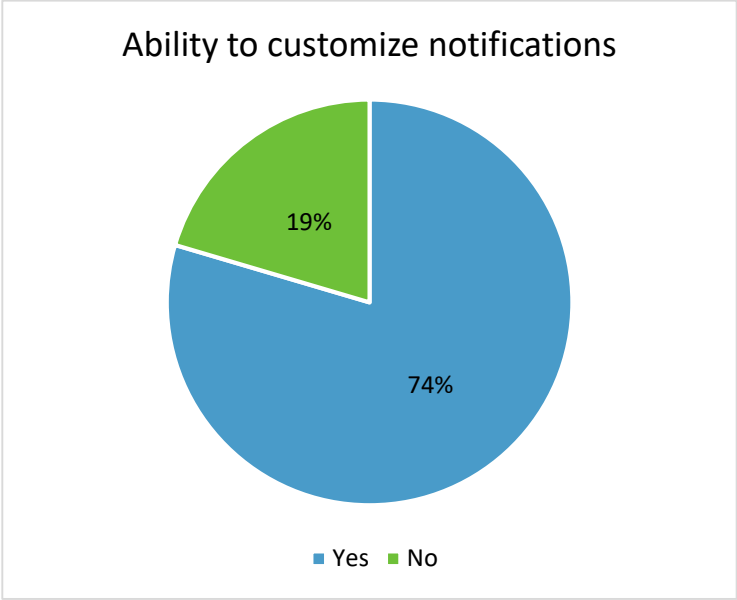

Figure 3.97 Classification of end-users based on their willing to have the ability to customize the notifications received by the system

Regarding their interest in the development of custom irrigation algorithms, the opinion of the end-users was divided. Less than 50% of the participants (41%) stated they would not be interested in such a development, while 37% replied positively (Figure 3.98). This may be attributed to the fact that most of the participants of the survey are domestic users. Not being an agricultural user leads to possible reduced understanding or ignorance of agronomical application and practices, and consequently to the establishment of various perceptions regarding irrigation.

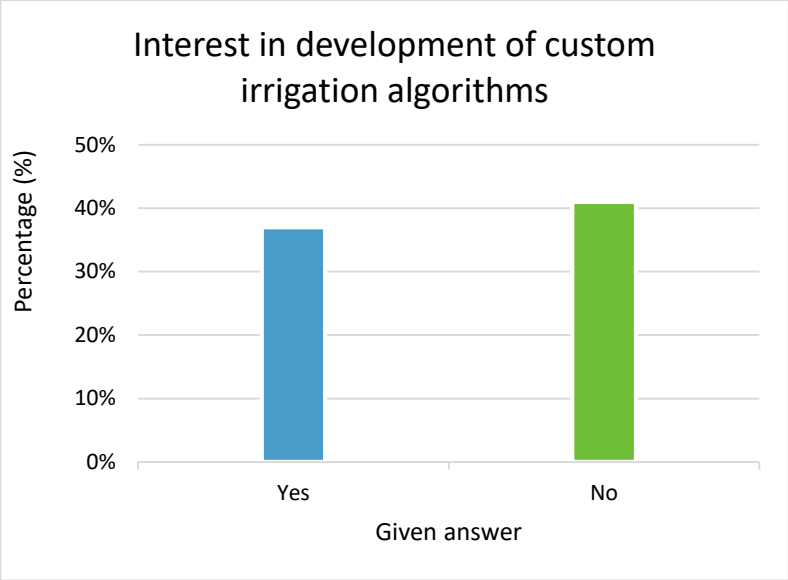

Figure 3.98 Expression of interest by the end-users for the development of custom irrigation algorithms

In the next part of the section of the survey, participants were asked to evaluate the importance of displaying several types of information. The most significant information to be displayed according to the participants were the maps (Figure 3.99). Statistics and diagrams were also very significant information to be displayed. Finally, reports and notifications were the less important information for the end-users (Figure 3.99).

More specifically, 49% of the participants characterized reports display as important/very important, while 4% characterized it not important/slightly important. 56% of the participants characterized maps display as important/very important, and 8% as not important/slightly important. 60% of the participants characterized statistics display as important/very important, and 4% as not important/slightly important. 60% of the participants characterized diagrams display as important/very important, and no participants characterized it as not important/slightly important. Finally, regarding notifications display, 48% of the participants characterized it as important/very important, while only 11% characterized it as not important/slightly important.

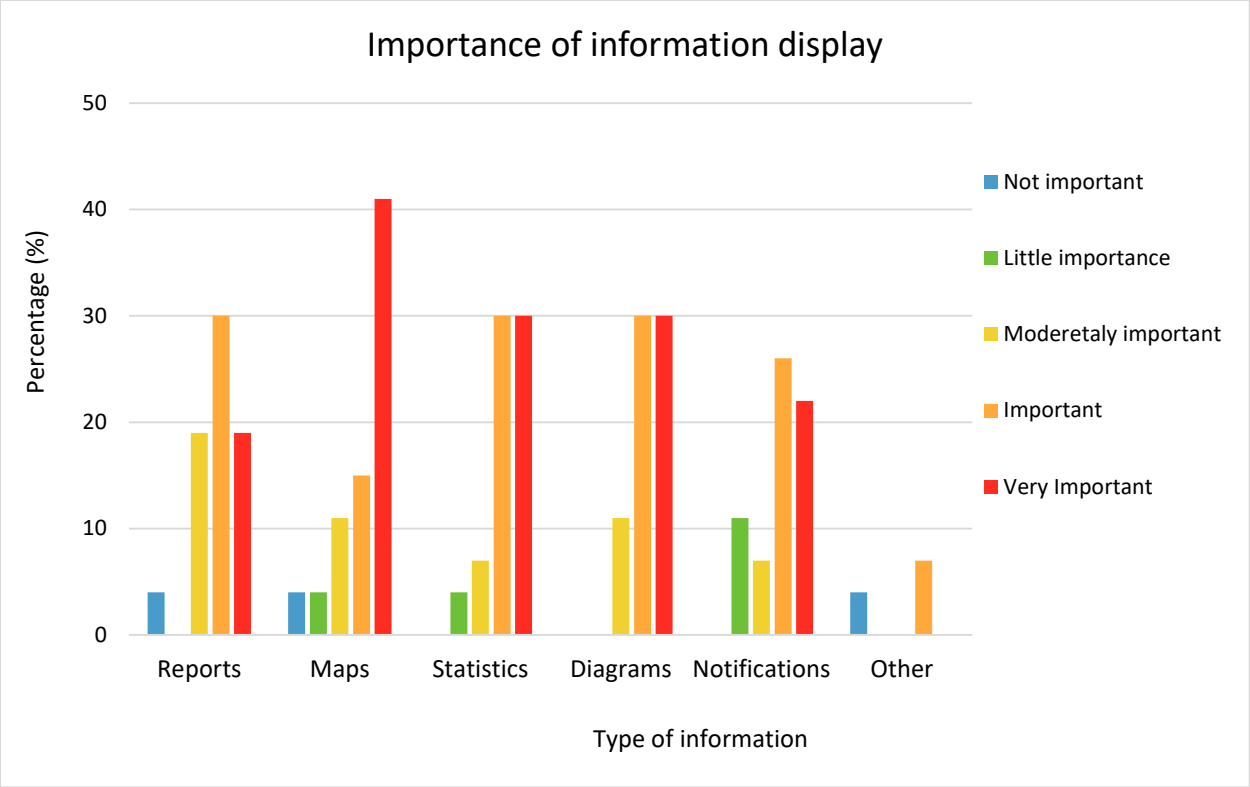

Figure 3.99 Importance of information display based on the type of information

Participants also found very useful the ability of HYDROUSA platform to provide information in different file formats. As result, several different answers were given regarding the preferable format of the extracted file by the system. The most preferred formats were TEXT and CSV (Figure 3.100) with a percentage of 38%.

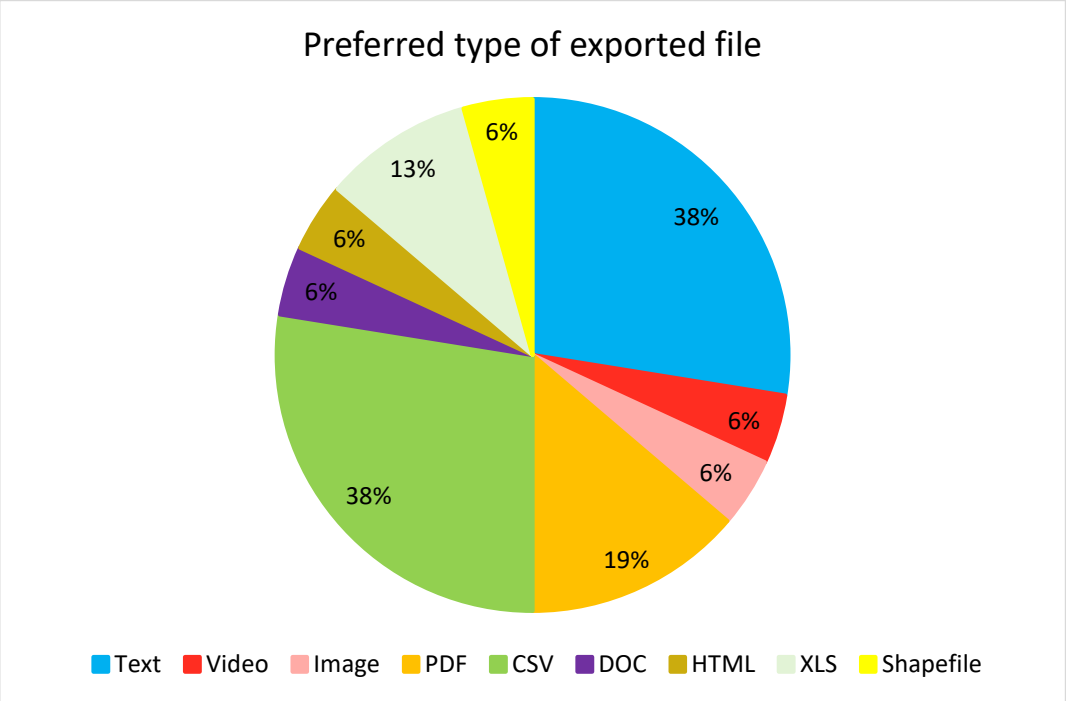

Figure 3.100 Different types of file format that end-users selected for exported files by the system

In respect of the optimum frequency for receiving notifications, end-users selected that the preferable frequency is on a daily basis, for 67% of the participants (Figure 3.101). A small percentage of the participants (11%) opted for notifications less frequently of once per day.

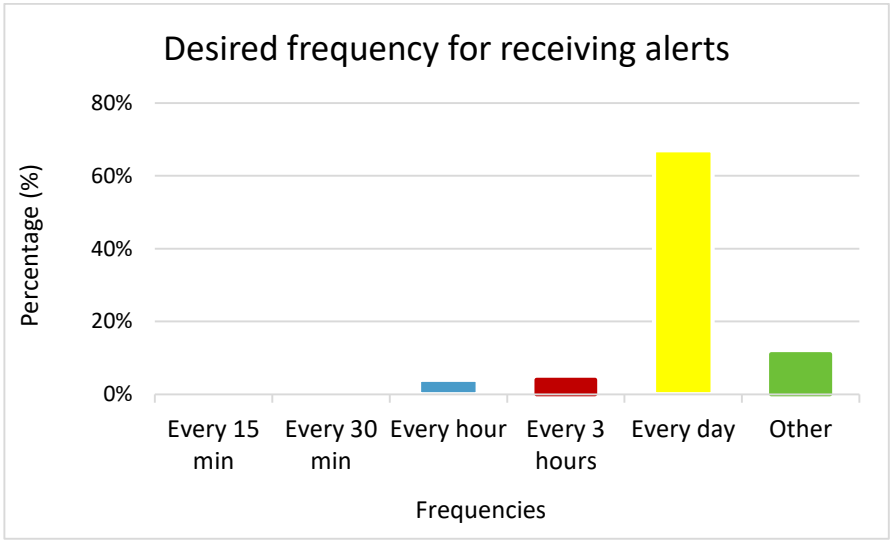

Figure 3.101 Desired frequency for the end-users to receive alerts by the system

The final question for the current section of the survey referred to the evaluation of the ability to access historical data in the system. The vast majority of the participants (78%) replied that they would like to be able to access historical data, while 11% not (Figure 3.102). This may reflect the willingness of the end-users to compare present with past data regarding water management.

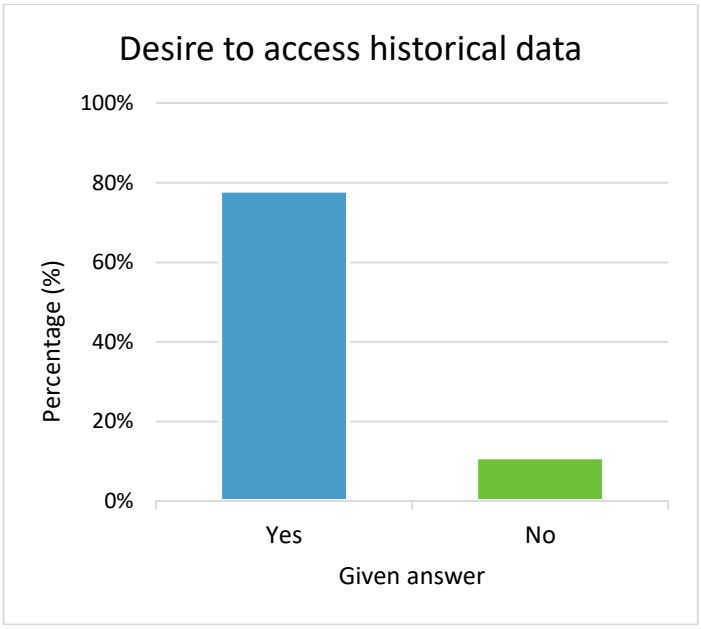

Figure 3.102 Desire of participants to have access to historical data of the system

Importance of HYDROUSA (Question 39)

At the end of the survey, end-users were asked to express their opinion regarding the importance of the project. More specifically, they were asked to answer whether HYDROUSA has the ability to solve the water deficiency problem of the island during the summer touristic period, or not.

In this final question of the survey, end-users relied on the project and embrace it for the proper management of water issues concerning their island. The vast majority of the participants (70%) believe that HYDROUSA is able to solve water shortage of the island, especially during the touristic period, when water deficiency mostly occurs (Figure 3.103). Only 19% of the participants are not convinced yet that the project has this ability (Figure 3.103). This result reflects the potential of the current project, with the contribution of the people from areas suffering from water shortage to accept modern innovative controlling methods.

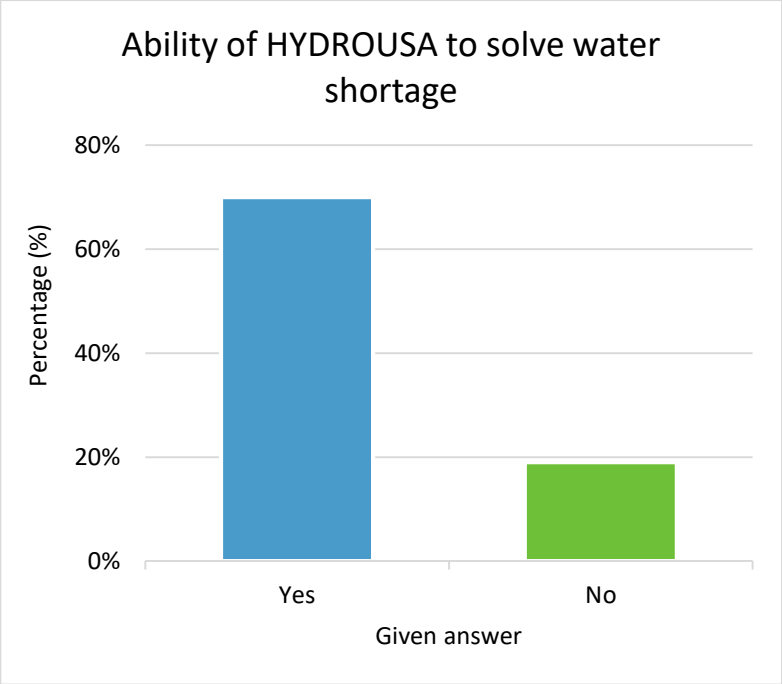

Figure 3.103 Opinion of the participants regarding the ability of HYDROUSA project to solve water deficiency of the island especially during the summer touristic period

Summary of HYDRO5 and HYDRO6 questionnaire

After the evaluation of the results extracted by the answers of the end-users, a summarizing list was created in order to properly highlight the needs of the end-users and correlate them with the initially determined requirements and specifications. In this way, requirements from all pilot islands can be interpreted to functionalities during the development of the platform and the establishment of the project. User requirements for Tinos Island are summarized in Table 3.3.

During the initial determination of requirements and specifications for each separate component of the system, stakeholders that participated, were specialized in the field. Thus, the initial determination of specifications was much diversified, while also targeted to certain technologies. However, the end-users participated in eliciting the updated specifications, apparently did not have such specialized knowledge. As a result, several specifications that were initially set by the stakeholders, were not addressed by the end-users in the updated monitoring. Nevertheless, all requirements initially addressed, were also addressed in the updated determination, especially water quantity and quality measurement sensors.

Regarding sensors, end-users mentioned flow meter sensors, pH sensor, and weather station installation in addition with soil moisture monitoring. Concerning systems, end-users mentioned the development of systems for clean water production. Concerning irrigation end-users stated that they would like to monitor the water flow rate and they were interested in the development of irrigation system equipment and irrigation of local crops and cultivations. Finally regarding software, end-users stated both web and mobile interfaces as desirable specifications.

Table 3.3 End-user specifications and requirements for each component in Tinos Island.

Components	Requirements	End-user specifications
Sensors	Water Quantity and Quality measurement	Tank level sensor
		Flow meter
		pH sensor
	Irrigation related sensors	Weather station
		Soil moisture sensor
Systems	Support of different processes	Clean water production
Irrigation	Support of irrigation characteristics	Water flow rate
		Irrigation system equipment
		Irrigation of local crops
Software	User interaction with devices	Web interface
		Mobile interface

4. CONCLUSIONS AND REMARKS

In all three islands, participants expressed their demand for having sufficient water of good quality. They were aware of the need to save water and exploit collected or treated water for several purposes. They also expressed their interest in the process of water treatment including water management, harvesting, distribution, storage, as well as in devices for measuring water quality and quantity, in order to establish a sustainable way of using water and adopt modern strategies for water circular use.

The entire process of the current deliverable aimed on defining the requirements that are close to the needs of the end-users that will use these systems on the demo Islands. The current survey specified the information that the users require as well as the way they use the water. **As an overall comparative remark, it is clear that residents who participated as potential end-users were not widely aware of innovative technologies as the ones proposed by the project.** Their unawareness regarding significant issues and aspects of circular water use, as well as of practically important water quality measurements, may lead to the establishment of inaccurate perceptions. The uncertainty and hesitation of the end-users is a very important factor in the determination of the end-user requirements. Due to their confusion, there is an ambiguity in the results, which makes the conclusions unclear to a certain degree. For this reason, safe conclusions can be elicited after comparison of the results of the current deliverable, with the results from the determination of user requirements of stakeholders (D5.2). Stakeholders are more familiar with innovative technologies, application of novel water management systems and relevant information and characteristics. In this way, understanding and determining end-users' requirements properly, becomes feasible and provide a realistic prospect of the current situation.

This deliverable has described in detail the user requirements of each demo site of HYDROUSA and will contribute to the development of the HYDROUSA's project integrated monitoring and controlling platform (D5.6) in order to cover all needs among the different pilot areas. HYDROUSA's ambition is to provide innovative solutions for decentralized management in water scarce areas globally, in terms of water/wastewater treatment and management, which will close the water loops and will also boost their agricultural and energy profile. HYDROUSA goes beyond the current water and wastewater management practices by adopting ICT enabled modern, nature-based and nature-inspired water management solutions for different types of water characterized by low energy footprint.

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ANNEX

Lesbos Questionnaire

HYDROUSA User Requirements – Questionnaire for stakeholders

By using this questionnaire that is related to the user requirements and is addressed to the interested members of the European project HYDROUSA a survey is conducted to evaluate the requirements and specifications of the users to monitor the pilot positions where Information and Communication Technologies (ICT) are used. The acquisition of the requirements and specifications of the users, results from the different needs of the interested parties, for the completion of one of the main objectives of HYDROUSA project. This goal concerns the creation of long-lasting, durable and attractive systems through the combination of specialized work with modern ICT solutions.

Main aim of the European project HYDROUSA is to develop a globally acceptable, adaptable and sustainable water supply and wastewater treatment system, based on a set of natural and ecological solutions that are usually found in places with intense tourist activity. This will be achieved through monitoring and control by modern ICT solutions. More specifically, sensors, controllers and actuators will be used to monitor and control important parameters in the various pilot positions. Different water treatment and sewage systems will be developed at each pilot site, called HYDRO, resulting in different requirements and specifications.

Q1	**Questionnaire identity**	
Q2	**Date of survey**	

I. Demographics

Q3	**Location and country:**	

Q4	**What is your age group?**				
	18-34 ☐	35-44 ☐	45-54 ☐	55-64 ☐	65+ ☐

Q5	What is your gender?		
	Male ☐	Female ☐	Other ☐

Q6	What is your education level?			
	Primary education ☐	Secondary education ☐	Graduate ☐	Postgraduate / PhD ☐

Q7	Which of the following categories do you represent?				
	Domestic consumer	Agricultural consumer	Commercial consumer	Water systems and irrigation	Public organization (Municipality etc.)
	☐	☐	☐	☐	☐

Q8	How do you have internet access?			
	Desktop PC ☐	Tablet ☐	Smartphone ☐	No internet connection ☐

II. General Questions

Q9	How important do you think it is to save water?			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q10	How important do you think is the re-use of water after its treatment in the biological treatment plant?			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q11	How important do you think is to collect, store and use treated wastewater for irrigation?			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q12	How important do you think it is to establish an agroforestry environment that will use the recyclable water produced by biological treatment?			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q13	How important do you consider the use of treated wastewater in the cultivation of aromatic plants for the production of essential oils?			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q14	How important do you consider the production of methane through the biological treatment of wastewater and its use as a fuel?			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q15	How important do you consider the use of treated water for: (Please rate from 1 to 5, with 1 being the least important and 5 the most important)					
		Not important 1	**2**	**3**	**4**	**Very important 5**
	Irrigation of cultivars	☐	☐	☐	☐	☐
	Irrigation of landscapes	☐	☐	☐	☐	☐
	Boilers for heating	☐	☐	☐	☐	☐
	Replenishment of the underground aquifer	☐	☐	☐	☐	☐
	Industrial use	☐	☐	☐	☐	☐
	Environmental Uses and Recreation	☐	☐	☐	☐	☐

Q16	How important do you think precision irrigation is?			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q17	Do you use any technology to monitor the quality and quantity of water (software or hardware, etc.)?	
	Yes ☐	No ☐

Q18	If you answered "Yes" on the previous question, mention the technologies that you use.

III. General questions for the development of the HYDROUSA project solution

Q19	**Which information related to water treatment, storage, transport and application would you like to have?**

Q20	**What kind of devices/sensors related to this information would you like to use?**

Q21	**Which are the reasons that you want to use them?**

IV. Hardware of HYDROUSA project

Q22	How important is monitoring of system parts? (Please rate from 1 to 5, with 1 being the least important and 5 the most important)					
		Not important 1	2	3	4	Very important 5
	Water consumption	☐	☐	☐	☐	☐
	Water production	☐	☐	☐	☐	☐
	Water flow	☐	☐	☐	☐	☐
	Water processing	☐	☐	☐	☐	☐
	Water storage	☐	☐	☐	☐	☐
	Energy consumption	☐	☐	☐	☐	☐
	Operational systems	☐	☐	☐	☐	☐
	Meteorological phenomena	☐	☐	☐	☐	☐
	Soil humidity for agricultural application	☐	☐	☐	☐	☐

Q23	Would you like to suggest some other parameters/sensors related to water quantity and quality measurements?	
	Yes ☐	No ☐

Q24	If you answered "Yes" to the question above, what other parameters/sensors related to the measurements of water quantity and quality would you suggest to be included?

Q25	Would you be interested in low-cost sensors for measuring water quantity and quality?	
	Yes ☐	No ☐

Q26	In terms of low-cost sensor systems, would you be interested in them being ready-made solutions or being able to intervene and conFigure?	
	Prepared solutions ☐	Possibility of intervention ☐

Q27	The maximum size/volume of such a sensor system may be in the range of 1-5 liters while in most cases they are accompanied by a solar panel. Do you think that the installation of such systems can cause functional and visual disturbance in the surrounding area?	
	Yes ☐	No ☐

Q28	Would you be interested in developing a public network that meets the wireless connectivity needs of these sensors throughout Lesbos, or would you prefer your sensors to be accessible only through your private internet network?	
	Public network ☐	Private network ☐

Q29	What measurements do you consider useful for your needs (pH, turbidity, etc.)?

Q30	How important do you think it is to use energy-autonomous systems to monitor and control water treatment and management units?			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

V. HYDROUSA platform

Q31	How would you prefer to access HYDROUSA information?			
	Desktop PC ☐	Tablet ☐	Smartphone ☐	No internet access ☐

Q32	Would you like to be able to customize the notifications you receive from the HYDROUSA platform according to your needs?	
	Yes ☐	No ☐

Q33	What types of notifications do you consider necessary for your needs?			
	SMS ☐	E-MAIL ☐	Mobile application ☐	Other .....

Q34	**Would you be interested in creating custom irrigation algorithms?**	
	Yes ☐	No ☐

Q35	**Please evaluate the following ways to display information about the HYDROUSA program from 1 to 5, with 1 being the least important and 5 the most important.**					
	The information is displayed as:	**Not important 1**	**2**	**3**	**4**	**Very important 5**
	Reports	☐	☐	☐	☐	☐
	Maps	☐	☐	☐	☐	☐
	Statistics	☐	☐	☐	☐	☐
	Diagrams	☐	☐	☐	☐	☐
	Notifications	☐	☐	☐	☐	☐
	Other ……..	☐	☐	☐	☐	☐

Q36	**In what kind of files would you like the results to be exported (**for example CSV, SHAPEFILE, TEXT**);**

Q37	**How often would you like to receive information from the HYDROUSA platform?**					
	Every 15 minutes ☐	Every 30 minutes ☐	Every 1 hour ☐	Every 3 hours ☐	Once a day ☐	Other ……

Q38	**Would you be interested in accessing older data?**	
	Yes ☐	No ☐

VI. Importance of HYDROUSA

Q39	**Do you think that the HYDROUSA program is going to solve the serious problem of water shortage during the high tourist season on the island?**	
	Yes ☐	No ☐

THANK YOU FOR YOUR TIME!!!

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 776643

Information leaflet for the participants

Project title:	Demonstration of water loops with innovative regenerative business models for the Mediterranean region
Acronym:	HYDROUSA
Grant Agreement number:	776643
Start date:	01/07/2018
End date:	31/12/2022
Funding:	European Union
Under the program:	Research and Innovation Program Horizon 2020
Website, Twitter, LinkedIn:	www.hydrousa.org, @HydrousaProject, HYDROUSA

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INTRODUCTION

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This document may contain words you do not understand. In this case, please ask the researcher or any other member of the research team to fully understand the meaning of the word or information you do not understand.

AIM OF HYDROUSA PROJECT

The European HYDROUSA program is part of the Horizon 2020 program, which is the European Union's main funding tool for Research and Innovation. HYDROUSA aims to develop, optimize and demonstrate low-cost innovative and cost-effective systems for non-conventional water management in Mediterranean areas. This includes wastewater management, rainwater, groundwater, seawater and atmospheric humidity. Their management aims to increase the water reserves of the Mediterranean regions, which face significant water shortage problems, but also the recovery of valuable materials and energy from liquid waste. The use of good quality non-conventional water will increase agricultural production and encourage the economic activity of the Mediterranean areas affected by water scarcity. HYDROUSA aims to close all water cycles locally, utilizing resources and

promoting the idea of decentralized water management, materials, energy saving, wastewater treatment and reuse of recovered water.
The philosophy of the HYDROUSA program is implemented with the implementation of 13 innovations, in six showrooms, on three Mediterranean islands (Lesbos, Mykonos and Tinos). Each site was selected according to different representative characteristics of the Mediterranean areas and other coastal areas.

Here are the main goals of HYDROUSA project:

- Prove that low-cost, nature-based circular technologies can produce and supply fresh water from unconventional water sources.
- Prove that low-cost, nature-based circular technologies can process wastewater and recycle nutrients while creating further environmental and social benefits.
- Prove that the technologies used are capable of having a positive economic impact within the existing (legal) constraints, creating jobs and strengthening the local and not only economy.
- Participation of the local community and all those interested in the management of non-conventional forms of water from the beginning of the project.
- Prove that specialized work combined with modern information and communication technologies create durable and attractive long-lasting systems.
- To establish the relationship between water management - energy consumption - employment with real cost accounting, as a tool for evaluating the circular economy.
- Reproduce HYDROUSA system systems in as many places as possible with additional funding.
- To effectively address the demand for unsustainable water consumption, through the use of non-conventional water resources in agriculture and for domestic use.

HYDROUSA PARTNERS

HYDROUSA partners come from a wide range of organizations involved in water management, agricultural activities, information and communication technologies (ICT) and commercial dissemination/communication throughout the water supply chain: small and medium-sized enterprises, non-governmental organizations (NGOs), regulators/organizations, end users, universities and research centers.

DURATION OF RESEARCH ACTIVITIES

The activities of the project will last 54 months, from July 1, 2018 to December 31, 2022.

DANGERS

There is no risk. You are only required to be available to participate in the research process.

BENEFITS

The solutions offered by the HYDROUSA program will benefit various sectors, including farmers, local water/sewage management companies and municipalities. The aforementioned will gain knowledge about diversified agricultural production, precision irrigation and the use of non-conventional water sources to their advantage. Municipal Water Supply and Sewerage Companies (DEYA) will see that the application of low cost and natural systems can provide solutions to the problems of water and wastewater management.

PRIVACY POLICY AND GDPR

The answers to be given to the questionnaires, interviews and any other research activity are recorded. Recorded data does not include sensitive or private information. The information will be processed during the data analysis phase and will be displayed in the project reports / presentations. It will not be possible to determine the source of the information. The results of this research can be published in scientific journals or conferences and can be used in further studies. The information provided will not be managed by third parties.

The license to use and access this information is valid until the end of the survey, unless you decide to cancel your participation. If you decide not to give your consent, please contact the Data Protection Officer (DPO) and inform him of your intention to leave the study (see DPO contact details). Whether or not you decide to authorize the use and dissemination of the information you provide is entirely voluntary. However, if you do not provide researchers with this authorization now or if you cancel it in the future, you will not be able to participate in this research.

CONTACT

For any issue regarding this research, please contact the data protection manager of HYDROUSA project, Zisis Tsiropoulos, by e-mail, tsiropoulos@agenso.gr and/or the Project Coordinator, Simos Malamis, by e-mail, malamis.simos@gmail.com.

Consent form

I responsibly state that:

- I am over 18 years old and I am able to give consent.
- I have been informed that ***HYDROUSA*** is a European Union research project carried out in the framework of the Horizon 2020 Research and Innovation Program. The coordinator of the project is the National Technical University of Athens (NTUA), which can contact me for any question about my participation in the questionnaire.
- I am fully informed about the objectives and the ambitions of ***HYDROUSA*** project.
- I understand that my participation in the research activity of ***HYDROUSA*** project is not mandatory.
- I have read the participants' brochure and had the opportunity to answer all my questions about the research project, as all my questions were answered by the research team.
- I agree and grant ***HYDROUSA*** the right to use my non-sensitive personal data in video or other digital media in any of their publications, including publications via Internet and academic and non-academic articles, free of charge.
- My personal data will be available only to ***HYDROUSA*** members and possibly to the European Commission.
- I demand that I will not be recognized in any research result.
- I understand that I will not be paid for my participation.
- I unreservedly authorize ***HYDROUSA*** to process, copy, display, publish or distribute my sensitive personal data for any legal purpose.
- I understand that I can refuse to answer any question and that I can withdraw my participation at any time without any charge.
- My participation in this research is voluntary.
- I totally agree with the distribution of information to any other researcher and partner involved in ***HYDROUSA*** project.

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Participants' Signature

Declaration of responsibility of the researcher: I explained the nature and purpose of this research, the actions to be taken and the potential risks. I offered to answer and answered all the questions I was asked. I believe that the participant has understood my explanation and has given his / her consent freely and consciously.

Date and place of the research

Researchers' Signature

This project has received funding from
the European Union's Horizon 2020
Research and Innovation Programme
under Grant Agreement No 776643

Mykonos Questionnaire

HYDROUSA User Requirements - Questionnaire for stakeholders

By using this questionnaire that is related to the user requirements and is addressed to the interested members of the European project HYDROUSA a survey is conducted to evaluate the requirements and specifications of the users to monitor the pilot positions where Information and Communication Technologies (ICT) are used. The acquisition of the requirements and specifications of the users, results from the different needs of the interested parties, for the completion of one of the main objectives of HYDROUSA project. This goal concerns the creation of long-lasting, durable and attractive systems through the combination of specialized work with modern ICT solutions.

Main aim of the European project HYDROUSA is to develop a globally acceptable, adaptable and sustainable water supply and wastewater treatment system, based on a set of natural and ecological solutions that are usually found in places with intense tourist activity. This will be achieved through monitoring and control by modern ICT solutions. More specifically, sensors, controllers and actuators will be used to monitor and control important parameters in the various pilot positions. Different water treatment and sewage systems will be developed at each pilot site, called HYDRO, resulting in different requirements and specifications.

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Q1	**Questionnaire identity**	
Q2	**Date of survey**	

I. Demographics

Q3	**Location and country:**	

Q4	**What is your age group?**				
	18-34 ☐	35-44 ☐	45-54 ☐	55-64 ☐	65+ ☐

Q5	**What is your gender?**		
	Male ☐	Female ☐	Other ☐

Q6	**What is your education level?**			
	Primary education ☐	Secondary education ☐	Graduate ☐	Postgraduate / PhD ☐

Q7	**Which of the following categories do you represent?**				
	Domestic consumer	Agricultural consumer	Commercial consumer	Water systems and irrigation	Public organization (Municipality etc.)
	☐	☐	☐	☐	☐

Q8	**How do you have internet access?**			
	Desktop PC ☐	Tablet ☐	Smartphone ☐	No internet connection ☐

II. General Questions

Q9	**How important do you think it is to save water?**			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q10	**How important do you think it is to measure the quantity of water?**			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q11	**How important do you think it is to measure the quality of water?**

	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q12	How important do you think it is to collect, storage and use rainwater for irrigation?			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q13	How important do you consider the use of rainwater in the cultivation of aromatic plants with low water requirements?			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q14	How important do you consider the process of collecting rainwater to cover your needs?			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q15	How important do you consider rainwater for domestic use (Please rate from 1 to 5, with 1 being the least important and 5 the most important)					
		Not important 1	**2**	**3**	**4**	**Very important 5**
	Shower	☐	☐	☐	☐	☐
	Face washing	☐	☐	☐	☐	☐
	Dish washing	☐	☐	☐	☐	☐
	Clothes washing	☐	☐	☐	☐	☐
	Boiler for heating	☐	☐	☐	☐	☐
	Bathroom	☐	☐	☐	☐	☐

Q16	How important do you think is precision irrigation?			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q17	Do you use any technology to monitor the quality and quantity of water (software or hardware, etc.)?

	Yes ☐	No ☐

Q18	If you answered "Yes" on the previous question, mention the technologies that you use.

III. General questions for the development of the HYDROUSA project solution

Q19	Which information related to water treatment, storage, transport and application would you like to have?

Q20	What kind of devices/sensors related to this information would you like to use?

Q21	Which are the reasons that you want to use them?

IV. Hardware of HYDROUSA project

Q22	How important is monitoring of system parts? (Please rate from 1 to 5, with 1 being the least important and 5 the most important)					
		Not important 1	2	3	4	Very important 5
	Water consumption	☐	☐	☐	☐	☐
	Water production	☐	☐	☐	☐	☐
	Water flow	☐	☐	☐	☐	☐
	Water processing	☐	☐	☐	☐	☐
	Water storage	☐	☐	☐	☐	☐
	Energy consumption	☐	☐	☐	☐	☐
	Operational systems	☐	☐	☐	☐	☐
	Meteorological phenomena	☐	☐	☐	☐	☐
	Soil humidity for agricultural application	☐	☐	☐	☐	☐

Q23	Would you like to suggest some other parameters/sensors related to water quantity and quality measurements?	
	Yes ☐	No ☐

Q24	If you answered "Yes" to the question above, what other parameters/sensors related to the measurements of water quantity and quality would you suggest to be included?

Q25	Would you be interested in low-cost sensors for measuring water quantity and quality?	
	Yes ☐	No ☐

Q26	In terms of low-cost sensor systems, would you be interested in them being ready-made solutions or being able to intervene and conFigure?

	Prepared solutions ☐	Possibility of intervention ☐

Q27	**The maximum size/volume of such a sensor system may be in the range of 1-5 liters while in most cases they are accompanied by a solar panel. Do you think that the installation of such systems can cause functional and visual disturbance in the surrounding area?**	
	Yes ☐	No ☐

Q28	**Would you be interested in developing a public network that meets the wireless connectivity needs of these sensors throughout Mykonos, or would you prefer your sensors to be accessible only through your private internet network?**	
	Public network ☐	Private network ☐

Q29	**What measurements do you consider useful for your needs (pH, turbidity, etc.)?**

Q30	**How important do you think it is to use energy-autonomous systems to monitor and control water treatment and management units?**			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

V. HYDROUSA platform

Q31	How would you prefer to access HYDROUSA information?			
	Desktop PC ☐	Tablet ☐	Smartphone ☐	No internet access ☐

Q32	**Would you like to be able to customize the notifications you receive from the HYDROUSA platform according to your needs?**	
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Q33	**What types of notifications do you consider necessary for your needs?**			
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Q35	Please evaluate the following ways to display information about the HYDROUSA program from 1 to 5, with 1 being the least important and 5 the most important.					
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	Statistics	☐	☐	☐	☐	☐
	Diagrams	☐	☐	☐	☐	☐
	Notifications	☐	☐	☐	☐	☐
	Other ……..	☐	☐	☐	☐	☐

Q36	In what kind of files would you like the results to be exported (for example CSV, SHAPEFILE, TEXT);

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Q38	Would you be interested in accessing older data?	
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VI. Importance of HYDROUSA

Q39	Do you think that the HYDROUSA program is going to solve the serious problem of water shortage during the high tourist season on the island?	
	Yes ☐	No ☐

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Date and place of the research

Researchers' Signature

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Tinos Questionnaire

HYDROUSA User Requirements - Questionnaire for stakeholders

By using this questionnaire that is related to the user requirements and is addressed to the interested members of the European project HYDROUSA a survey is conducted to evaluate the requirements and specifications of the users to monitor the pilot positions where Information and Communication Technologies (ICT) are used. The acquisition of the requirements and specifications of the users, results from the different needs of the interested parties, for the completion of one of the main objectives of HYDROUSA project. This goal concerns the creation of long-lasting, durable and attractive systems through the combination of specialized work with modern ICT solutions.

Main aim of the European project HYDROUSA is to develop a globally acceptable, adaptable and sustainable water supply and wastewater treatment system, based on a set of natural and ecological solutions that are usually found in places with intense tourist activity. This will be achieved through monitoring and control by modern ICT solutions. More specifically, sensors, controllers and actuators will be used to monitor and control important parameters in the various pilot positions. Different water treatment and sewage systems will be developed at each pilot site, called HYDRO, resulting in different requirements and specifications.

Q1	**Questionnaire identity**	
Q2	**Date of survey**	

I. Demographics

Q3	**Location and country:**	

Q4	**What is your age group?**				
	18-34 ☐	35-44 ☐	45-54 ☐	55-64 ☐	65+ ☐

Q5	**What is your gender?**		
	Male ☐	Female ☐	Other ☐

Q6	**What is your education level?**			
	Primary education ☐	Secondary education ☐	Graduate ☐	Postgraduate / PhD ☐

Q7	**Which of the following categories do you represent?**				
	Domestic consumer	Agricultural consumer	Commercial consumer	Water systems and irrigation	Public organization (Municipality etc.)
	☐	☐	☐	☐	☐

Q8	**How do you have internet access?**			
	Desktop PC ☐	Tablet ☐	Smartphone ☐	No internet connection ☐

II. General Questions

Q9	**How important do you think it is to save water?**			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q10	**How important do you think it is to measure the quantity of water?**			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q11	How important do you think it is to measure the quality of water?			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q12	How important do you think is the desalination procedure to cover your needs?			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q13	How important do you consider the procedure of rainwater collection to cover your needs?			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q14	How important do you consider the use of clean water in the food production for plants?			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q15	How important do you consider rainwater for domestic use (Please rate from 1 to 5, with 1 being the least important and 5 the most important)					
		Not important 1	**2**	**3**	**4**	**Very important 5**
	Shower	☐	☐	☐	☐	☐
	Face washing	☐	☐	☐	☐	☐
	Dish washing	☐	☐	☐	☐	☐
	Clothes washing	☐	☐	☐	☐	☐
	Boiler for heating	☐	☐	☐	☐	☐
	Bathroom	☐	☐	☐	☐	☐

Q16	How important do you think precision irrigation is?			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

Q17	Do you use any technology to monitor the quality and quantity of water (software or hardware, etc.)?

	Yes ☐	No ☐

Q18	If you answered "Yes" on the previous question, mention the technologies that you use.

III. General questions for the development of the HYDROUSA project solution

Q19	Which information related to water treatment, storage, transport and application would you like to have?

Q20	What kind of devices/sensors related to this information would you like to use?

Q21	Which are the reasons that you want to use them?

IV. Hardware of HYDROUSA project

Q22	How important is monitoring of system parts? (Please rate from 1 to 5, with 1 being the least important and 5 the most important)					
		Not important 1	2	3	4	Very important 5
	Water consumption	☐	☐	☐	☐	☐
	Water production	☐	☐	☐	☐	☐
	Water flow	☐	☐	☐	☐	☐
	Water processing	☐	☐	☐	☐	☐
	Water storage	☐	☐	☐	☐	☐
	Energy consumption	☐	☐	☐	☐	☐
	Operational systems	☐	☐	☐	☐	☐
	Meteorological phenomena	☐	☐	☐	☐	☐
	Soil humidity for agricultural application	☐	☐	☐	☐	☐

Q23	Would you like to suggest some other parameters/sensors related to water quantity and quality measurements?	
	Yes ☐	No ☐

Q24	If you answered "Yes" to the question above, what other parameters/sensors related to the measurements of water quantity and quality would you suggest to be included?

Q25	Would you be interested in low-cost sensors for measuring water quantity and quality?	
	Yes ☐	No ☐

Q26	In terms of low-cost sensor systems, would you be interested in them being ready-made solutions or being able to intervene and conFigure?

	Prepared solutions ☐	Possibility of intervention ☐

Q27	**The maximum size/volume of such a sensor system may be in the range of 1-5 liters while in most cases they are accompanied by a solar panel. Do you think that the installation of such systems can cause functional and visual disturbance in the surrounding area?**	
	Yes ☐	No ☐

Q28	**Would you be interested in developing a public network that meets the wireless connectivity needs of these sensors throughout Tinos, or would you prefer your sensors to be accessible only through your private internet network?**	
	Public network ☐	Private network ☐

Q29	What measurements do you consider useful for your needs (pH, turbidity, etc.)?

Q30	**How important do you think it is to use energy-autonomous systems to monitor and control water treatment and management units?**			
	Not important ☐	Minor importance ☐	Important ☐	Very important ☐

V. HYDROUSA platform

Q31	**How would you prefer to access HYDROUSA information?**			
	Desktop PC ☐	Tablet ☐	Smartphone ☐	No internet access ☐

Q32	**Would you like to be able to customize the notifications you receive from the HYDROUSA platform according to your needs?**	
	Yes ☐	No ☐

Q33	**What types of notifications do you consider necessary for your needs?**

	SMS ☐	E-MAIL ☐	Mobile application ☐	Other ……

Q34	Would you be interested in creating custom irrigation algorithms?	
	Yes ☐	No ☐

Q35	Please evaluate the following ways to display information about the HYDROUSA program from 1 to 5, with 1 being the least important and 5 the most important.					
	The information is displayed as:	**Not important 1**	**2**	**3**	**4**	**Very important 5**
	Reports	☐	☐	☐	☐	☐
	Maps	☐	☐	☐	☐	☐
	Statistics	☐	☐	☐	☐	☐
	Diagrams	☐	☐	☐	☐	☐
	Notifications	☐	☐	☐	☐	☐
	Other ……..	☐	☐	☐	☐	☐

Q36	In what kind of files would you like the results to be exported (for example CSV, SHAPEFILE, TEXT);

Q37	How often would you like to receive information from the HYDROUSA platform?					
	Every 15 minutes ☐	Every 30 minutes ☐	Every 1 hour ☐	Every 3 hours ☐	Once a day ☐	Other ……

Q38	Would you be interested in accessing older data?	
	Yes ☐	No ☐

VI. Importance of HYDROUSA

Q39	Do you think that the HYDROUSA program is going to solve the serious problem of water shortage during the high tourist season on the island?	
	Yes ☐	No ☐

THANK YOU FOR YOUR TIME!!!

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 776643

Information leaflet for the participants

Project title:	Demonstration of water loops with innovative regenerative business models for the Mediterranean region
Acronym:	HYDROUSA
Grant Agreement number:	776643
Start date:	01/07/2018
End date:	31/12/2022
Funding:	European Union
Under the program:	Research and Innovation Program Horizon 2020
Website, Twitter, LinkedIn:	www.hydrousa.org, @HydrousaProject, HYDROUSA

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 776643

INTRODUCTION

You have been invited to participate in a research activity of the HYDROUSA program. Before deciding whether or not you want to participate, read this document carefully. Please do not hesitate to ask anything, as to continue you must be confident and have understood all the procedures of the study, the risks and benefits of which it is characterized.

This document may contain words you do not understand. In this case, please ask the researcher or any other member of the research team to fully understand the meaning of the word or information you do not understand.

AIM OF HYDROUSA PROJECT

The European HYDROUSA program is part of the Horizon 2020 program, which is the European Union's main funding tool for Research and Innovation. HYDROUSA aims to develop, optimize and demonstrate low-cost innovative and cost-effective systems for non-conventional water management in Mediterranean areas. This includes wastewater management, rainwater, groundwater, seawater and atmospheric humidity. Their management aims to increase the water reserves of the Mediterranean regions, which face significant water shortage problems, but also the recovery of valuable materials and energy from liquid waste. The use of good quality non-conventional water will increase agricultural production and encourage the economic activity of the Mediterranean areas affected by water scarcity. HYDROUSA aims to close all water cycles locally, utilizing resources and promoting the idea of decentralized water management, materials, energy saving, wastewater treatment and reuse of recovered water.

The philosophy of the HYDROUSA program is implemented with the implementation of 13 innovations, in six showrooms, on three Mediterranean islands (Lesbos, Mykonos and Tinos). Each site was selected according to different representative characteristics of the Mediterranean areas and other coastal areas.

Here are the main goals of HYDROUSA project:

- Prove that low-cost, nature-based circular technologies can produce and supply fresh water from unconventional water sources.
- Prove that low-cost, nature-based circular technologies can process wastewater and recycle nutrients while creating further environmental and social benefits.
- Prove that the technologies used are capable of having a positive economic impact within the existing (legal) constraints, creating jobs and strengthening the local and not only economy.
- Participation of the local community and all those interested in the management of non-conventional forms of water from the beginning of the project.
- Prove that specialized work combined with modern information and communication technologies create durable and attractive long-lasting systems.
- To establish the relationship between water management - energy consumption - employment with real cost accounting, as a tool for evaluating the circular economy.
- Reproduce HYDROUSA system systems in as many places as possible with additional funding.
- To effectively address the demand for unsustainable water consumption, through the use of non-conventional water resources in agriculture and for domestic use.

HYDROUSA PARTNERS

HYDROUSA partners come from a wide range of organizations involved in water management, agricultural activities, information and communication technologies (ICT) and commercial dissemination/communication throughout the water supply chain: small and medium-sized enterprises, non-governmental organizations (NGOs), regulators/organizations, end users, universities and research centers.

DURATION OF RESEARCH ACTIVITIES

The activities of the project will last 54 months, from July 1, 2018 to December 31, 2022

DANGERS

There is no risk. You are only required to be available to participate in the research process.

BENEFITS

The solutions offered by the HYDROUSA program will benefit various sectors, including farmers, local water/sewage management companies and municipalities. The aforementioned will gain knowledge about diversified agricultural production, precision irrigation and the use of non-conventional water sources to their advantage. Municipal Municipal Water Supply and Sewerage Companies (DEYA) will see that the application of low cost and natural systems can provide solutions to the problems of water and wastewater management.

PRIVACY POLICY AND GDPR

The answers to be given to the questionnaires, interviews and any other research activity are recorded. Recorded data does not include sensitive or private information. The information will be processed during the data analysis phase and will be displayed in the project reports / presentations. It will not be possible to determine the source of the information. The results of this research can be published in scientific journals or conferences and can be used in further studies. The information provided will not be managed by third parties.

The license to use and access this information is valid until the end of the survey, unless you decide to cancel your participation. If you decide not to give your consent, please contact the Data Protection Officer (DPO) and inform him of your intention to leave the study (see DPO contact details). Whether or not you decide to authorize the use and dissemination of the information you provide is entirely voluntary. However, if you do not provide researchers with this authorization now or if you cancel it in the future, you will not be able to participate in this research.

CONTACT

For any issue regarding this research, please call and inform the data protection manager of HYDROUSA project, Zisis Tsiropoulos, by e-mail, tsiropoulos@agenso.gr or the Project Coordinator, Simos Malamis, via e-mail, malamis.simos@gmail.com.

This project has received funding from
the European Union's Horizon 2020
Research and Innovation Programme
under Grant Agreement No 776643

Consent form

I responsibly state that:

- I am over 18 years old and I am able to give consent.
- I have been informed that ***HYDROUSA*** is a European Union research project carried out in the framework of the Horizon 2020 Research and Innovation Program. The coordinator of the project is the National Technical University of Athens (NTUA), which can contact me for any question about my participation in the questionnaire.
- I am fully informed about the objectives and the ambitions of ***HYDROUSA*** project.
- I understand that my participation in the research activity of ***HYDROUSA*** project is not mandatory.
- I have read the participants' brochure and had the opportunity to answer all my questions about the research project, as all my questions were answered by the research team.
- I agree and grant ***HYDROUSA*** the right to use my non-sensitive personal data in video or other digital media in any of their publications, including publications via Internet and academic and non-academic articles, free of charge.
- My personal data will be available only to ***HYDROUSA*** members and possibly to the European Commission.
- I demand that I will not be recognized in any research result.
- I understand that I will not be paid for my participation.
- I unreservedly authorize ***HYDROUSA*** to process, copy, display, publish or distribute my sensitive personal data for any legal purpose.
- I understand that I can refuse to answer any question and that I can withdraw my participation at any time without any charge.
- My participation in this research is voluntary.
- I totally agree with the distribution of information to any other researcher and partner involved in ***HYDROUSA*** project.

This consent form is in accordance with relevant national, European and international laws and regulations on data protection and personal data processing obligations. Specifically, this consent document is in accordance with the General Regulation on Personal Data Protection 2016/679, which was approved on 14 April 2016 and entered into force on 25 May.

Participants' Signature

Declaration of responsibility of the researcher: I explained the nature and purpose of this research, the actions to be taken and the potential risks. I offered to answer and answered all the questions I was asked. I believe that the participant has understood my explanation and has given his/her consent freely and consciously.

Date and place of the research

Researchers' Signature