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Water and Environment Support
in the ENI Southern Neighbourhood region

Activity Report

Regional Training and Study Tour on Non-Revenue Water

RW-6-REG & RW-6-ST

February 2023

Version	*Document Title*	*Author(s)*	*Review and Clearance*
v.1	*Activity Report on Training and Study Tour NRW in Athens*	*Cor Merks (Ramboll)*	*Prof. Michael Scoullos*

WATER AND ENVIRONMENT SUPPORT IN THE ENI SOUTHERN NEIGHBOURHOOD REGION

The "Water and Environment Support (WES) in the ENI Neighbourhood South Region" project is a regional technical support project funded by the European Neighbourhood Instrument (ENI South). WES aims to protect the natural resources in the Mediterranean context and to improve the management of scarce water resources in the region. WES mainly aims to solve the problems linked to pollution prevention and the rational use of water.

WES builds on previous similar regional projects funded by the European Union (Horizon 2020 CB/MEP, SWIM I and II, SWIM-Horizon 2020 SM) striving to create a supportive environment and increase the capacity of all stakeholders in the partner countries (PCs).

The WES Partner Countries are Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine, Syria, and Tunisia. However, to ensure the coherence and effectiveness of EU funding or to promote regional cooperation, the eligibility of specific actions can be extended to neighbouring countries in the Southern Neighbourhood region.

As part of the WES project workplan for the third year (2021-2022) related to the Regional Activities, a **regional training** (**RW-6-REG**), **study tour (RW-6-ST) and a Peer-to-Peer** (**RW-6-P2P**) exchange **were envisioned to be organized with a focus on Non-Revenue Water (NRW) management**. The P2P exchange kick-started on November 21st and will last until end of August 2023. The regional training and the study tour were carried out over five (days) between the 16th and 20th of January 2023. The two on-site activities are completed.

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ABBREVIATIONS

AM	Asset Management
CB/MEP	Capacity Building/Mediterranean Environment Programme
DMA	District Metered Area
EC	European Commission
ENI	European Neighbourhood Instrument
EU	European Union
IFI	International Financing Institution
KPI	Key Performance Indicator
MNF	Minimum Night Flow
NGO	Non-Governmental Organisation
NKE	Non-Key Expert
NRW	Non-Revenue Water
PCs	Partner Countries
P2P	Peer-to-Peer
PMZ	Pressure Managed Zone
ST	Study Tour
SWIM	Sustainable Water Integrated Management
SWIM-Horizon2020 SM	Sustainable Water Integrated Management – Support Mechanism Project
UNEP-MAP	United Nations Environment Program - Mediterranean Action Plan
UfM	Union for the Mediterranean
WES	Water and Environment Support

1 BACKGROUND INFORMATION AND OBJECTIVES

1.1 BACKGROUND

Non-revenue water (NRW) presents a critical challenge for water utilities and authorities in Mediterranean countries, where optimizing the efficiency of distribution networks and ensuring the sustainable use of water resources are both pressing concerns. NRW encompasses both physical (or: real) losses, such as leakages, bursts, and unauthorized consumption, and commercial (or: apparent) losses, including metering inaccuracies, billing errors, and theft. Addressing these losses is crucial to conserving scarce water resources and enhancing the viability of water utilities.

Water utilities and authorities are therefore challenged to find cost-effective solutions that prioritize NRW reduction while also meeting their environmental responsibilities. Effective strategies include the adoption of advanced technologies, improved water management practices, and community participation in leak detection and reporting. Effectively managing NRW was the subject of this Regional Training and Study Tour within the framework of the WES project, so that water utilities and authorities in the participating Partner Countries (PCs) can strike a balance between the efficiency of their networks and the sustainable use of water resources, thereby contributing to a more secure and resilient water future in Mediterranean countries.

Among other things, the training zoomed into the different approaches that are used to manage Non-Revenue Water, introducing key definitions and tools that lay the foundations of appropriate NRW management, such as methods for NRW quantification and water balance calculations. Technical and commercial KPIs were presented, to help experts set targets and track performance in their countries. The training highlighted various interventions for the reduction of NRW, including the Real and Apparent Lossess Control Strategies as well as highlighting the role of spatial and hydraulic data in NRW decision making.

The regional training gathered planners, managers, technical coordinators, decision makers/stakeholders, engineers and NGO representatives involved in the planning, management of water resources and implementation of NRW as part of strategies and programmes aiming to improve systems' efficiency and water use in the Partner Countries (PCs).

1.2 OBJECTIVES

The purpose of the specific regional activity RW-6-REG, RW-6-ST and RW-6-P2P is to build the capacity of the project countries (PCs) on Non-Revenue Water including the role of GIS and hydraulic modelling in facilitating NRW management. The study tour showcased measures for reducing physical and commercial losses taken by the Athens' water utility EYDAP with successful outcomes. The activity followed several specific objectives, such as: the quantification of Non-Revenue Water, the establishment of district metered areas, models for assessment of physical losses, key-performance indicators, NRW reduction and management measures, the role of information systems (GIS) and hydraulic modelling in NRW management, etc.

2 METHODOLOGY & STRUCTURE OF THE REGIONAL TRAINING

2.1 METHODOLOGY

The training was divided into four classroom training days, held between the 16th and 20th of January 2022 and a technical visit in the same week at the Athens' water utility EYDAP (see more details in Section 2.2):

- Training day 1 (TD1) on Jan 16: NRW Definitions and tools.
- Training day 2 (TD2) on Jan 17: NRW Reduction interventions.
- Study Tour (ST/TD3) on Jan 18: Technical visit at EYDAP in Athens.
- Training day 3 (TD4) on Jan 19: NRW Data Management.
- Training day 4 (TD5) on Jan 20: NRW Asset management.

For each of these training modules, the following methodology was applied:

- Participants were present physically in a multifunctional space with a classroom layout.
- Training modules were facilitated by Ramboll experts, using a tailormade slide deck and engaging exercises and quizzes on Mentimeter on TD2, TD4 and TD5.
- TD2, TD4 and TD5 included one part of plenary training, and one part of breakout rooms where participants got to work together on exercises related to NRW measures and data management.
- TD1 and TD2 included round tables where participants got to exchange their views.
- Demonstrations on software uses (Water Audit Software, TD4), plenary exercises (KPI calculation, interpretation on TD1 and simulation results for NRW decision making on TD4).
- Different case studies on NRW management touching on different topics were presented during every training day:
    - Decision making on the most appropriate NRW interventions (Vitens, NL) during TD1.
    - Implementation of pressure management and implementation of active leak detection (Vitens, NL) during TD2.
    - Decision making on the most appropriate NRW interventions (ApaVital, RO) during TD2.
    - Réaliser un diagnostique de la performance de l'Eau Non Facturée (ENF) dans un service public pilote[1] (DZ), presented by participants Mohammedi Lounes & Yahiaoui Fahem on TD4.
    - Water Demand Management Plan Demo Area Metn (LB) presented by participant Eng. Ramzi Saliba on TD5.
    - The NRW Action Plan of Egypt (EG) presented by participants from Egypt on TD4

[1] Carry out a diagnosis of the performance of Non-Revenue Water (NRW) in a pilot public water service provider

During the training week, the slide decks as presented were sent to all participants by email each day.

Ramboll co-developed the Concept Note for the regional training and study tour on NRW management in close collaboration with the WES Key Water Expert, Ms. Suzan Taha (based in Amman, Jordan). Finally, as per Terms of Reference, a Google Form evaluation questionnaire was shared with all training participants after completion of TD5. Two additional questionnaires were prepared to evaluate participants' level of expertise within NRW before and after the training week.

Annex 6.1 provides a full list of all deliverables. Each deliverable has been submitted to WES as a separate PDF document.

FIGURE 2-1 – GROUP PICTURE AT THE ACROPOLYS OF ATHENS ON WEDNESDAY, JANUARY 18, 2023

The regional training and study tour on NRW management has been delivered by the following Ramboll Water experts:

- Andreea Florea, Young Water Professional, based in Denmark.
- Andrei Cristea, Senior Expert on Hydraulic modelling & GIS (NKE2), based in Romania.
- Cor Merks, Senior Expert on Non-Revenue Water reduction management (NKE1), based in the Netherlands.

2.2 STRUCTURE OF THE REGIONAL TRAINING AND STUDY TOUR

The regional training was divided in four classroom training days, as follows:

- **TD1 – NRW Definitions and tools**
  - Introduction of WES.
  - Short personal introduction of participants.
  - Standard IWA/AWWA Annual Water Balance.
  - Plenary round table on existing experience with the Annual Water Balance.
  - Relevant Key Performance Indicators (KPIs) for NRW management.
  - Decision making on the most appropriate NRW interventions (Vitens, NL).
- **TD2 – NRW Reduction interventions**
  - Four basic Real Losses control strategies:
    - Pressure Management.
    - Active Leakage Control.
    - Asset Management: Maintenance / Renewal / Replacement.
    - Speed and quality of repairs.
  - Implementation of pressure management and implementation of active leak detection (Vitens, NL)
  - Four basic apparent losses control strategies:
    - Customer metering inaccuracies.
    - Data transfer errors & poor customer accountability.
    - Data analysis errors between archived data and data used for billing/water balance.
    - Unauthorized consumption.
  - Plenary round table Unbilled Authorised Consumption and Apparent Losses.
  - Breakout session on opportunities to implement basic control strategies, followed by plenary presentation of the highlights of the discussions.
  - Decision making on the most appropriate NRW interventions (ApaVital, RO).
  - IT tools for data collection and performance monitoring.
  - Quiz.
- **TD4 – NRW Data Management**
  - Application of GIS for NRW data management.
  - Application of hydraulic modelling for NRW data management.
  - Exercises on using simulation results for decision making on NRW interventions:
    - DMA set-up.

        - Pressure Management Zones (PMZs) set-up.
        - Network segmentation.
        - Criticality analysis.
        - Burst backtracking support.
    - Demonstration of examples of Water Audit Software.
    - Breakout session on data acquisition and representation levels, followed by plenary presentation of the highlights of the discussions.
    - Importance of accurate burst registration:
        - Data requirements.
        - Standardized burst registration in the Netherlands.
    - Case study presentation from Algeria: *Réaliser un diagnostique de la performance de l'Eau Non Facturée (ENF) dans un service public pilote*.
- **TD4 – NRW Asset Management**
    - Case study presentation from Lebanon: *Water Demand Management Plan Demo Area Metn*.
    - Establishment of Pressure Managed Zones (PMZs) and District Metered Areas (DMAs), highlighting the need for accurate flow and pressure monitoring.
    - DMA data monitoring including Minimum Night Flow (MNF) analysis.
    - Breakout session on development of a tailored NRW reduction program, followed by plenary presentation of the highlights of the discussions.
    - Case study presentation from Egypt: *The NRW Action Plan of Egypt*.
    - Basic and advanced pressure management methods
    - Non-technological aspects of asset management and NRW management, including short introduction of the so-called PESTLE analysis (Political, Economic, Sociological, Technological, Legal, Environmental).

The study tour was carried out over one day at the facilities of EYDAP in Athens. The technical visit included:

- A presentation of EYDAP's experience and practices on NRW management and reduction.
- Field visit to an ongoing EYDAP project site.

3 ELEMENTS OF THE REGIONAL TRAINING IMPLEMENTATION

No. of presentations on examples/case studies	8 examples including 3 case studies presented by participants
No. of international speakers from the Region	3 (from Algeria, Egypt, and Lebanon).
No. of international speakers from the EU	3 trainers (from Denmark, Netherlands, and Romania). Prof. Michael Scoullos (from Egypt). 2 presenters from EYDAP, Greece.
No. of training-oriented presentations (on concepts, methodologies, etc.)	4 full slide decks during the regional training, one for each classroom training day. 2 presentations during the study tour.
No. of interactive/participatory activities (breakoutroom discussions, plenary exercises, round tables)	9
No. of participants	39 (excluding guest speakers and facilitators)

FIGURE 3-1 – CERTIFICATES CEREMONY ON FRIDAY, JANUARY 20, 2023

4 PROFILES OF THE PARTICIPANTS

Thirty-nine persons participated in the 4-day training, and two observers from the EYDAP water company (Athens). The list of participants can be found in Annex 7.3.

In detail, the profile of participants who attended the training:

Specialized engineers	10
Operational management	19
Senior management	10

FIGURE 4-1: TRAINEES PER COUNTRY

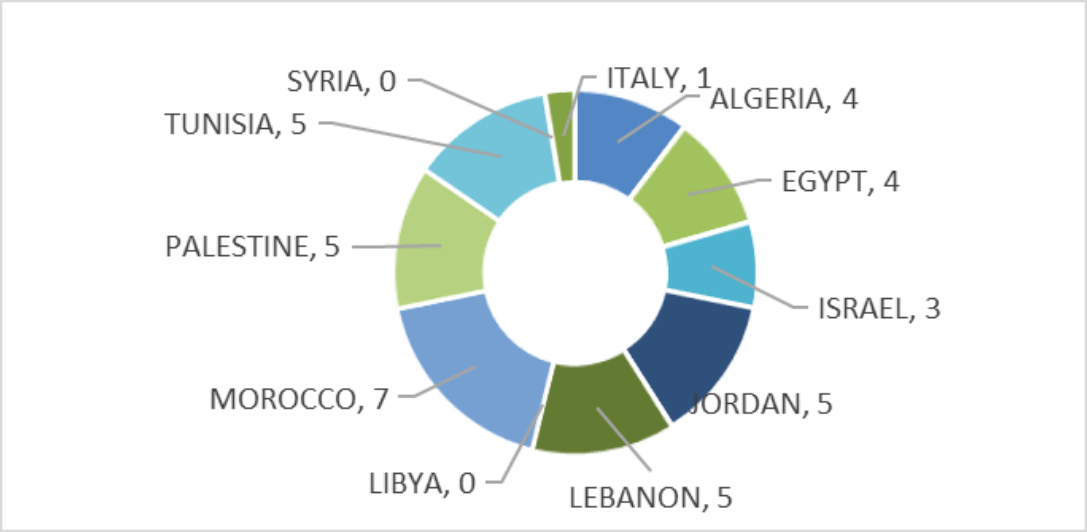
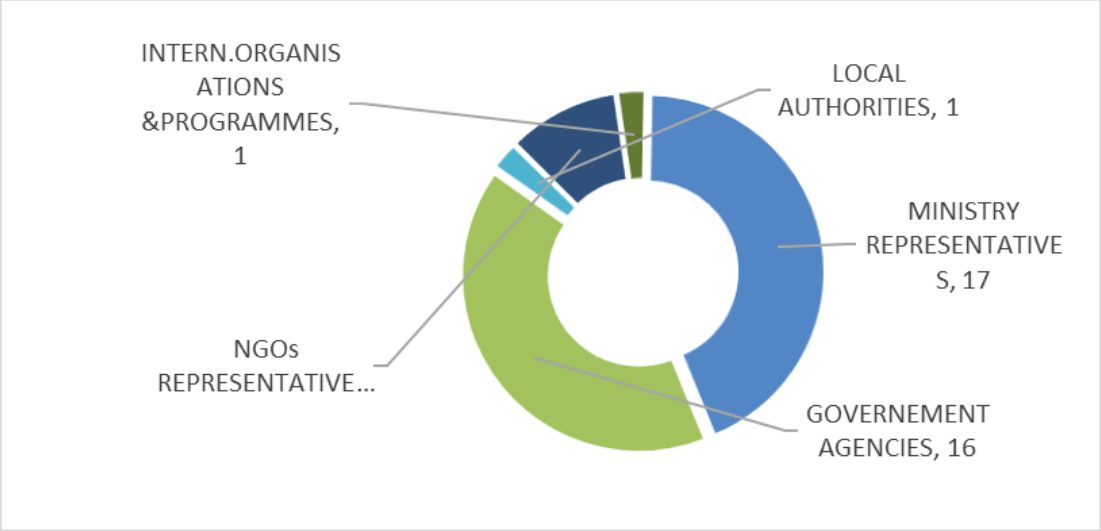


FIGURE 4-2: TRAINEES PER TYPE OF INSTITUTION



5 STATISTICS GENDER AND YOUTH

FIGURE 5-1: GENDER OF ALL PARTICIPANTS

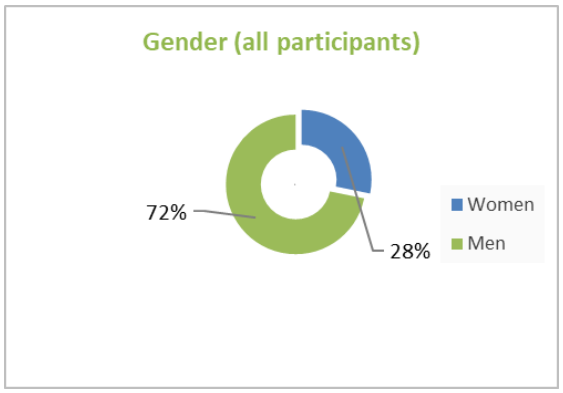


FIGURE 5-2: GENDER (TRAINEES & OBSERVERS)

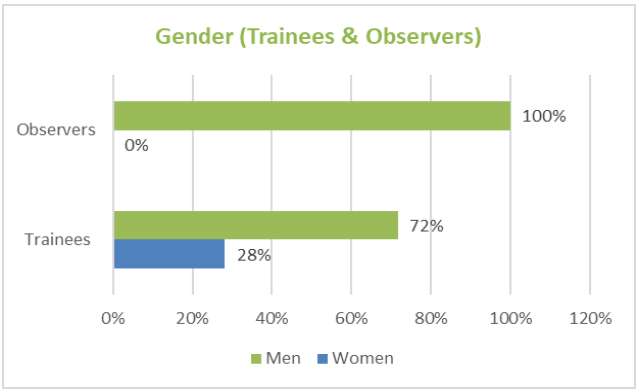


FIGURE 5-3: GENDER (EXPERTS/TRAINERS/WES TEAM)

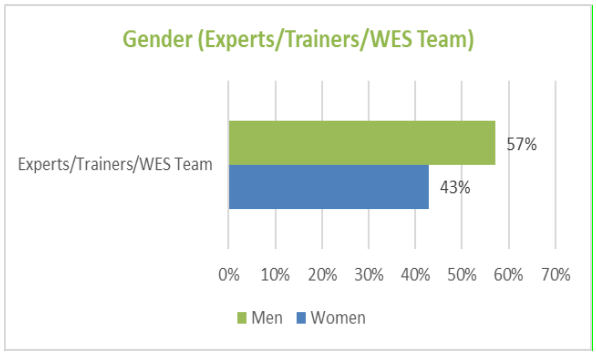


FIGURE 5-4: TRAINEES AGE

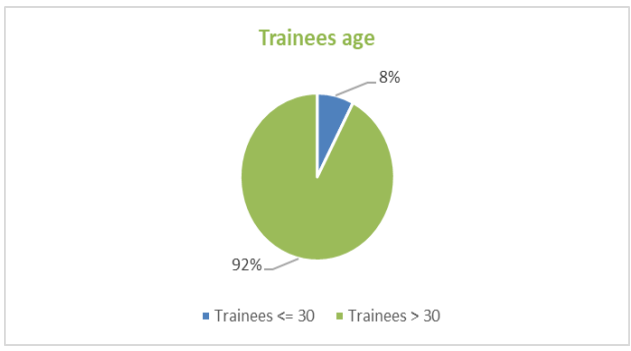


FIGURE 5-5: TRAINEES AGE

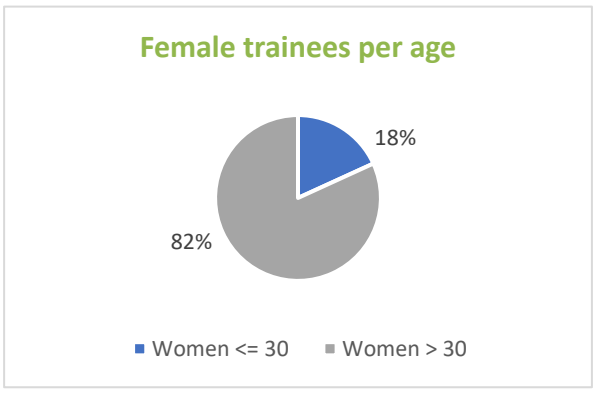
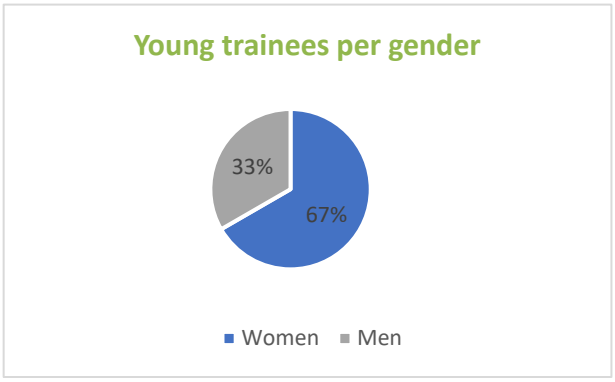


FIGURE 5-6: YOUNG TRAINEES (18-30) - GENDER



6 EVALUATION OF THE REGIONAL TRAINING

Two categories of indicators were used to evaluate the workshop: i) evaluation indicators reflecting the quality of the workshop logistics and organizational aspects (See section A below), together with the assessment of the technical quality of the workshop (See section B below) as perceived by the participants and ii) impact indicators, reflecting the direct impact of the workshop (See Section C below). The indicators and associated ratings are presented in Tables 5-1, and 5-2 respectively. Table 5-4 provides the specific remarks made by the non-key expert on the workshop (Section D below).

A. Organisational, administrative and planning issues

A set of 11 criteria; A1-A11 (See table below) were assessed by the participants, using a qualitative description ranging between "Excellent" to "Poor". Forcomparison purposes, the qualitative descriptions are given assigned numbers as follows: Excellent = 4 Good = 3 Average = 2 Poor = 1

TABLE 5-1: ORGANISATIONAL, ADMINISTRATIVE AND PLANNING ISSUES

A. ORGANISATIONAL, ADMINISTRATIVE AND PLANNING ISSUES BEFORE AND DURING THE EVENT		EXCELLENT	GOOD	AVERAGE	POOR	Total Replies	Average Score (max = 4)
A1	Appropriate handling of invitations, visa support, information sharing and smoothing obstacles	24	7	1	0	**32**	3.71
A2	Efficient logistics: accommodation, transportation, location of venue and interpretation	21	8	3	0	**32**	3.56
A3	Provision of support (if requested) for participants' preparation for the event	23	9	0	0	**32**	3.71
A4	Efficient and effective follow-up of preparations and progress towards the event	22	10	3	0	**32**	3.68
A5	Planning for the event: selection and design of methodology, programme/daily agenda, and work rules	14	17	1	0	**32**	3.46
A6	Smooth flow of programme, efficient handling of emerging needs and attentiveness to participants concerns	14	15	3	0	**32**	3.34
A7	Presentations correspond and contribute to the planned objectives and are conducive to enhanced shared understanding and participation on addressed topics	18	13	1	0	**32**	3.53
A8	Clarity, coverage and sufficiency of concepts, objectives, anticipated outputs	17	13	2	0	**32**	3.56
A9	Usefulness of the distributed material	15	15	1	0	**31**	3.45
A10	Efficiency and effectiveness of the facilitation	19	13	0	0	**32**	3.59
A11	Overall rating of the event	19	13	0	0	**32**	3.59

Figure 5-6-1: Handling of the invitations (A.1)

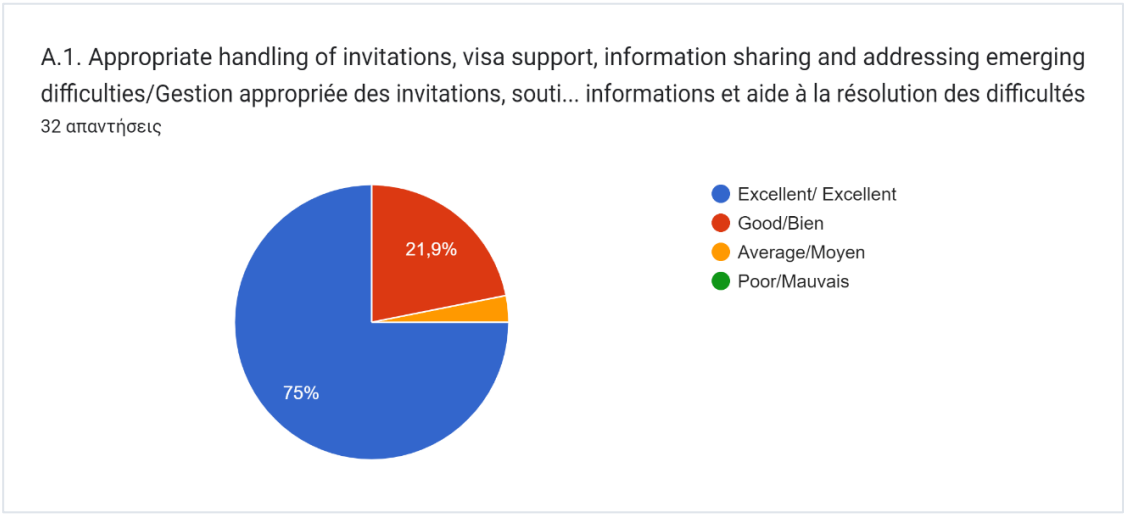


Figure 5-6-2: Efficient logistics (A.2)

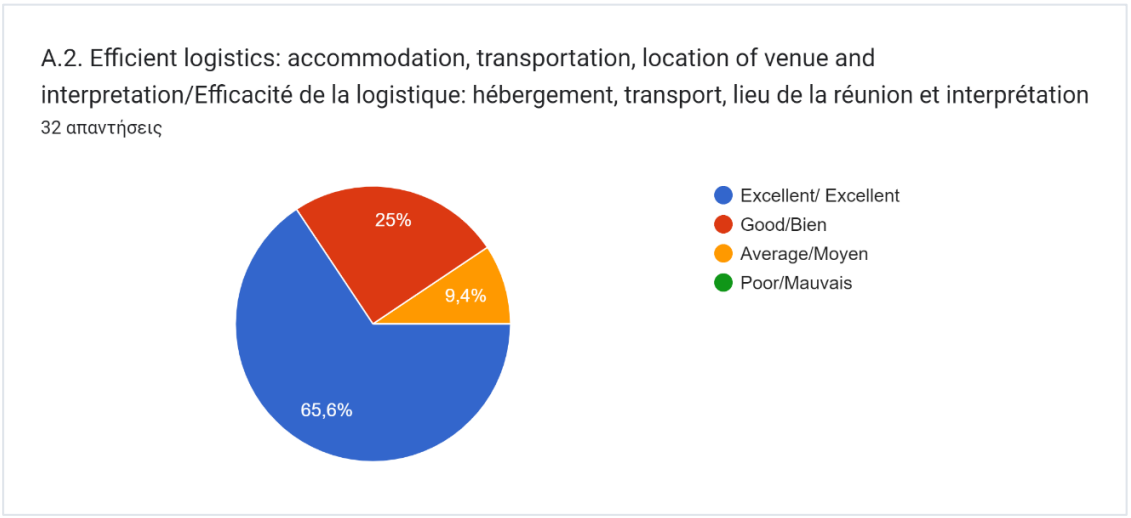


Figure 5-6-3: Provision of support (A.3)

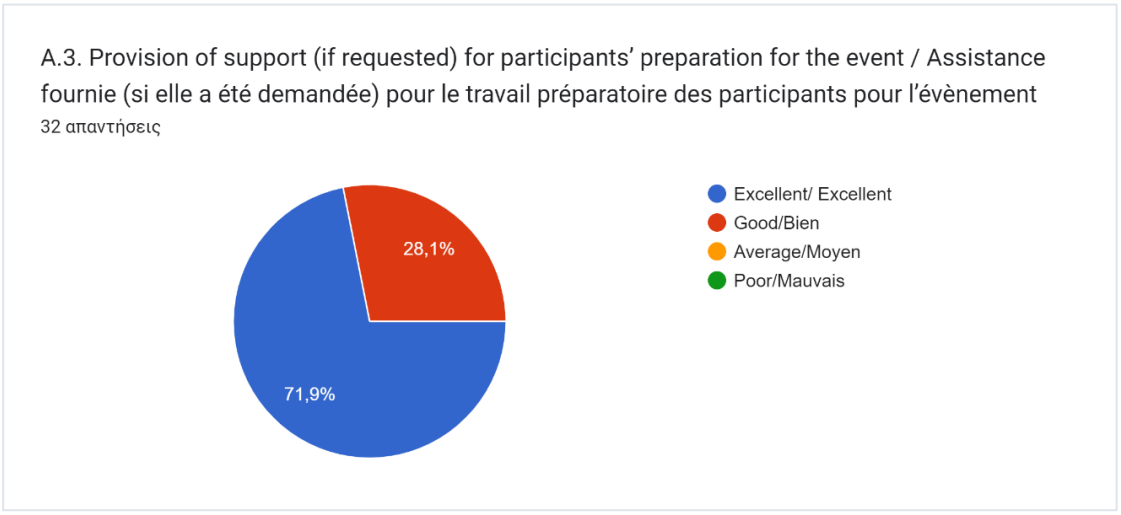


Figure 5-6-4: Follow up (A.4)

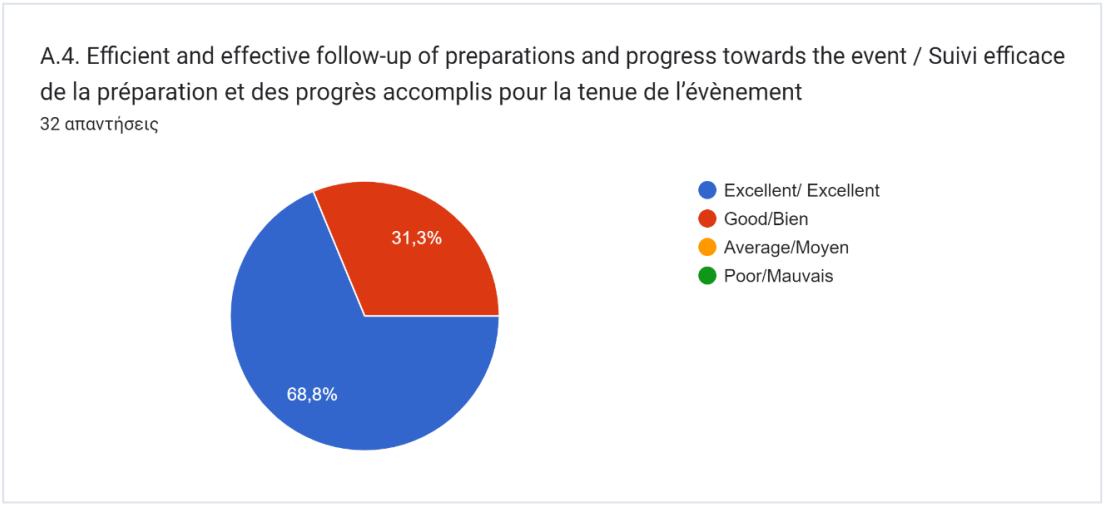


Figure 5-6-5: Planning (A.5)

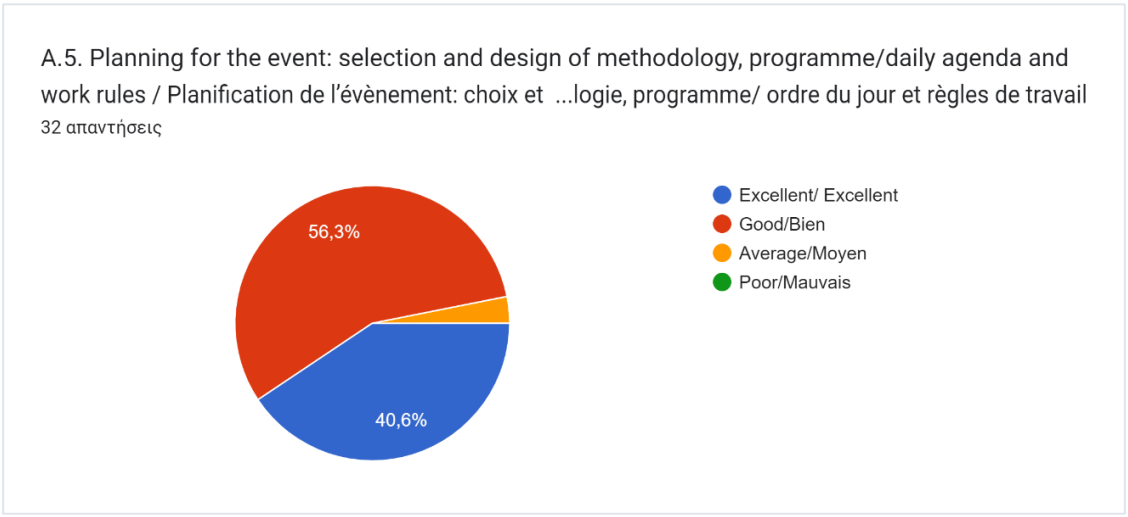


Figure 5-6-6: Flow of programme (A.6)

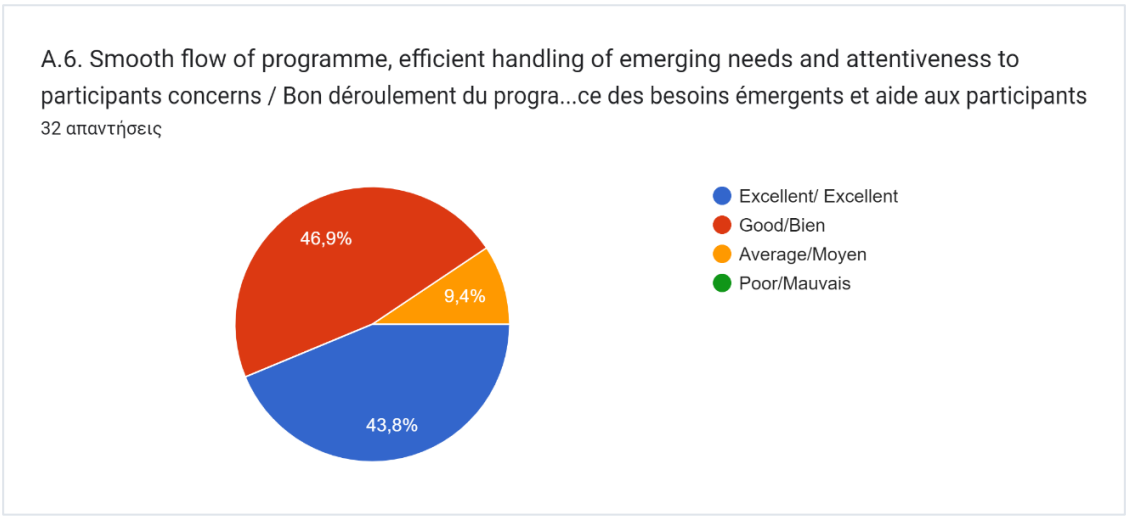


Figure 5-6-7: Evaluation of presentations (A.7)

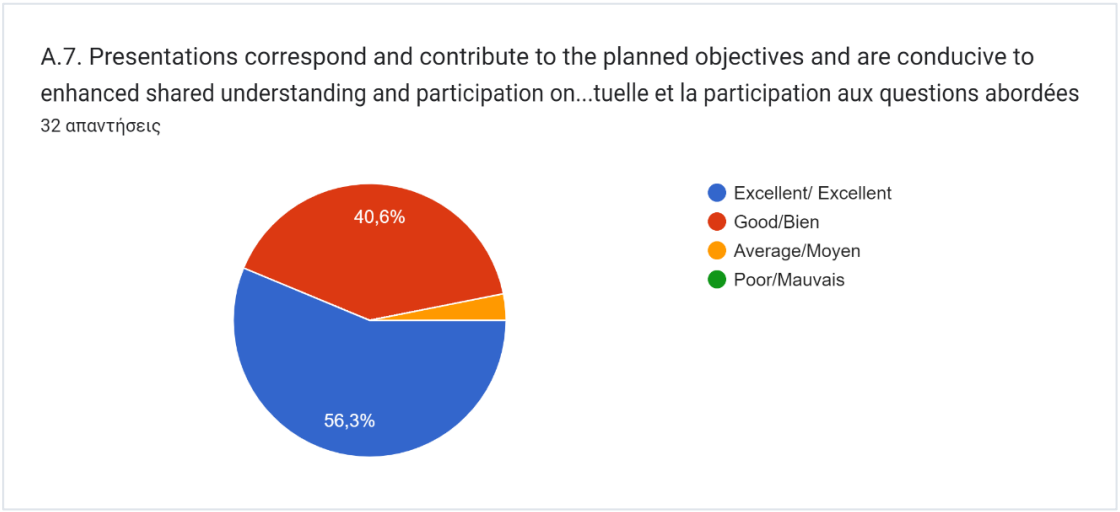


Figure 5-6-8: Clarity (A.8)

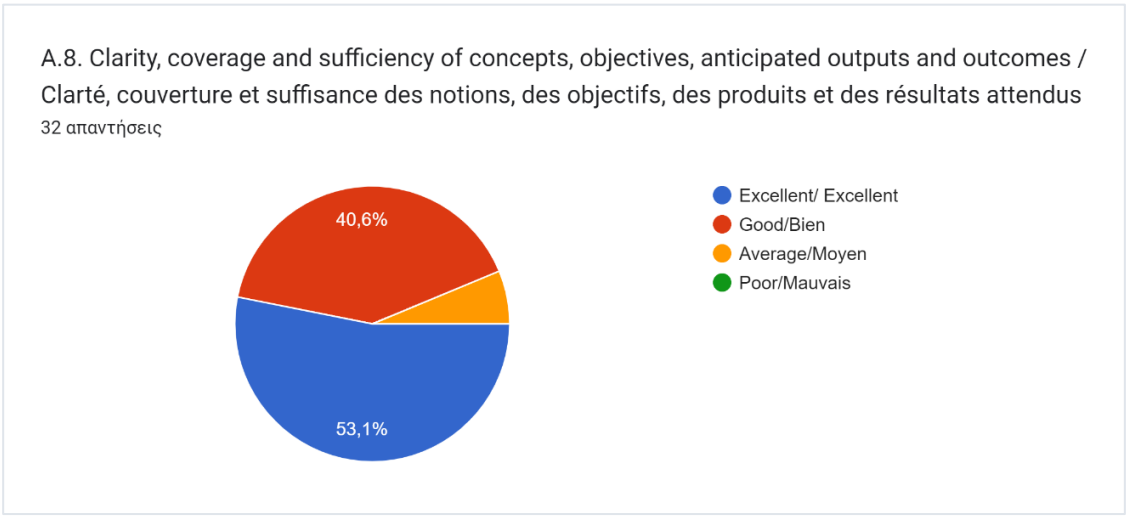


Figure 5-6-9: Usefulness of distributed material (A.9)

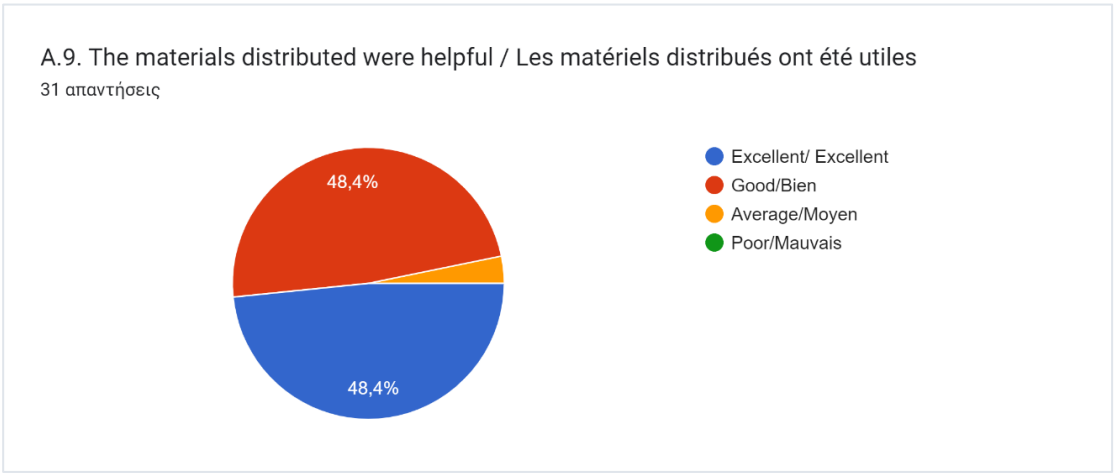


Figure 5-6-10: Efficiency and effectiveness of facilitation (A.10)

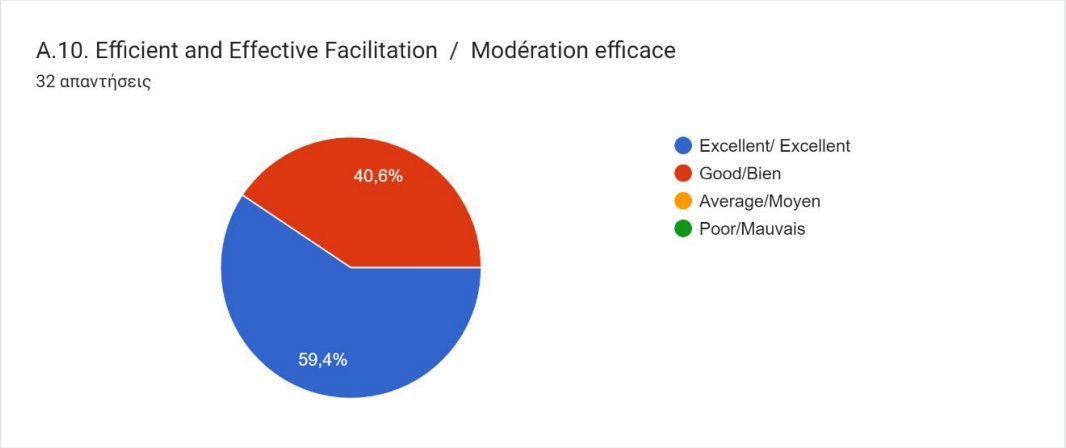
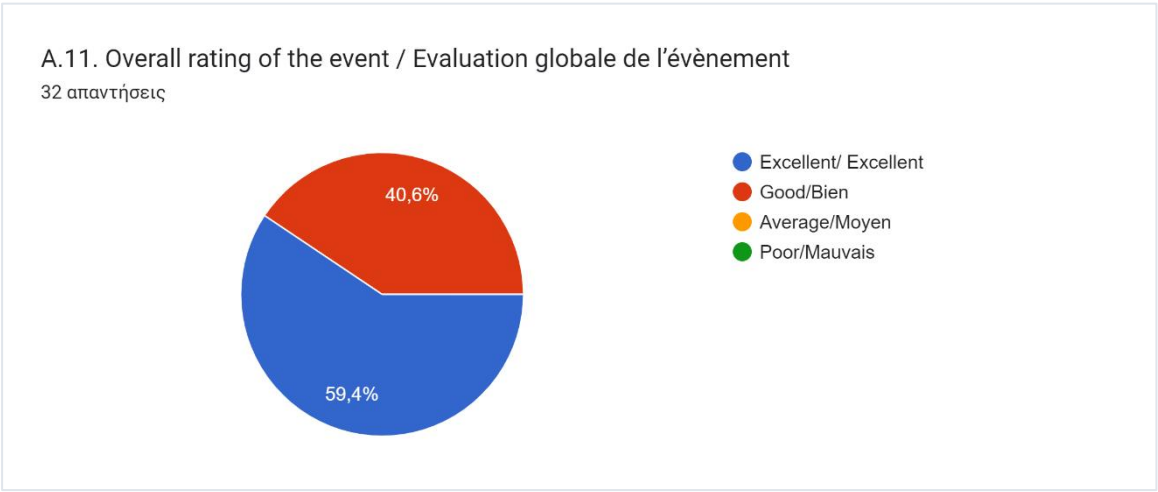


Figure 5-6-11: Overall rating (A.11)



B. Feedback from the participants

TABLE 5-2: FEEDBACK ON TECHNICAL ASPECTS

B. FEEDBACK ON TECHNICAL ASPECTS		No. of replies
B1	**Coverage of the event** **In your opinion did the event cover (tick one of the following):**	
	All the topics necessary for a good comprehension of the subject nothing more	18
	Some topics covered are not necessary	5
	Some additional topics should be included	8
	No reply	1
	Total Replies	**32**
B2	**Level of difficulty**	
	Difficult	0
	Adequate	29
	Elementary	3

	No reply	0
	Total Replies	**32**
B3	**Length of the training** **In your view the workshop duration (tick one of the following):**	
	Longer than needed	2
	Sufficient	21
	Shorter than required	9
	No reply	0
	Total Replies	**32**

Figure 6-12: Coverage of the event (B.1)

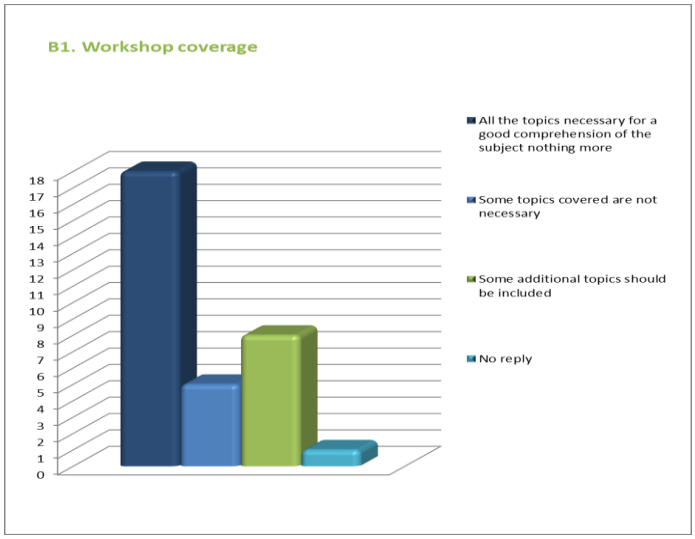


Figure 6-13: Level of difficulty (B.2)

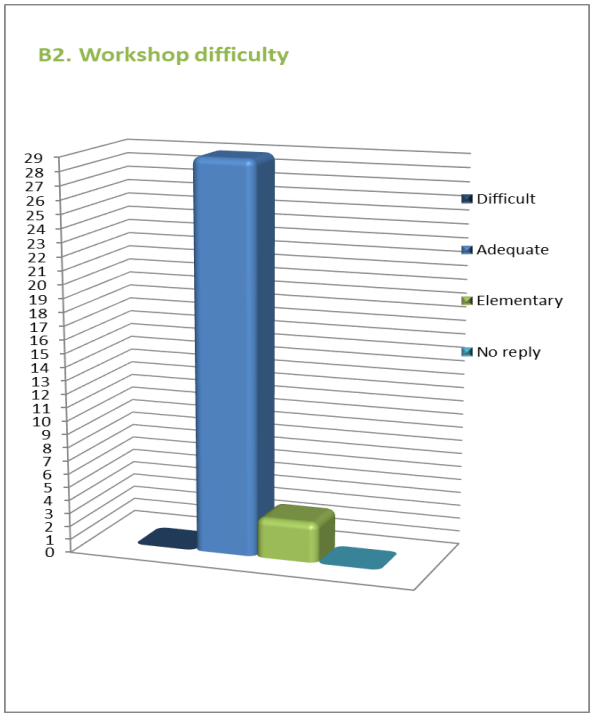
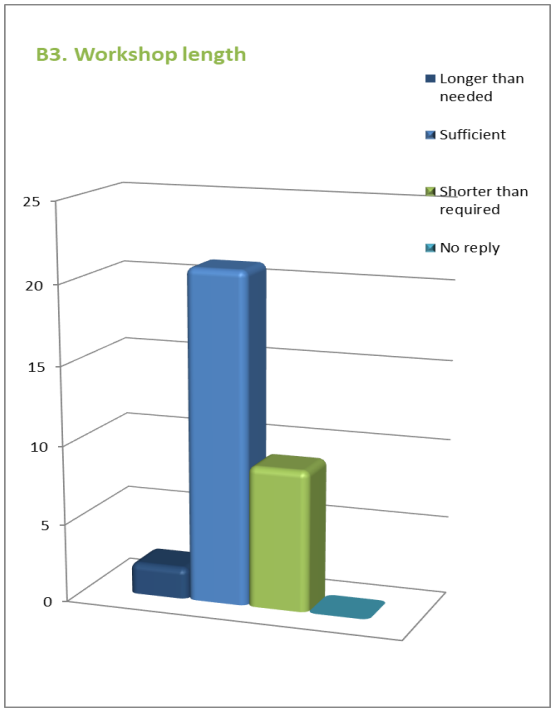


Figure 6-14: Length of the training (B.3)



C. Summary of participants' statements

There was a general agreement that the exchange experience between specialists from various countries in this field was very useful as well as the site visit to EYDAP water company.

Participants expressed most valuable topics were related to:

- Use of DMA, pressures management and water balance
- Importance of non-revenue water management
- Overall action plan and KPIs to deal with Non-Revenue Water
- Different KPIs, strategies, software, and asset management for non-revenue water

Table 6-3: SUMMARY OF MOST FREQUENT STATEMENTS MADE BY THE PARTICIPANTS

Summary of most frequent statements made by the participants	
B4	**What is the most valuable thing you learned during the workshop (knowledge or skills)?**
	• The importance of the division of DMA and pressures management in the system
B5	**How do you think that the current event will assist you in your future work on the subject?**
	• It has helped on assuming knowledge and concepts regarding NRW reduction to be transferred to stakeholders and technical operators
B6	**Please indicate whether (and how) you could transfer part of the experience gained from the event to your colleagues in your country?**
	• By organizing a workshop in the water sector to transfer this valuable example
B7	**What did you like most about this event?**
	• Study tour
B8	**What needs to be improved?**
	• More duration and more field and site visit

D. Remarks by the trainer

A set of nine criteria; B1-B9 (See table 6) are used hereby by the trainer to provide an overall assessment of the event.

TABLE 6-4: REMARKS FROM THE TRAINER

B1	**Efficient and effective performance and interaction by participants** Good interaction between participants
B2	**Efficient and effective cooperation and team spirit** Optimim cooperation between participants during the training
B3	**Level of achievement of planned objectives** Continuous training should be planned to improve knowledge on NRW
B4	**Did the event contribute to helping participants practice skills or gain knowledge related to course concepts** Yes, but more practical case studies would be beneficial
B5	**What worked well during the event** Good communication

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by the European Union

B6	**What didn't work well and why** Long lecture session seemed to make participants tired
B7	**What components/concepts did participants seem to understand well** Importance of DMAs and leakage prevention
B8	**Were there any components/concepts that participants appeared to not understand** N/A
B9	**What aspects of the event could be improved and what to be kept** Allow more time for practical exercise, case studies interactions with water operators that successfully apply NRW technologies in everyday activity

7 ANALYSIS OF THE TRAINING COURSE RESULTS (quiz results)

Changes in awareness, knowledge and skills. New acquired knowledge	Before - Acquainted with the topic before training	After - Acquainted with the topic after training	Before the training		After the training		Improvement
Questions	35	38	Correct replies before the event	Correct %	Correct replies after the event	Correct %	Improvement based on accumulated experience (%)
1. Do you know the various components of the Standard IWA/AWWA Annual Water Balance?	21	37					42
2. Do you have experience with developing a Standard IWA/AWWA Annual Water Balance?	13	29					42
3. Do you know the various Key Performance Indicators (KPIs) that are used for Non-Revenue Water (NRW) management?	19	37					47
4. What Key Performance Indicator(s) do you use besides percentage of System Input Volume (% SIV)?							
5. Do you know the four basic Real Losses control strategies?	14	36					58
6. What Real Losses control strategies do you use in your daily practice?							
7. Do you know the four basic Apparent Losses control strategies?	12	34					58
8. What type of Apparent Losses do you experience in your daily practice?							
9. Do you have experience with implementing District Metered Areas (DMAs)?	25	30					13
10. Why do you use a District Metered Area (DMA)?	5 for monitoring 25 for monitoring and pressure management	4 for monitoring 30 for monitoring and pressure management					
11. What is your experience with a Geographic Information System (GIS)?	20 basic 10 Intermediate 5 Advanced 0 expert	13 basic 15 Intermediate 8 Advanced 1 expert					
12. Do you use a GIS in your daily practice?	19	25					
13. What is your experience with hydraulic modelling of a water supply system?	25 basic 2 Intermediate 7 Advanced 1 expert	11 basic 16 Intermediate 5 Advanced 4 expert					
14. Do you use a hydraulic model of a water supply system in your daily practice?	10	21					
15. Do you have experience with using data from a Supervisory Control and Data Acquisition (SCADA) system?	21	26					
16. Do you have experience with a professional burst registration system?	6	14					
17. What are the four pillars of the Real Losses Control Strategy? Correct answer: a,b,d					15 correct 22 with one mistake 1 not answered	40%	
18. What is the role of spatial data in relation to active leakage detection? Correct answer: b,c					5 correct answers 32 not correct 1 not answered	13%	
19. Why should burst registration be carried out? Correct answer: c					26 correct answers	70%	
20. Why should DMAs be developed? Correct answer: a,b					3 correct answers 35 not correct	7%	
21. Why is NRW not only a technical topic? Correct answer: b,c,d					4 correct 32 incorrect 2 not answered	10%	
22. What is included in EYDAP's NRW Action Plan? Correct answer: a,b,c					21 correct 17 incorrect	55%	
17. What is the level of experience of your organisation with Pressure Managed Zones (PMZs) and District Metered Areas?							
18. What is the level of experience of your organisation zith Asset Management according to ISO 55001 Asset Management?							
19. Does your organisation have a recent (less than three years old) and specific NRW reduction program?	27						
20. Does your organisation have an exclusive formal position of NRW redcution coordinator/manager?	19						

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 CONCLUSIONS

The regional training and study tour provided knowledge and insights to the participants on the following topics:

- Understanding of NRW, its quantification and benefits of NRW management.
- Tools, techniques for NRW reduction and KPIs for performance tracking.
- The use of spatial and temporal data, in particular GIS for NRW management, as well as hydraulic modelling.
- Establishment of Pressure Managed Zones and District Metered Areas.
- Minimum Night Flow analysis.
- Practical examples and best practice from different European countries, including on-site example during the technical visit at EYDAP with successful outcomes in NRW management.
- Case studies from the Southern-Mediterranean region, presented by PC representatives.

The training provided an opportunity to exchange experiences and knowledge on NRW among 39 participants from nine countries. Training modules included a wide variety of demonstrations, along with examples and case studies presented by the speakers and participants from the Partner Countries, as well as roundtable discussions and group exercises.

Following this training, the Peer-To-Peer exchange will be a key activity to ensure knowledge diffusion throughout participating countries, and to produce tangible outputs from training learnings.

8.2 RECOMMENDATIONS

Based on lessons learnt from the training programme, the following recommendations can be made to strengthen capacities for effective NRW in the South Mediterranean:

- The Peer-to-Peer (P2P) exchange activity should focus on the topics that are deemed most relevant by participants from partner countries.
- P2P working groups should aim to produce tangible and impactful outputs that can inform decision-making for NRW in the South Mediterranean.
- An online platform for information and knowledge sharing among training participants and P2P peers should be created and maintained.
- Case studies are highly valuable, and even more when some thinking is made to see how they can be adapted to another context.

9 ANNEXES

9.1 LIST OF DELIVERABLES

Key deliverables
Project management deliverables
Concept Note Regional training and study tour on Non-Revenue Water Management
Pre-training questionnaire EN
Post-training questionnaire EN
Activity Report on Training and Study Tour NRW in Athens EN (this document)
Various relevant material related to the training
TD1 - NRW Definitions and tools
Agenda Classroom training day 1
Slide deck classroom training day 1 EN to be presented
Slide deck classroom training day 1 EN as presented
TD2 - NRW Reduction interventions
Agenda Classroom training day 2
Slide deck classroom training day 2 EN to be presented
Slide deck classroom training day 2 EN as presented
ST/TD3 – Technical visit at EYDAP Athens
Agenda day 3 Study Tour EYDAP
Presentation *Water Losses Management - NRW* by Mr. Papadakis Konstantinos (EYDAP S.A.)
Presentation *NRW Action Plan* by Mr. Koutsoumplis Leonidas (EYDAP S.A.)
TD4 - NRW Data Management
Agenda Classroom training day 4
Slide deck classroom training day 4 EN to be presented
Slide deck classroom training day 4 EN as presented
TD5 - NRW Asset management
Agenda Classroom training day 5
Slide deck classroom training day 5 EN to be presented
Slide deck classroom training day 5 EN as presented

Each of these deliverables has been submitted to WES in English language. The slide decks are submitted to WES as Pdf documents.

9.2 AGENDA

Training day 1: 16 January 2023

08:30-09:00	**Registration and access to the room ERECHTHION of the hotel**
09:00-09:35	Welcome, opening and introduction WES *Prof. Michael Scoullos, Team Leader, WES* *Mr. Cor Merks, Non-Key Expert, Ramboll*
09:35-10:05	Short personal introduction participants *Facilitated by Ms. Andreea Florea, Young Water Professional, Ramboll*
10:05-10:15	Pre-training knowledge and experience questionnaire (quiz) *Introduction and explanation by Mrs Andreaa Florea and Mr. Cor Merks*
10:15-10:30	**Short break including time to finalise filling out the pre-training questionnaire**
10:30-11:30	Standard IWA/AWWA Annual Water Balance *Mr. Cor Merks* *Mr. Andrei Cristea, NKE, Ramboll*
11:30-12:00	Plenary round table on existing experience with the Annual Water Balance *One participant per country* *Facilitated by Ms. Andreea Florea and Mr. Cor Merks*
12:00-13:00	**Lunch break**
13:00-13:30	Demonstration example Water Audit Software *Mr. Cor Merks*
13:30-14:00	Relevant Key Performance Indicators (KPIs) for NRW management *Mr. Cor Merks*
14:00-14:15	Plenary exercise on KPI calculation and interpretation *Introduction by Mr. Cor Merks* *Facilitated by Ms. Andreea Florea and Mr. Andrei Cristea*
14:15-14:30	**Short break**
14:30-15:15	Decision making on the most appropriate NRW interventions (Case study ApaVital Iași) *Mr. Andrei Cristea and Mr. Cor Merks* *Questions & Answers facilitated by Ms. Andreea Florea*
15:15-15:50	IT tools for data collection and performance monitoring *Mr. Cor Merks and Mr. Andrei Cristea* *Questions & Answers and Discussion facilitated by Mr. Cor Merks*
15:50-16:00	**Agenda for tomorrow and closure of the training day**

Training day 2: 17 January 2023

08:45-09:00	**Access to the room ERECHTHION of the Divani Palace Acropolis Athens hotel**
09:00-10:00	**Four basic Real Losses control strategies** *Mr. Cor Merks*
10:00-10:15	**Implementation of pressure management (Case study Vitens part 1)** *Mr. Cor Merks*
10:15-10:30	**Short break**
10:30-10:45	**Implementation of active leak detection (Case study Vitens part 2)** *Mr. Cor Merks*
10:45-11:30	**Four basic Apparent Losses control strategies** *Mr. Cor Merks*
11:30-12:00	**Plenary round table on Unbilled Authorised Consumption and Apparent Losses** *All participants are invited to share their expertise and experience* *Facilitated by Ms. Andreea Florea and Mr. Andrei Cristea*
12:00-13:00	**Lunch break**
13:00-14:00	**Breakout session on opportunities to implement basic control strategies** *At least two of the following four basic control strategies should be discussed and reported:* • *Pressure management.* • *Active leak detection.* • *Customer metering inaccuracies.* • *Unauthorised consumption.* *Facilitated by Ms. Andreea Florea, Mr. Andrei Cristea and Mr. Cor Merks* *Take about 15-20 minutes to discuss the opportunities to implement a basic control strategy in the region. Use the last 10 minutes to prepare the presentation of highlights*
14:00-14:15	**Plenary presentation of the highlights of the discussion during the breakout session** *One volunteer-presenter per discussion group* *Facilitated by Ms. Andreea Florea*
14:15-14:30	**Short break**
14:30-15:15	**Importance of accurate production and customer flow metering** *Mr. Cor Merks* *Questions & Answers facilitated by Ms. Andreea Florea*
15:15-15:45	**Basic and advanced pressure management methods** *Mr. Cor Merks* *Questions & Answers and Discussion facilitated by Mr. Andrei Cristea*
15:45-16:00	**Short quiz on today's topics and closure of the training day** *Quiz facilitated by Ms. Andreea*

Training day 3: 19 January 2023

08:45-09:00	**ACCESS TO THE ROOM ERECHTHION OF THE DIVANI PALACE ACROPOLIS ATHENS HOTEL**
09:00-10:00	**Application of GIS for NRW data management** *Mr. Andrei Cristea and Ms. Andreea Florea*
10:00-10:15	**Spatial systems development and application in NRW management (Case study Compania de Apă Someș Cluj-Napoca and Apa Nova București)** *Mr. Andrei Cristea*
10:15-10:30	Short break
10:30-11:15	**Application of hydraulic modelling for NRW data management** *Mr. Andrei Cristea*
11:15-11:30	**Additional information sources working together with spatial data** *Mr. Andrei Cristea*
11:30-12:00	**Exercises on using simulation results for decision making on NRW interventions** *Demonstration by Mr. Andrei Cristea* *Questions & Answers and Discussion facilitated by Ms. Andreea Florea*
12:00-13:00	**Lunch break**
13:00-14:00	**Breakout session on data acquisition and representation levels related to water operators in the South-Mediterranean region** *Please discuss the following three topics:* • *Data gathering opportunities – SCADA system, customer interaction apps, etc.* • *Choosing the right data representation levels.* • *Common data transfer and workflows impacting NRW management decisions.* *Facilitated by Ms. Andreea Florea, Mr. Andrei Cristea and Mr. Cor Merks* *Take about 15-20 minutes to discuss each topic and to share your experience with the other participants.* *Use the last 10 minutes to prepare the presentation of highlights*
14:00-14:15	**Plenary presentation of the highlights of the discussion during the breakout session** *One volunteer-presenter per discussion group* *Facilitated by Ms. Andreea Florea*
14:15-14:30	**Short break**
14:30-15:00	**Importance of accurate burst registration** *Mr. Cor Merks* *Questions & Answers facilitated by Ms. Andreea Florea and Mr. Andrei Cristea*
15:00-15:45	**Experience with GIS and hydraulic modelling in the South-Mediterranean region** *Case study presentation by one of the participants from Algeria or Egypt* *Questions & Answers and Discussion facilitated by Mr. Andrei Cristea*
15:45-16:00	**Short quiz on today's topics and closure of the training day** *Quiz facilitated by Ms. Andreea Florea*

Training day 4: 20 January 2023

08:45-09:00	**ACCESS TO THE ROOM ERECHTHION OF THE DIVANI PALACE ACROPOLIS ATHENS HOTEL**
09:00-10:00	**Establishment of Pressure Managed Zones (PMZs) and District Metered Areas (DMAs)** *Mr. Cor Merks and Mr. Andrei Cristea*
10:00-10:15	**Examples of implementation of DMAs by various water operators worldwide** *Mr. Cor Merks*
10:15-10:30	**Short break**
10:30-11:15	**DMA data monitoring including Minimum Night Flow (MNF) analysis** *Mr. Cor Merks and Mr. Andrei Cristea*
11:15-12:00	**Development of an operator-specific NRW reduction program** *Mr. Cor Merks and Mr. Andrei Cristea*
12:00-13:00	**Lunch break**
13:00-14:00	**Breakout session on development of an operator-specific NRW reduction program** *Discuss the priorities for each of the basic control strategies in a NRW reduction program in the South-Mediterranean region:* • *Pressure management – basic or advanced?* • *Active leak detection – DMAs, virtual sectorisation, satellite leak localisation, or …?* • *Improvement of speed and quality of repairs – how?* • *Asset management – repair or replace?* • *Improvement customer metering accuracy – meter management?* • *Reduce unauthorised consumption – what focus and how?* • *Improve data collection and transmittance – customer accountability?* • *Improve data processing – how to ensure correct data for billing and for developing the standard (annual) water balance?* *Facilitated by Ms. Andreea Florea, Mr. Andrei Cristea and Mr. Cor Merks* *Use the last 10 minutes to prepare the presentation of the priority with highlights*
14:00-14:15	**Plenary presentation of the highlights of the discussion during the breakout session** *One volunteer-presenter per discussion group* *Facilitated by Ms. Andreea Florea*
14:15-14:30	**Short break**
14:30-15:10	**Introduction to asset management** *Mr. Cor Merks* *Questions & Answers and Discussion facilitated by Ms. Andreea Florea*
15:10-15:40	**Non-technical aspects of asset management and NRW reduction management** *Mr. Cor Merks* *Questions & Answers and Discussion facilitated by Mr. Andrei Cristea*
15:40-15:55	**Post-training knowledge and experience questionnaire (quiz)** *Introduction and explanation by Mrs Andreaa Florea and Mr. Cor Merks*
15:55-16:00	**CLOSURE OF THE TRAINING**

9.3 QUIZ FORMS

Post-training knowledge and experience questionnaire (quiz)

Training Title	Regional training and study tour on Non-Revenue Water management
Date	January 16-20, 2023; this quiz is for January 20, 2023
Venue Location	Divani Palace Acropolis Athens hotel, Greece
Participant Name	
Participant Title/Position	
Participant Country	
INSTRUCTIONS: **Please respond to the questions below by choosing one reply only per question unless specifically asked.** Your feedback is sincerely appreciated. Thank you.	

1. Do you know the various components of the Standard IWA/AWWA Annual Water Balance?

☐ No
☐ Yes

2. Do you have experience with developing a Standard IWA/AWWA Annual Water Balance?

☐ No
☐ Yes

3. Do you know the various Key Performance Indicators (KPIs) that are used for Non-Revenue Water (NRW) management?

☐ No
☐ Yes

4. What Key Performance Indicator(s) do you use besides percentage of System Input Volume (% SIV)?
Please choose all valid KPIs

☐ Litres per billed property
☐ Litres per service connection
☐ m^3 per kilometre of mains
☐ Minimum Night Flow
☐ Percentage of Water Supplied
☐ Infrastructure Leakage Index (ILI)
☐ Volume per year

5. Do you know the four basic Real Losses control strategies?

☐ No
☐ Yes

6. What Real Losses control strategies do you use in your daily practice?
Please choose all valid control strategies

☐ Active leak detection
☐ Asset management
☐ Pressure management
☐ Speed and quality of repairs improvement

7. Do you know the four basic Apparent Losses control strategies?

☐ No
☐ Yes

8. What type of Apparent Losses do you experience in your daily practice?
Please choose all valid types of apparent losses

☐ Customer metering inaccuracies
☐ Data collection and transmittance problems
☐ Illegal connections
☐ Meter bypass and other fraud
☐ Unbilled unmetered free drinking water
☐ Unbilled unmetered network flushing

9. Do you have experience with implementing District Metered Areas (DMAs)?

☐ No
☐ Yes

10. Why do you use a District Metered Area (DMA)?

☐ Flow monitoring only
☐ Flow monitoring and pressure management

11. What is your experience with a Geographic Information System (GIS)?

☐ Basic
☐ Intermediate
☐ Advanced
☐ Expert

12. Do you use a GIS in your daily practice?

☐ No
☐ Yes

13. What is your experience with hydraulic modelling of a water supply system?

☐ Basic
☐ Intermediate
☐ Advanced
☐ Expert

14. Do you use a hydraulic model of a water supply system in your daily practice?

☐ No
☐ Yes

15. Do you have experience with using data from a Supervisory Control and Data Acquisition (SCADA) system?

☐ No
☐ Yes

16. Do you have experience with a professional burst registration system?

☐ No
☐ Yes

17. What are the four pillars of the Real Losses Control Strategy?
Please choose all valid types of answers
☐ Active Leak Detection
☐ Asset Management
☐ Consequence of failure
☐ Pressure management

18. What is the role of spatial data in relation to active leakage detection?
Please choose all valid types of answers
☐ The need to balance cost
☐ The need to locate the asset
☐ The need to locate the leak
☐ The need to prioritize intervention

19. Why should burst registration be carried out?
Please choose all valid types of answers
☐ To analyse the consequence of failure
☐ To analyse the likelihood of failure
☐ Both

20. Why should DMAs be developed?
Please choose all valid types of answers
☐ To facilitate pressure management
☐ To improve active leak detection
☐ To improve speed and quality of repairs
☐ To limit consequence of failure for connected customers

21. Why is NRW not only a technical topic?
Please choose all valid types of answers
☐ Because politicians are influenced by the media
☐ Because of its spatial component
☐ Because it aims to battle water scarcity
☐ Because it requires organizational reform

22. What is included in EYDAP's NRW Action Plan?
Please choose all valid types of answers
☐ Active Leak Detection
☐ Meter management
☐ Pressure management
☐ Source control

THANK YOU!

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