Co-funded by the European Union

Hydroponic Vertical Farming:

Developing VET for addressing vertical hydroponic farming skill needs

Hydro-Farm-VET

R.2.3:
Hellenic National report
(QUESTIONNAIRES- INTERVIEWS)

Tables of Figures

Tables of Tables

1. Hellenic National report

1.1 Brief Review

This national report is part of outcome R_2.3 “Five(5) National Reports as needs assessment to determine the gap or discrepancy between the present state and the desired state in the hydroponic field”.

The data presented in the report consists of two main activities:

A. collection of information through questionnaires
B. collection of information through Key Informant Interviews with 3 agricultural specialists per country

Below is the analysis of data collected from the questionnaires distributed and the conducted interviews to develop the R_2.3 “Five(5) National Reports as needs assessment to determine the gap or discrepancy between the present state and the desired state in the hydroponic field”.

Content

This report will present the results of questionnaire responses and interviews conducted with key informants in the field of hydroponics and vertical hydroponics.

Section 1.2 presents the results of the data from the questionnaires and in section 1.3 the information in aggregate from the key informant interviews.

1.2 Presentation and analysis of questionnaires

This section reports the analysis of 15 questionnaire responses collected between mid-June and mid-July 2023, in Greece.

Questionnaires were sent out to selected stakeholders via the online platform Google Forms. The objective was to collect information about the country's hydroponic situation and assess skill gaps and training needs in vertical hydroponic agriculture.

Questionnaire

The questionnaire consists of six main sections:

1. Section_1, information on data collection and processing
2. Section_2, type of participant

3. Section_3, about the respondents' experience with hydroponic and vertical hydroponic farming (e.g. whether they have hydroponics systems, the size of their systems, whether they have attended courses in this field, etc.)
4. Section_4, with regard to their training needs in the areas of technological and agronomic knowledge.
5. Section_5 with regard to their training needs in the area of management knowledge
6. Section_6, for any comments on the questionnaire

Presentations of the results

Data presentation and results

Type of participant	Frequency	Percent [%]
Farmers	3	20
Hydroponic technology producers (e.g. LED, equipment, etc.)	1	7
Research (Researcher)	7	47
Consultants	3	20
Public Institutions	1	7
Total	*15*	100

Table 1: Type of participant

In table 1, we show the data of the participants to the questionnaires by frequency and percentage.

In figure 1, a graphic representation of data in table 1 is presented. As we can see from the graph in Figure 1, 20% of the respondents are farmers, 7% Hydroponic technology producers, 40% Researchers, 20% Consultants, and 1% Public Institutions.

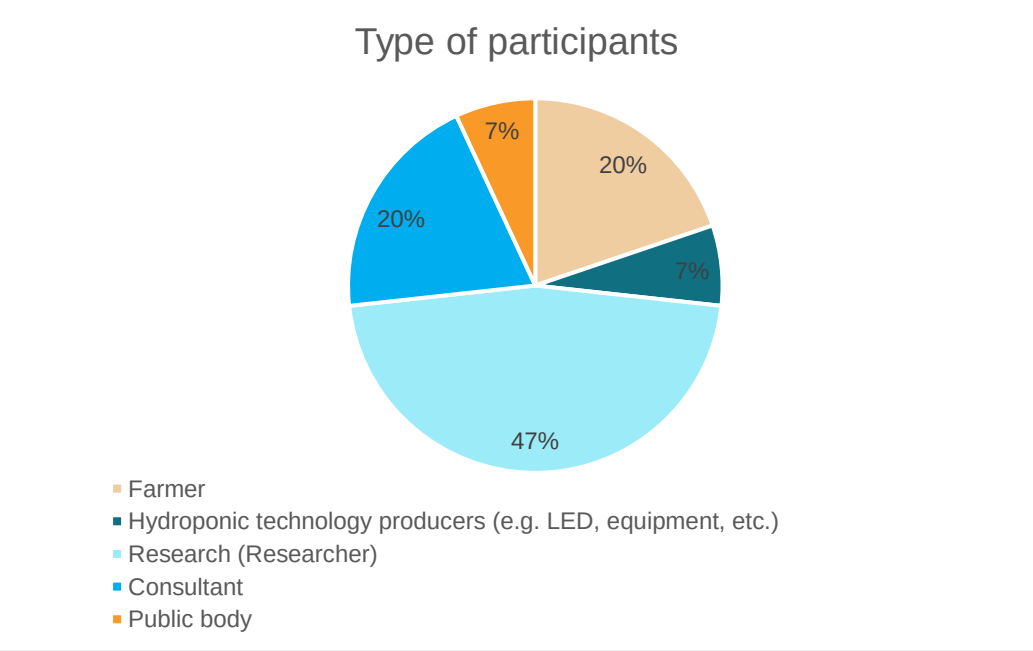


Figure 1: Type of participants

European Knowledge Spot (EKS) and iAgroCert contributed to the distribution of questionnaires and EKS proceeded with the analysis of data.

Among others the questionnaire link had been sent to twelve (12) hydroponic companies and various related social media groups.

In table 2, we see the spread of the use of hydroponics technologies among the respondents

Use of hydroponics technology	Yes	No	Tot
I am already using hydroponics	40%	60%	100%
I am already using vertical hydroponics	27%	73%	100%

Table 2: Use of hydroponics technology

60% of the respondents answered that they are not using Hydroponics while 40% answered that they are already using this kind of cultivation technique.

73% of the respondents answered that they are not using Vertical Hydroponics while 27% answered that they are already using this kind of cultivation.

Table 3 shows the answers concerning the respondents' experience with hydroponics.

Specify your experience with hydroponics from 0 (none) to 5 (high experience)	Frequency	Percent [%]
0	3	20
1	3	20
2	2	13
3	5	33
4	1	7
5	1	7
total	*15*	*100*

Table 3: Specify you experience with hydroponics from (0) to 5 (high experience)

As we can see from table 3, 7% had excellent experience with Hydroponics (5 from a scale 0 to 5), 7% had a very good experience with Hydroponics (4 from scale 0 to 5), 33% had good experience with hydroponics (3 from scale 0 to 5), 13 had intermediate experience with hydroponics (2 from scale 0 to 5), 20 % had entry level of experience with hydroponics (1 from scale 0 to 5),20 % had not at all experience with hydroponics (0 from scale 0 to 5).

Specify your experience with hydroponics from 0 (none) to 5 (high experience)	Value
Average	2,07
Standard Deviation	1,48

Table 4: Specify your experience with hydroponics from 0 (none) to 5 (high experience) - Average and Standard Deviation

With regard to the hydroponic farming that the respondents possess in m^2, five (5) respondents seem to possess farms as follows:

- 5.000 / 16.000 acres
- 6000 m^2
- 8 m^2
- 15000 m^2
- 150 m^2

With regard to the dimension of vertical hydroponic crops two (2) respondents mentioned that they possess the following crops in m^2:

- 6000 m^2

- 250 m^2

With regard to the dimension of the farm in ha two (2) respondents mentioned the following dimension of the farm in ha

- 6000 ha
- 250 ha

Table 5, on the other hand, describes the percentage of respondents who have attended courses in hydroponics or vertical hydroponics farming.

Courses	Yes	No	Tot
Did you attend courses on hydroponics?	53%	47%	100%
Did you attend courses on vertical hydroponics?	47%	53%	100%

Table 5: Attendance of courses on hydroponics

With regard to the attendance of Hydroponic courses 8 respondents answered that they have attended Hydroponic courses for 53% of the total and 7 that they did not attend for 47% of the total.

With regard to the attendance of Vertical Hydroponic courses 7 respondents answered that they have attended Vertical Hydroponic courses for the 47% of the total and 8 that they did not attend for the 53% of the total.

In qualitative terms, we also gathered information on the main products. The main products, respondents produce are mentioned below:

- Research
- equipment - services
- Tomato, cucumber
- I do not have
- cut peppers alagro
- Production
- Hydroponic Tomato - Tomatini
- Grapes
- Avocados
- Peaches

The participants came from the following regions

- 3 from Attica region
- 1 from Central Greece
- 5 from Central Macedonia
- 1 from the Ionian Island of Lefkada
- 1 from Crete
- 2 from Western Greece
- 1 from East Macedonia and Thrace.

The last parts of the questionnaire concerned the determination of knowledge needs in different areas concerning hydroponics agriculture and vertical hydroponics farming. In particular, three main areas were considered, technological knowledge, agronomic knowledge and management knowledge. Asking in all three areas to indicate a value, from 1 (minimum) to 5 (maximum), of the training needs related to the listed items.

Table 6 shows the scores indicated by the respondents concerning training needs in the area of technological knowledge.

Technological knowledge			
Give a value, from 1 (**minimum**) to 5 (**maximum**) of the **training needs regarding**:			
General knowledge of hydroponics technologies		Frequency	Percent [%]
	1	3	20
	2	3	20
	3	5	33
	4	1	7
	5	3	20
total		15	100
General knowledge of LED lights and energy efficiency		Frequency	Percent [%]
	1	2	13
	2	5	33
	3	5	33

4	3	20
5	0	0
total	15	100
Hydraulic functioning and management	Frequency	Percent [%]
1	4	27
2	5	33
3	3	20
4	2	13
5	1	7
total	15	100
System automation	Frequency	Percent [%]
1	3	20
2	3	20
3	2	13
4	5	33
5	2	13
total	15	100

Table 6: Technological Knowledge

Table 7 shows the value of the average and standard deviation associated to each area, as we can see with regard to the training needs on technological knowledge almost all the topics were ranging as an average score between 2,4 to 3 with the **System automation** having the maximum score and the hydraulic function the minimum score.
See below:

Technological Knowledge	**General knowledge of hydroponics technologies**	**General knowledge of LED lights and energy efficiency**	**Hydraulic functioning and management**	**System automation**
Average	2,87	2,60	2,40	3,00
Standard Deviation	1,36	0,95	1,20	1,37

Table 7: Technological Knowledge - synthesis

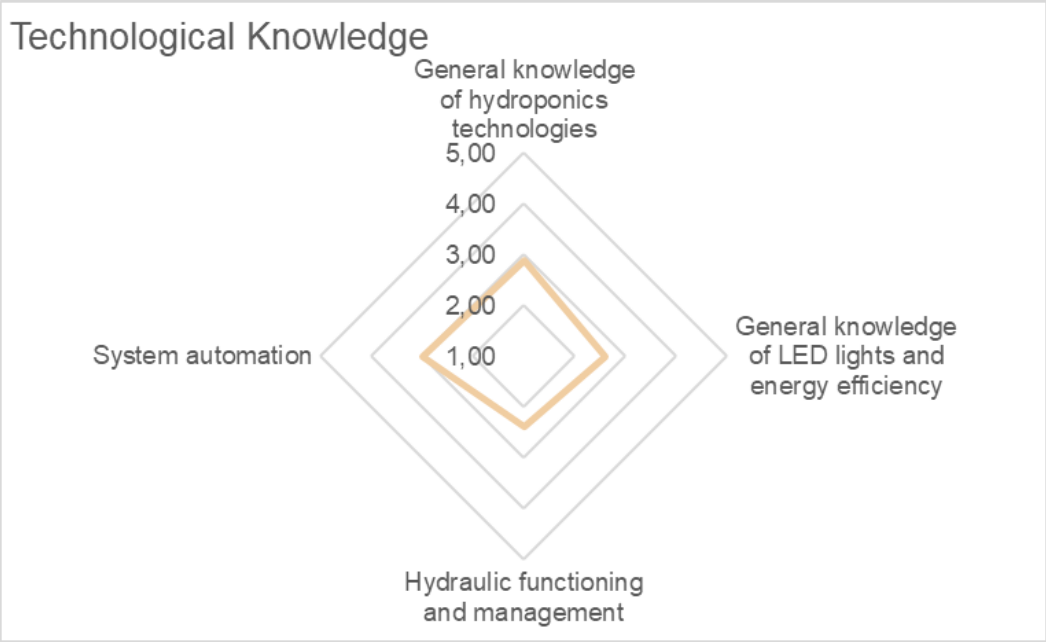


Figure 2: Technological Knowledge

In Figure 2, we can see the graphic representation of the values reported in table 7.

Table 8 illustrates the frequency and the relative percentage indicated by the respondents concerning training needs in the area of agronomic knowledge.

Agronomic knowledge		
Give a value, from 1 (**minimum**) to 5 (**maximum**) of the **training needs regarding:**		
Substrata to be utilized	Frequency	Percent [%]
1	3	20
2	2	13
3	4	27
4	5	33
5	1	7
total	15	100
Composition of the nutritive solution	Frequency	Percent [%]
1	4	27
2	2	13
3	4	27
4	2	13

5	3	20
total	15	100
Integration of minerals	Frequency	Percent [%]
1	5	33
2	3	20
3	4	27
4	2	13
5	1	7
total	15	100
Crop types	Frequency	Percent [%]
1	2	13
2	2	13
3	7	47
4	2	13
5	2	13
total	15	100
Pathogens, fungi, and parasites of soilless crops. Diagnostic elements	Frequency	Percent [%]
1	1	7
2	3	20
3	5	33
4	3	20
5	3	20
total	15	100
Pathogens, fungi, and parasites of soilless crops. Defense strategies	Frequency	Percent [%]
1	2	13
2	1	7
3	6	40
4	3	20
5	3	20
total	15	100

Table 8: Agronomic Knowledge

Table 9 shows the value of the average and standard deviation associated to each area, as we can see with regard to the training needs on agronomic knowledge almost all topics were ranging as an average score between 2,4 to 3,26 with the thematic of **Pathogens, fungi, and parasites of soilless crops. Diagnostic elements** gaining the maximum score and the integration of minerals the minimum score. See below:

Agronomic knowledge	**Substrata to be utilised**	**Composition of the nutritive solution**	**Integration of minerals**
Average	2,93	2,87	2,40
Standard Deviation	1,24	1,45	1,25
Agronomic knowledge	**Crop types**	**Pathogens, fungi, and parasites of soilless crops. Diagnostic elements**	**Pathogens, fungi, and parasites of soilless crops. Defence strategies**
Average	3,00	3,27	3,27
Standard Deviation	1,15	1,18	1,24

Table 9: Agronomic knowledge - Synthesis

In Figure 3, we can see the graphic representation of the values reported in table 9.

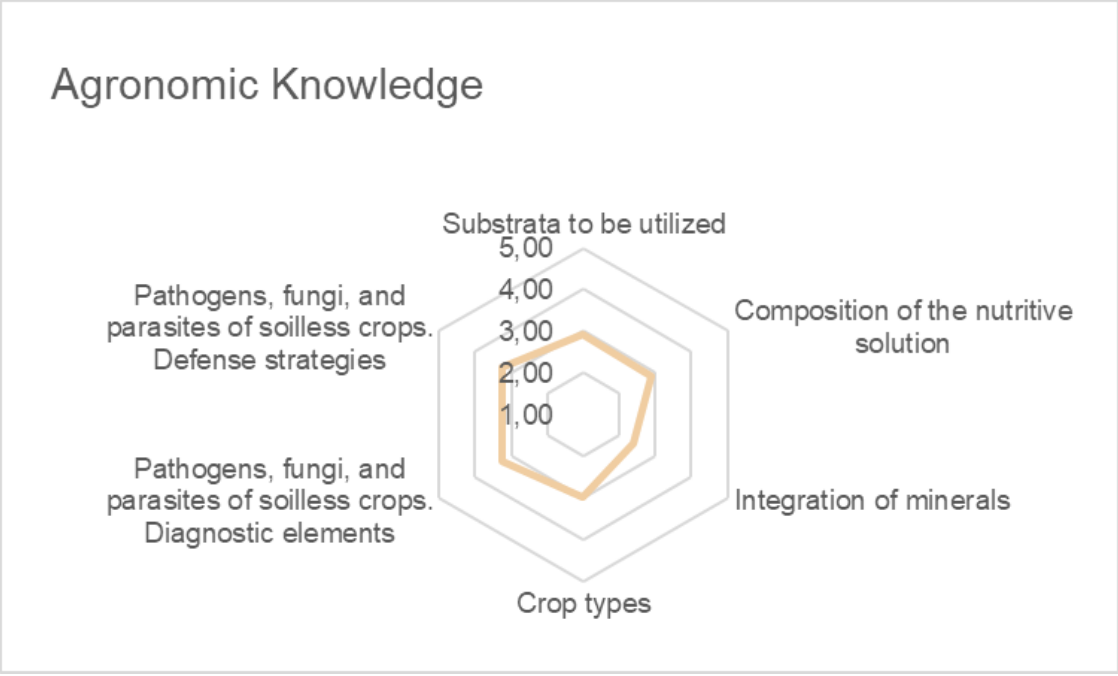


Table 10 illustrates the frequency and the relative percentage indicated by the respondents concerning training needs in the area of Management knowledge.

Management knowledge		
Give a value, from 1 (minimum) to 5 (maximum) of the **training needs regarding**:		
Cost analysis and business planning	Frequency	Percent [%]
1	1	7
2	2	13
3	5	33
4	3	20
5	4	27
total	15	100
Funding opportunities	Frequency	Percent [%]
1	0	0
2	3	20
3	5	33
4	4	27
5	3	20
total	15	100
Communication and visibility	Frequency	Percent [%]
1	1	7
2	2	13
3	6	40
4	2	13
5	4	27
total	15	100
Access to market	Frequency	Percent [%]
1	2	13
2	1	7
3	3	20
4	3	20
5	6	40

total	15	100

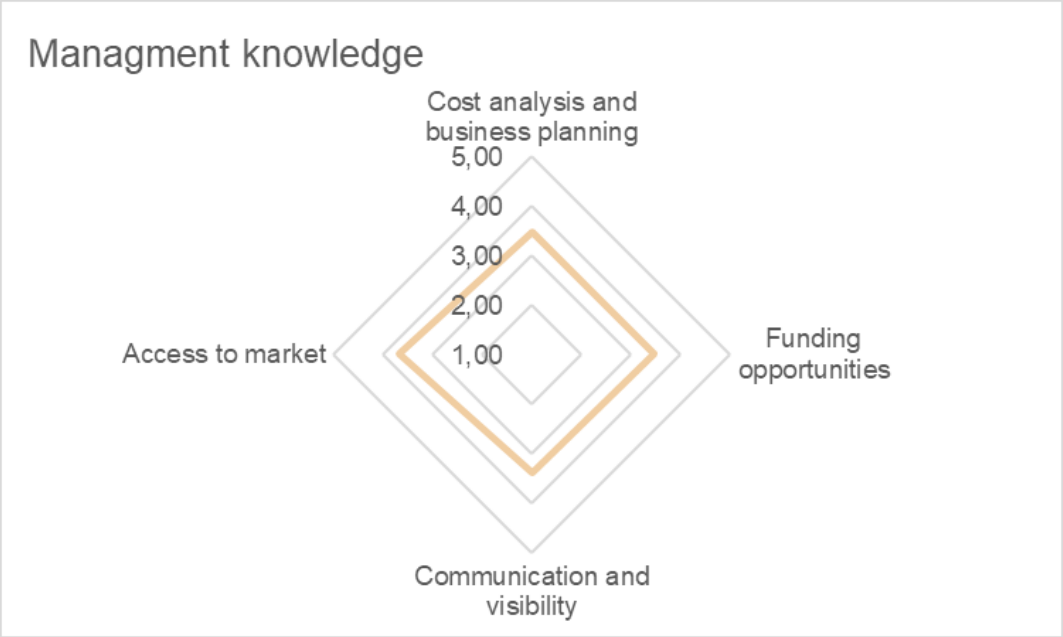
Table 10: Management Knowledge

Table 9 shows the value of the average and standard deviation associated to each area, as we can see with regard to the training needs on Management knowledge almost all topics were ranging as an average score between 3,40 to 3,67 with the thematic of **Access to market** gaining the maximum score and the communication and visibility the minimum score.
See below:

Management knowledge	**Cost analysis and business planning**	**Funding opportunities**	**Communication and visibility**	**Access to market**
Average	3,47	3,47	3,40	3,67
Standard Deviation	1,20	1,02	1,20	1,40

Table 11: Management knowledge - synthesis

In Figure 4, we can see the graphic representation of the values reported in table 11.



1.3 Presentation and analysis of key Informant Interviews with 3 agricultural specialists per country

Key informant interviews were conducted with 3 experts in the field of hydroponics.

The interviews were conducted through Zoom for online interviews and one conducted via telephone.

Key Informant interviews

The interviews lasted between 21 June and 15 August 2023 and covered the following questions:

1. What are the main knowledge barriers (e.g. lack of training courses, overpriced training courses, etc.) to developing vertical hydroponics in the country?
2. Which are the main courses and experiences to be used as an example in the country
3. General comment on the first results of the questionnaire (e.g. by listing, and presenting the main training needs highlighted by the questionnaire, if the knowledge gap can be addressed by existing courses/ initiatives in the country or not).
4. Their opinion of actual knowledge gap
5. From your experience which professional figures are most sought after by vertical/hydroponics farming companies?

Presentation of the results

Data presentation and results

The Key informant interviews were:

n	Profession
1	Producer of hydroponic vegetables and fruits | Agronomist
2	Hydroponic crop supervisor - agronomist
3	Hydroponics Supervisor in a private company

The information obtained from the interviews will be presented below in aggregate and divided by question.

1. *What are the main knowledge barriers (e.g. lack of training courses, overpriced training courses, etc.) to developing vertical hydroponics in the country?*

With regard to the first question, the information expressed by the respondents is as follows. It is highlighted that although hydroponics is gaining popularity in Greece, its promotion is limited, and governmental concern seems lacking. Also, it seems that a genuine instructional guidance appears to be absent.

It is interesting to report how one of the interviewees points out that hydroponics is a hands-on experience. “There's no official training available for us growers, so we rely on talking to each other”.

The central role of specialised figures that can guide companies in this sector is emphasised. In particular, two of the respondents highlighted how agronomists who specialise in this area can transfer knowledge and guide companies as central.

One respondent, emphasises how, while there are certain hydroponic companies offering pro bono consulting services, their quality is often subpar, highlighting a significant concern for the education in this area. And adds that teaching in the field of agronomy appears to be derived from outdated resources dating back to the 1980s, four decades behind current academic standards.

Finally, it is widely recognized that hydroponic require continuous updating and adaptation of knowledge

2. *Which are the main courses and experiences to be used as an example in the country?*

One of the interviewees points out that additional training and seminars are crucial for those interested in taking up hydroponics. While initial knowledge can be acquired through seminars, practical experience and hands-on learning develop over time.

Two of the interviewees state that they have been trained in hydroponic technologies by companies mainly from the Netherlands. Stressing how the different conditions (e.g., environmental), between Greece and the Netherlands, offered the opportunity to realise the need for climate control systems and in some cases also required adaptability of the training received.

One respondent, the prevailing sentiment indicates a lack of enthusiasm in embracing new knowledge and programmes.

One respondent also emphasises how "hydroponics is learned through experience," highlighting the need to accompany academic experience with practical experience.

3. *General comment on the first results of the questionnaire (e.g. by listing, and presenting the main training needs highlighted by the questionnaire, if the knowledge gap can be addressed by existing courses/ initiatives in the country or not).*

Respondents highlight the importance of certain aspects in regard to hydroponics. It is emphasised that it is very important to know about irrigation, fertilisation, how to protect plants, how to use different growing materials, and importance is also given to climate control.

In addition, it is pointed out that a nuanced understanding of the intricate technical apparatus is crucial, encompassing adept management of their operation and troubleshooting in the event of malfunctions. But these vital skills remain absent from current curricula.

One of the interviewees points out that because the industry relies mostly on electronic systems, knowing how to handle machinery is essential. Furthermore, although LED lamps are not universally indispensable, their importance is accentuated for those working in specific regions or at particular times.

It is also added how a knowledge of financial aspects can help in understanding what is most convenient to produce in hydroponics.

4. *Their opinion on actual Knowledge gap*

One interviewee pointed out that currently is lacking the concept of "education," both from an academic and producers' perspective.

Is highlighted that it is very important to continue to improve knowledge to ensure the success of hydroponic crops.

Finally, again from one of the interviewees, the importance of practical experience in the greenhouse is emphasised, as the hydroponics sector it's not merely an extension of conventional farming but rather a distinct industry, demanding a unique skill set and approach.

5. *From your experience which figures are most sought after by hydroponic farming companies?*

In this case, respondents expressed what they think are the skills most sought after by hydroponic farms. For example, they focused on precision in fertiliser compounding, irrigation, climate control and machinery management.

It was highlighted how hydroponic cultivation revolves around precision, particularly in managing the delicate balance between water and fertilisers. In the practical realm, the individuals responsible for hands-on tasks play a pivotal role. Their duties encompass vigilantly scouting for viruses and diligently maintaining a consistent regimen of spraying to safeguard plant health.

1.4 Comparison of the information and conclusions

Comparison of the information and conclusions

Collectively the responses from the questionnaires and interviews highlight the need for a multidisciplinary approach to hydroponics education, merging practical experience, technical know-how, and specialised agronomic guidance. Addressing these gaps will require concerted efforts from educators, researchers, and industry stakeholders to establish comprehensive training programs that equip hydroponic enthusiasts with the knowledge and skills necessary to thrive in this innovative agricultural frontier.

Concerning the information gathered from the questionnaires, we can see the following issues:

Use of Hydroponics technology:

- 40% of respondents have experience with hydroponic technology, and 27% have experience using vertical hydroponic technology.

- Most respondents have no prior experience with hydroponics. 60% have not used hydroponic technology while 73% have not used vertical hydroponic technology.

Experience with Hydroponic

- Overall almost half of participants have experience with Hydroponic farming i.e 47% rating between 3 to 5 (from a scale 1-5)

Course Attendance:

- 53% of respondents have attended hydroponic courses, while 47% have participated in vertical hydroponics courses, indicating that almost half of participants received some kind of training in the field.

With regard to the training needs we can see the following high scores from the indicated subjects.

- System automation (average 3)
- Crop types (average 3)
- Pathogens, fungi, and parasites of soilless crops. Diagnostic elements (average 3,27)
- Pathogens, fungi, and parasites of soilless crops. Defence strategies(average 3,27)
- Cost analysis and business planning (3,47)
- Funding opportunities (3,47)
- Communication and visibility (3,40)
- Access to Market (3,67)

It is important to point out that the other subjects also achieved somewhat similar scores (average between 2,4 to 2,93)and will also have to be taken into consideration.

As also reported in the interviews, it will be very important to develop training modules with regard to business plan development, climate control and training opportunities that are part of a general training that can present all the opportunities that can arise from these technologies but also be able to provide concrete guidance on their management and costs to be incurred.

With regard to the key informant interviews, the experiences and viewpoints of the participants, shed light on both the progress and the gaps within the hydroponic agriculture in Greece. As the industry gains traction, certain gaps in knowledge and skills become evident.

One shared observation is the existing void in formal education and structured training programs specifically tailored to hydroponics. While some information is available through seminars and consultations, a comprehensive and standardised curriculum appears to be lacking. This absence becomes particularly pronounced when considering the complex interplay between climate, substrates, irrigation, and fertilisation. In terms of skills, the hydroponic farmers and experts stress the importance of hands-on

experience and meticulous attention to detail. The dynamic nature of hydroponics demands not only theoretical knowledge but also practical expertise.

A clear skill gap lies in the realm of climate manipulation and technical apparatus management. Given the diversity of substrates and the nuanced challenges posed by Greece's climate, a robust understanding of these factors is crucial for success. Moreover, the effective integration of advanced technology and machinery remains a common aspiration. As the sector becomes more mechanised, the ability to handle and troubleshoot these systems becomes indispensable. Additionally, understanding the financial aspects of hydroponic farming emerges as a key consideration, enabling growers to make informed decisions about crop selection and resource allocation. While sustainable practices are highly valued, challenges persist in marketing clean, chemical-free products to consumers. Bridging this gap between production and consumer awareness is crucial for realising the full potential of hydroponic agriculture's environmental benefits.

As this innovative approach gains momentum in addressing agricultural challenges, these insights serve as beacons guiding the way forward for sustainable and efficient food production.