Educational Requirements Analysis

VERMICOMPOSTING: The Future of Sustainable Agriculture and Organic Waste Management in Europe

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- ILA International Labour Association, www.ilabour.eu

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1. SUMMARY

This report is part of the IO2- WP02 PowerWORMS Educational Requirements Analysis (ERA) from the project VERMICOMPOSTING: The Future of Sustainable Agriculture and Organic Waste Management in Europe - POWERWORMS. The major aim of the status analysis is to gain a comprehensive understanding of the present situation in the participating countries.

This report is created based on the research conducted in the project countries in the period from September 2022 until December 2022.

Increasing the agricultural production in parallel with the increase in the world population causes the use of more inputs. Considering the population growth and the need for agricultural production, the most intense input consumption will be in developing countries. Countries with the potential to develop agriculture, such as Türkiye , are candidate countries to meet their future food needs. Some of the negativities caused by the intensive use of chemical fertilizers, which are at the beginning of the inputs used in agriculture, create hesitations in consumers. Undesirable effects resulting from excessive and unplanned use of fertilizers highlight the increase in controlled fertilizer consumption. It is possible to increase productivity without using unconscious and intense inputs and without destroying nature and the environment. Continuing studies and new methods on plant nutrition and fertilization show that healthy agricultural products can be grown from soil to table.

In order to obtain more efficiency and to obtain quality and healthy products with a balanced plant nutrition and fertilization, it is necessary to determine the fertilizer need correctly and to monitor the information such as fertilizer type and amount, application method, application frequency and time. Increasing the efficiency of fertilizer use will also play an important role in meeting the plant nutrient requirement by reducing the risks. Measures to increase fertilizer efficiency are important in terms of product and environment, as well as economically.

In order to obtain maximum benefit from fertilizers, it is necessary to use the right fertilizer in the right plant, in the right place, at the right time, taking into account plant demands, climate, soil structure and vegetation period. By applying the required type and amount of fertilizer; As a result of excessive use of fertilizers, quality deterioration in yield, loss of productivity of agricultural lands, negative effects on the environment, waste of resources, etc. problems will

be prevented, as well as the decrease in efficiency and quality encountered as a result of underuse will be prevented.

Considering the reasons stated above, the Powerworms project aims to produce and disseminate technical knowledge on the production and use of worm manure, which will protect natural resources, prevent soil and environmental pollution, and increase efficiency. This report presents the implications from farmers, local professionals, educators and experts in the current state of worm castings production and use, which promotes organic farming activities and good agricultural practices that prioritize consumers' access to natural, healthy foodstuffs.

2. BACKGROUND

The enormous increase in population, economic growth, urbanization, industrialization, and agricultural production is coupled with the accumulated waste generation, creating a serious problem in the environment. In order to dispose of this waste safely, it should be converted effectively. This is achieved by bio-composting and vermicomposting of the farm, urban and agro-industrial waste and remains. It is being increasingly realized that composting is an environmentally friendly process, convert a wide variety of wastes into valuable agricultural inputs.

Global exploitative industrial agriculture, reliant on the excessive use of agrichemicals is attributed to be the key contributor to the widespread destruction of the soil and is accountable for 50% of total GHG emissions (Koont, 2011). The rising economic and environmental cost of agricultural chemicals, coupled with the ever-increasing cost of landfills, calls for a reorientation of agricultural management. The process of utilizing surface-dwelling species of earthworms to efficiently and ecologically break down organic waste, producing a superior organic fertilizer as a byproduct, referred to as vermicomposting, is successfully providing sustainable solutions in food production and organic waste management worldwide. The integration of vermicomposting in agriculture and mainstream waste management presents economic, environmental, and social benefits for Europe, building resilience in response to the impacts of climate change, natural resource depletion, and desertification.

It is the belief that harnessing the power of the earthworm to provide the foundations to transform our food system that underpins the purpose of the PowerWORM project proposal. Worm composting, otherwise known as vermicomposting delivers the foundations for building a local organic food movement that simultaneously provides sustainable solutions in organic waste management. From a political and cultural perspective, Europe has to focus on the role of vermicomposting as an integrated model within agriculture, looking at both urban and rural farming within the private, cooperative, and state governed sector.

The value and importance of earthworms in agriculture was first recognized in writing by the father of ecology Charles Darwin, who in 1881, declared “Worms are powerful than the African Elephant and are more important to the economy than the cow”.

Partners from five European countries recognizing the Power that Worms can bring to organic farming came close in collaboration towards the realization of the New Common Agricultural Policy (CAP) 2023-2027 for sustainable soil management and the European Soil Strategy (ESS) for the restoration of degraded soil by promoting to the European family VERMICOMPOSTING as The Future of Sustainable Agriculture and Organic Waste Management in Europe.

So the PowerWORMS consortium has been devoted to addressing in the most efficient way and to a certain level of degree the improvement of the response of EU agriculture to societal demands on food and health, including safe, nutritious and sustainable food, food waste, foster sustainable development and efficient management of natural resources such as water, soil and air promoting formal and informal educational and training on vermicomposting to farmers, students, families, teachers, and professionals.

3. METHODOLOGY AND DISCUSSION QUESTIONS

PowerWORMS Project aims to study, research and verify the production techniques and specifications of vermicomposting in order to transfer the knowledge to interested parties; farmers and consumers so that the utmost importance of using vermicomposting could be disseminated. The project also aims to establish a network link and a discussion platform among researchers, academicians, public organization representatives, marketing experts, consumers, and local producers to share different perspectives, expert opinions and in order to discover new opportunities and ways to improve the existing production processes and facilitate the product innovation.

The overarching objective of the project is to promote, facilitate and accelerate the global transition to regenerative agriculture and food systems, farming, and land management in order to restore climate stability, increase biodiversity, rebuild soil fertility and produce healthy food. The methodology is part from the project result IO2- WP02 PowerWORMS Educational Requirements Analysis (ERA).

The Educational Requirements Analysis (ERA) objective is to determine the level of vermicomposting contribution to productivity in agriculture and farming in rural areas,

The Educational Requirements Analysis (ERA) is based on the current situation and best practices on bio-composting and vermicomposting of farm, urban and agro-industrial waste in today's agriculture, education sector, public awareness and demand in the participating Countries is the foundation of the project.

The major aim of the status analysis is to gain a comprehensive understanding of the present situation in the participating countries. The status analysis include the following actions:

- Educational Needs Assessment (Farmer Producers, Educational Organizations, and Policy Makers)
- Learning Needs Gap Definition
- Educational Toolbox Detailed Design Specifications

To conduct this research, we utilized an descriptive survey research. Our main goal of this research is to observe the farmers, VET schools, universities and agricultural centers knowledge

regarding vermicomposting and to determine their perception of the vermicomposting potentials. To fulfill the goals of this survey research, we used various research models, like face to face interviews, online survey tools, focus groups, study visits etc.

This activity include three sub activities:

- Sub Activity-1: IO2.1 Survey of the Current Educational Curriculum on Vermicomposting both in VET educational and University level
- Sub Activity-2: IO2.2 Survey on VET Professionals and Farmers on the contemporary and real business knowledge needs
- Sub Activity-3: IO2.3 Compassion of the Current Pool of Knowledge and the Actual Educational Needs

The leading organization of this activity is Foundation Agro-Centre for Education (FACE). Each partner contributed in the sub activities carried out in the implementation of this project result.

The survey of the current level of knowledge pool was conducted in each of the respective countries that are partners in the project:

- Türkiye – responsible partner Malatya Turgut Ozal University in Assistance of Apricot Research Institute and Naturainnova Gıda Tarım ve İlaç Ltd. Şti.
- North Macedonia – responsible partner FACE.
- Greece – responsible partner Innotomia P.C. in Assistance of Innopolis Centre for Innovation and Culture.
- Spain – responsible partner WWOOF España.
- Netherlands – responsible partner Internatıonale Arbeıdsverenıg Ing.

In the countries where there are multiple partners involved in the implementation of the activities, the responsible partners divided the national tasks among the partners from the same country. Each country implemented:

- Survey of the Current Educational Curriculum on Vermicomposting both in VET educational and University level, and

- Survey on VET Professionals and Farmers on the contemporary and real business knowledge needs.

The partners began with the implementation of the activities starting from August 2022 until November 2022.

For the survey purposed the partners used various means questionnaires, checklists, live interviews and study visits is a guide regarding information (existing or required) that may be useful in understanding the needs and strengths of the educational curricula on the specific subject of vermicomposting. All means were agreed between partners and passed a pilot evaluation before implementation. The study tools were commonly used in all countries, in order to be easily compared.

The guideline for implementation of the surveys are shown below under each activity.

At the end of each activity, the partners summarized the findings in one national report and delivered them to FACE for the creation of the common PowerWORMS Educational Requirements Analysis (ERA). FACE provided the partners common template for the national reports.

Guideline for implementation of IO2.1 Survey of the Current Educational Curriculum on Vermicomposting both in VET educational and University level

Description: The survey of the current level of knowledge pool that consists of the educational curriculum on the subject of Vermicomposting both in VET school educational and at University level at all participating countries is considered crucial for finalization of the actual contemporary educational needs analysis.

For this purpose the partners used the questionnaire below. The minimum number of respondents on the questionnaire by country is:

- Türkiye – 45 respondents
- North Macedonia – 15 respondents
- Greece – 30 respondents
- Spain – 15 respondents
- Netherlands – 15 respondents

The questionnaire below served as a guide for the partners for the collection of the information.

Tasks for sub-activity-1:

IO.2.1.1 Questionnaires to the VET Schools, Agricultural Centers, and HEIs

The Questions that the partners used from the Questionnaire below collected data from the VET Schools, Agricultural Centers, and HEIs and are divided in several groups:

The first section asks about the basic information, including age, education, and years of teaching experience, Literacy of the respondents on vermicomposting.

- What is your age?
- What is your occupation?
- What is the type of the organization you teach/work at?
- How long are you teaching/working in the agricultural sector?
- Do you have any educational qualification?
    - If no, what is the level of your education?
- Have you received any agricultural training?
- Have you received any vermicomposting training?

The second section asks about the vermicomposting terms and involvement of vermicomposting in the Agricultural education:

- What are the Challenges in agricultural sector in relation, but not restricted, to: increased demographics, food waste, and intense use of natural resources, climate change, poverty, and hunger in your country?
- Are you familiar with terminologies, and the range of vermicomposting technologies being increasingly used in Farming and Agricultural activities?
- How confident are you in your knowledge about vermicomposting?
- Is vermicomposting included in the curriculums for VET Schools/University?
- How is it involved? Under which programmes?
- How familiar are the students with vermicomposting?
- Does the practical work of students include vermicomposting activities?

- What educational materials are you using to train/teach staff, community members, students, and families on vermicomposting?
- What are the strengths of these materials?
- What are the weaknesses of these materials?
- What topics do the materials cover?
- What barriers, if any, do you face in the process of teaching on vermicomposting?
- Whom do you collaborate with when addressing vermicomposting activities?
- Are you familiar with the National Policies & Initiatives which are aimed to promoting the concepts/benefits of vermicomposting and fostering support in implementing vermicomposting?

The third section looks at teachers/trainers experiences with vermicomposting in national context and the education needs of the sector in their country:

- Do you have any experience with vermicomposting?
- Can you identify some positive examples of farmers that practice vermicomposting in your country?
- Where VET Teachers/Trainers feel incompetent to work with farmers because they do not have the appropriate professional training to do that?
- What do you think is missing in the education system for vermicomposting?
- Do you think that students and farmers have the necessary knowledge to practice vermicomposting?
- Do you think that students and farmers would be interested in training activities on vermicomposting?

IO.2.1.2 Live Interviews and Study visits to VET Schools, Agricultural Centers, and HEIs

The suggested methodology of collection of the information are various means questionnaires, checklists, live interviews and study visits, online surveys, etc. The questionnaire serves as a guide regarding information (existing or required) that may be useful in understanding the needs and strengths of the VET professionals and organic farmers in the practice of vermicomposting.

For this research we recommend to use Semistructured in-depth interviews, during study visits, focus groups, online meetings or structured as an online surveys.

Semistructured in-depth interviews are commonly used in qualitative research and are the most frequent qualitative data source. This method typically consists of a dialogue between researcher and participant, guided by a flexible interview protocol and supplemented by follow-up questions, probes and comments. The method allows the researcher to collect open-ended data, to explore participant thoughts, feelings and beliefs about a particular topic and to delve deeply into personal and sometimes sensitive issues.

Overall, semistructured interviewing requires both a relational focus and practice in the skills of facilitation.

Skills include:

- determining the purpose and scope of the study,
- identifying participants,
- considering ethical issues,
- planning logistical aspects,
- developing the interview guide,
- establishing trust and rapport,
- conducting the interview,
- memoing and reflection,
- analyzing the data,
- demonstrating the trustworthiness of the research,
- presenting findings in a paper or report.

Guideline for implementation of IO2.2 Survey on VET Professionals and Farmers on the contemporary and real business knowledge needs

Description: The survey of the current level of knowledge practical information tried to detect real needs that come for the business side focusing in SMEs and individual farmer owners in all participating countries. For this purpose the partners used the questionnaire below.

The minimum number of respondents on the questionnaire by country is:

- Türkiye – 45 respondents
- North Macedonia – 15 respondents

- Greece – 30 respondents
- Spain – 15 respondents
- Netherlands – 15 respondents

The questionnaire below served as a guide for the partners for the collection of the information.

Tasks for sub-activity-2:

IO.2.2.1 Questionnaires to local VET Professionals and Farmers

The Questions that the partners used from the Questionnaire below collected data from the farmers divided in several groups:

Farmer's information

- What is your age?
- What is the type of your farm?
- Are you an individual farmer of family farmer?
- What is your family size?
- What is the size of your farm?
- How long are you working in agriculture?
- Do you have any educational qualification?
- If no, what is the level of your education?
- Have you received any agricultural training?
- Have you received any vermicomposting training?

Respondent's knowledge on vermicomposting.

- Are you familiar with the term vermicomposting?
- Do you have any organic waste accumulating from your farming activities?
- How do you deal with the organic waste from you farm?
- Do you think that farmers can produce vermicompost very shortly by themselves through utilization of that waste?
- Have you ever seen or experienced some vermicomposting techniques?
- Are you familiar with the advantages of vermicomposting?
- Are you familiar with the production cost of vermicomposting?

- Are you familiar with the composition of vermicompost?
- Do you think that vermicompost can help barren land turned into fertile?
- What barriers, if any, do you face in the process of practicing vermicomposting?
- Can you think of some ecological advantages that vermicomposting has over the environment?
- Read the following statements to the respondents and ask them if they agree with them on not:
  - Introducing earthworms into soil from vermicomposting is one of the most natural, ancient and perhaps the best among all sustainable agriculture practice.
  - Vermicomposting means less reliance on purchased inputs leading to low cost of production
  - Enhancement of soil productivity.
  - With vermicompost the produce will be with better taste, luster and keeping qualities without toxic residues
  - Vermicompost is rich in nutrients content and this may be good asset for sustainable agriculture.
  - Wastes become valuable raw material for the soil biotechnological processes.
  - More ground water recharge and less groundwater depletion.
  - Soil salinization is reduced with low soil erosion and runoff.
  - Vermicomposting can boost up rural economy.
  - Reduced wasteland formation.

Respondent's experience with vermicomposting.

- Have you ever tried to start composting the waste from your farm?
- If yes, what type of compost system do you use?
- Are compost earthworms currently present in the system?
- How did the earthworms colonize the compost system?
- How old is your compost system?
- What do you put in your compost system?
- If no, do you know someone who is composting?

Respondent's interest in vermicomposting.

- Are you interested in using this technology in the future?
- Do want to take part in more training programs on vermicomposting?
- Do you think that you are able to practice vermicomposting in the future?

IO.2.2.2 Live Interviews and Study visits to local VET Professionals and Farmers

The suggested methodology of collection of the information are various means questionnaires, checklists, live interviews and study visits, online surveys, etc. The questionnaire serves as a guide regarding information (existing or required) that may be useful in understanding the needs and strengths of the VET professionals and organic farmers in the practice of vermicomposting.

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- analyzing the data;
- demonstrating the trustworthiness of the research
- presenting findings in a paper or report.

4. SHARED ISSUES AND CONCERNS

The Survey for VET Schools, Agricultural Centers, and HEIs included 147 participants and the Survey for local VET Professionals and Farmers included 218 participants. The answers of both Surveys are analyzed below. The most common issue that was identified with this research was the lack of education on vermicomposting on both secondary and university level.

The collection of the answers was done with the use of various means like questionnaires, phone interviews, live interviews with VET trainers and study visits to farmers. The data was collected in a Google form specifically designed in every country language.

Some constrains that emerged during the research are:

- time delays, the research was planned to be finished by November 2022. However, due to some unforeseen difficulties we had to extend the period of the research until the end of December 2022.
- Unwillingness of the education sector to participate in the research. This issue specifically appeared in Spain only, where the partners had a bit of difficulties to reach and ensure participation of the education sector. However, the partners provided the necessary inputs from Spain successfully.
- The indicated numbers of respondents were reached and exceeded in all of the countries, except Greece. The indicated number was 30 respondents in each survey, and the received numbers are 25 respondents for the Questionnaire for VET Schools, Agricultural Centers, and HEIs, and 27 respondents for the Questionnaire for local VET Professionals and Farmers. However, due to the large number of respondents from Türkiye and the very insignificant difference, we accepted the results as relevant.
- Data is missing for some of the questions, specifically in Greece.

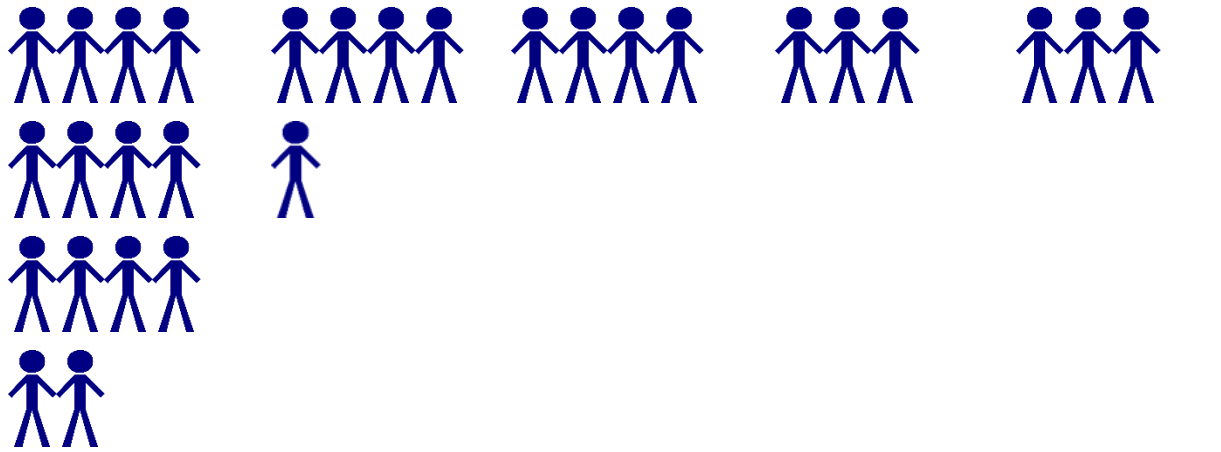
5. CONCLUSIONS

IO.2.1. Questionnaires for VET Schools, Agricultural Centers, and HEIs

IO.2.1.1. Participants profile

The Data collection questionnaire for VET Schools, Agricultural Centers, and HEIs was implemented with the participation of 147 respondents in total from Türkiye , North Macedonia, Greece, Spain and Netherlands.

Türkiye	Greece	North Macedonia	Spain	Netherlands
70 Respondents	25 Respondents	22 Respondents	15 Respondents	15 Respondents



The composition of the respondents professional background differed in each country.

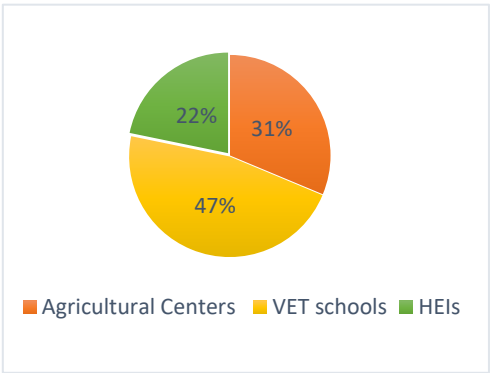
In North Macedonia, Greece and Spain, the majority of the respondents were teachers and trainers from the Secondary Agricultural Schools with 90.9% in North Macedonia, 68% in Greece and around 60% in Spain. In Türkiye the respondents were mainly from Agricultural Centers (55.7%). In the Netherlands the composition of the respondents was equal between the target groups with 33.3% from each target group.

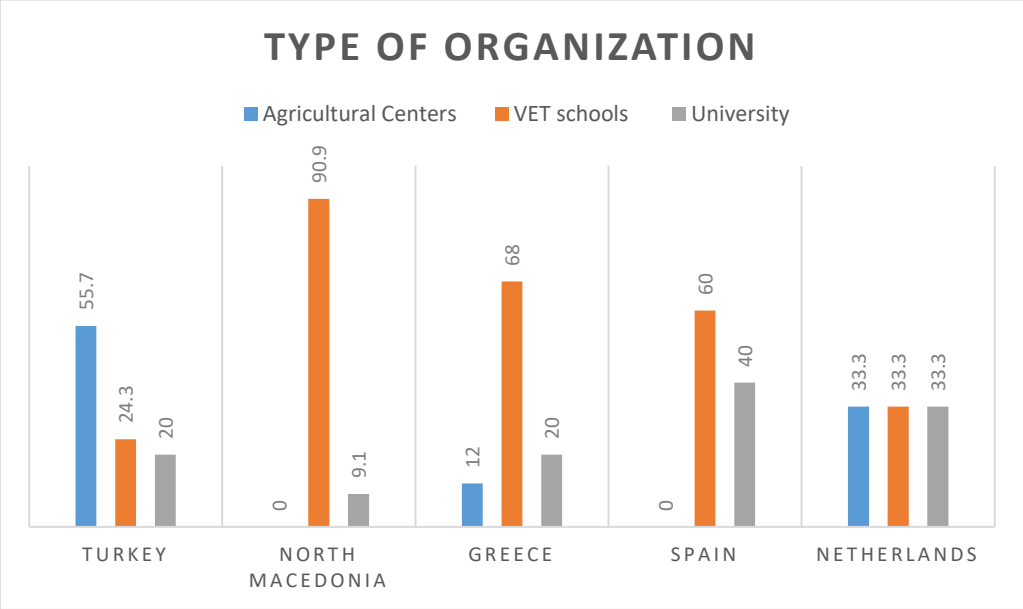
In total from 147 respondents in 5 countries we have:

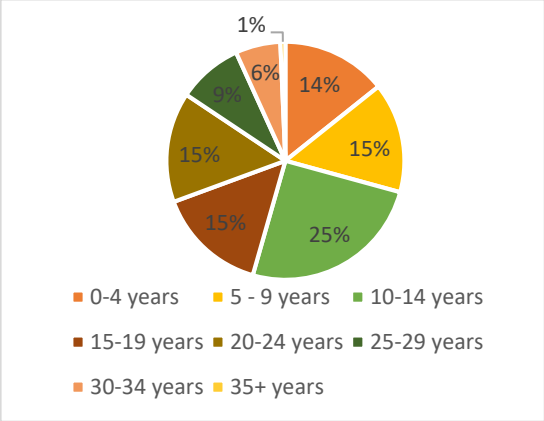
31.29% respondents from the Agricultural Centers

46.94% respondents from the VET schools

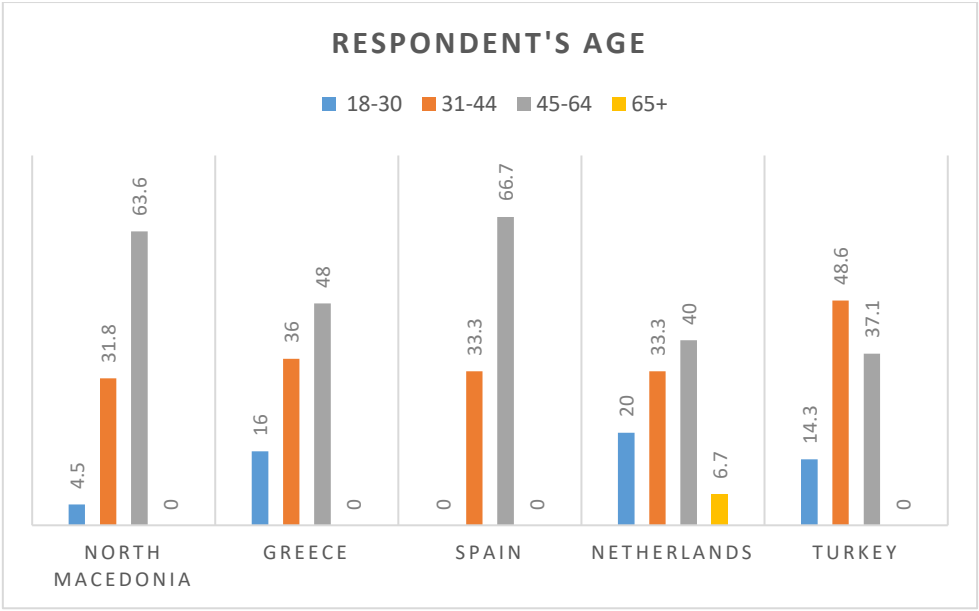
21.77% respondents from the HEIs



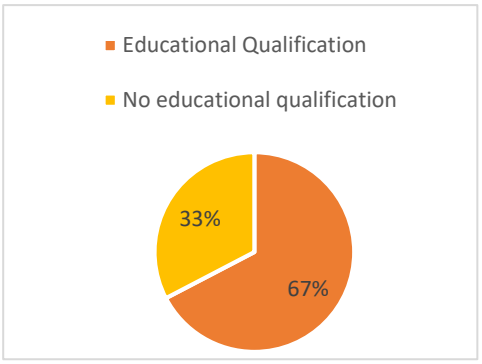




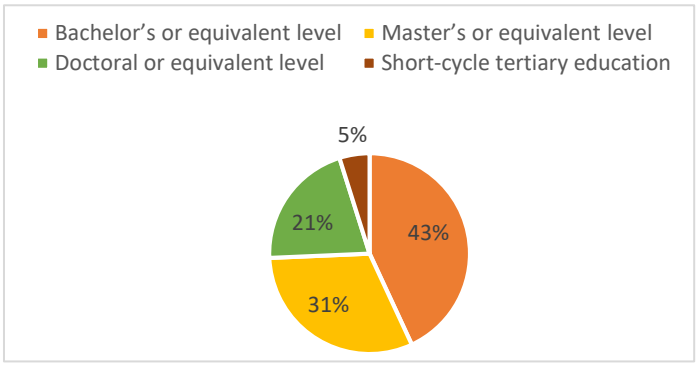
The respondents have been working in the agricultural sector for different period of time. The age of the participants is combined and varies from below age 30 to 64 years old participants. Based on the results from the surveys, the majority of the respondents were in the range from 31 to 64 years old. A very small percentage from the respondents were less than 30 years old.

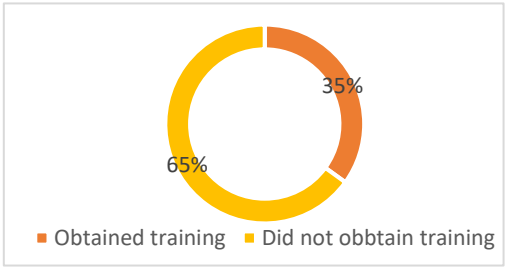


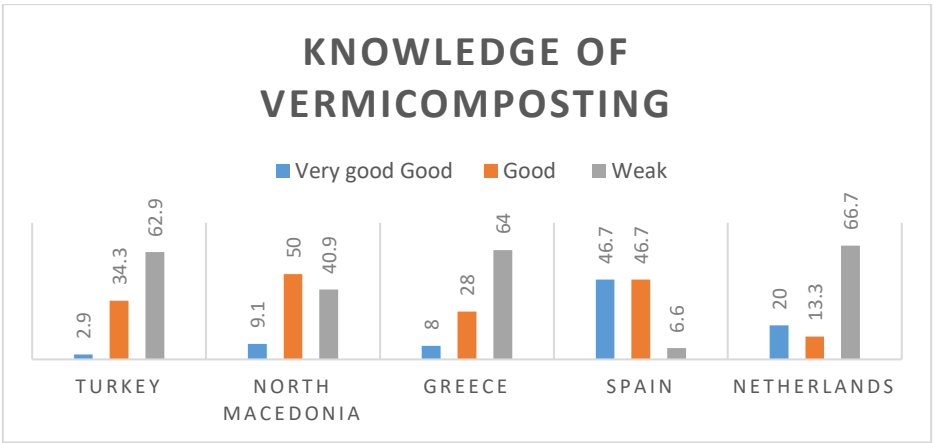
The majority of the respondents have educational qualification - 67.35%.



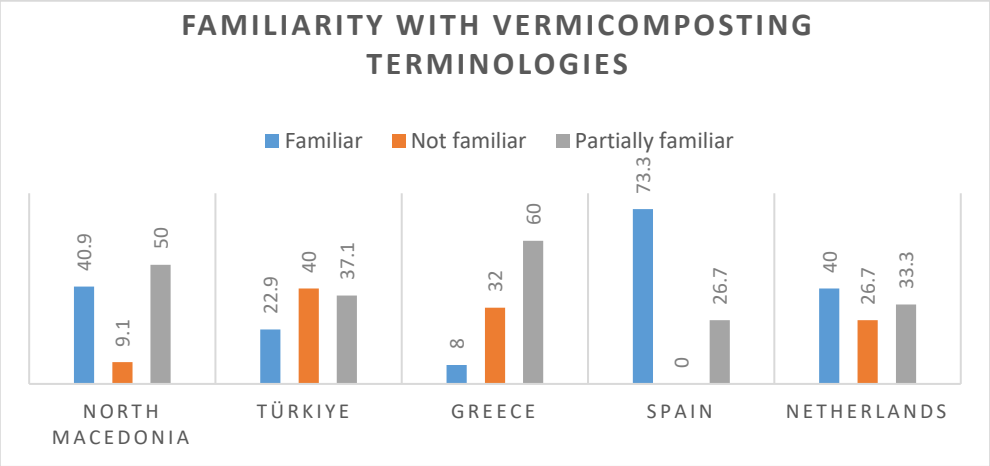
42.22% from the respondents have Bachelor's or equivalent level of education, 30.61% from the respondents have Master degrees, 20.41% from the respondents are Doctors in their field, and 4.76% from the respondents have Short-cycle tertiary education. In Spain, Greece, Türkiye and in North Macedonia, the vast majority of the participants have participated in some sort of Agricultural training, while in the Netherlands, only 40% of the respondents have obtained any agricultural training. The results shown that in each country the number of respondents that received training on Vermicomposting or partial training is very small, 37.41%. It is important to mention that in Türkiye , Greece, North Macedonia and the Netherlands, the majority of the respondents stated that the knowledge they have in vermicomposting is weak, while the majority of the respondents in Spain stated that their knowledge is very good.



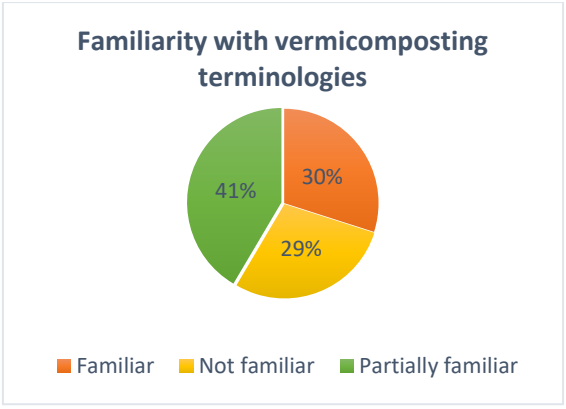




In North Macedonia, 40.9% from the respondents are familiar with terminologies and the range of vermicomposting technologies that are used in Farming, Agricultural activities, 50% are partially familiar, and 9.1% are not familiar. In Spain 73.3% of the respondents are familiar with terminologies and the range of vermicomposting technologies that are used in Farming, Agricultural activities, while the rest of 26.7% are partially familiar.



In Türkiye , 22.9% from the respondents are familiar with terminologies and the range of vermicomposting technologies that are used in Farming, Agricultural activities, 37.1% are partially familiar, and 40.0% are not familiar. In the Netherlands, 40.0% from the respondents are familiar with terminologies and the range of vermicomposting technologies that are used in Farming, Agricultural activities, 33.3% are partially familiar, and 26.7% are not familiar. In Greece, 8% from the respondents are familiar with terminologies and the range of vermicomposting technologies that are used in Farming, Agricultural activities, 60% are partially familiar, and 32% are not familiar.



IO.2.1.2. Identification of the most common challenges in the agricultural sector by country

In order to identify the respondents awareness and understanding of the issues and concerns in the agricultural sector in their countries, we asked them to state what they think are the challenges in the agricultural sector in relation to: increased demographics, food waste, and intense use of natural resources, climate change, poverty, and hunger.

This challenges are in very close relation in regards to the use of vermicomposting for sustainable agriculture.

The most common challenges that were given by the participants by country are listed as follow:

North Macedonia	• The impact from the climate changes, • Increased demand for food, • Poor soil yields (lack of minerals and elements), • Non-ecological food production, • Impact of climate change on the yield of agricultural products, • Unplanned production, • Large quantities of food ending up as waste, • Irrational use of natural resources.
Türkiye	• Unconscious use of fertilizers • Increased demographics • Political barriers • Financial and technical barriers • Insufficient breeding efforts • Intense use of natural resources • Crop field losses due to climate changes • Misuse of agricultural lands • High input costs
Greece	• Climate change • Decreased yield growth rates even with increased fertilization.

	• Food waste • Improving Quality Standards In The Secondary And Partly Primary Sector • Food waste means wasted money, wasted water, wasted energy, wasted land and wasted transportation. • To Cover Consumer Needs By Minimizing Costs And At The Same Time Preserving Natural Resources And Ensuring Sustainability • Meet rising demand for more food of higher quality. • Satisfy consumers' changing tastes and expectations. • Changing climate in traditional crop growing areas (especially changes in temperature and precipitation patterns and soil degradation. • The main challenge facing agriculture is usually land-related. Loss of viable land, erosion, and other factors decrease the ability of farmers to use land. • Investment in farm productivity • Soil degradation. Shortage of water resources. • Due to the increases in the intensity and number of transboundary outbreaks of plant pests and diseases, the food and agricultural systems are under threat, which in turn causes food safety issues and risk of radiation events. • Poverty, increasing population, environmental setbacks, impacts of biofuel production, food waste, climate change. • Not a Clear National Policy • Very Low Educational Level Of Farmers • Improvements In The Agricultural Sector In The Last Years
Spain	• Application of the best agricultural practices in terms of conservation of natural resources • Rethinking the intensive use of resources to make agricultural production more sustainable

	• Lack of money • Excessive use of fertilizers • High demand • Insufficient resources • Bad press
Netherlands	• Climate change, • Water management, • Soil health, • Use of pesticides and herbicides, • Animal welfare • Ensuring food safety, • Contamination prevention, • Managing food waste • Soil degradation, • Lack of skilled trainers • Climate change, • Lack of skilled farmers • Lack of government support, • Limited land availability • Volatility of commodity prices, • Limited access to finance and market • Access to training, • Limited access to technology and resources, • Competition from imports, • Food security, • Agricultural sustainability, • Changing consumer preferences • Lack of access to nutritious foods, • Foodborne illnesses • Aging rural society,

	• Rural migration, • Lack of labor force in rural areas

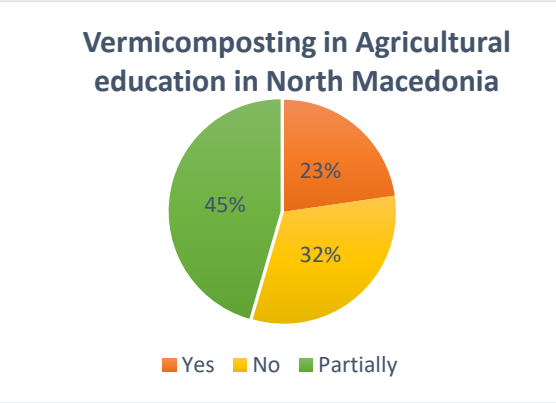
The above stated examples shown that the respondents are quite aware and familiar with the most common challenges in the agricultural sector in their own country.

Additionally, some of the participants gave their opinions on some possible solutions and recommendations for dealing with this issues:

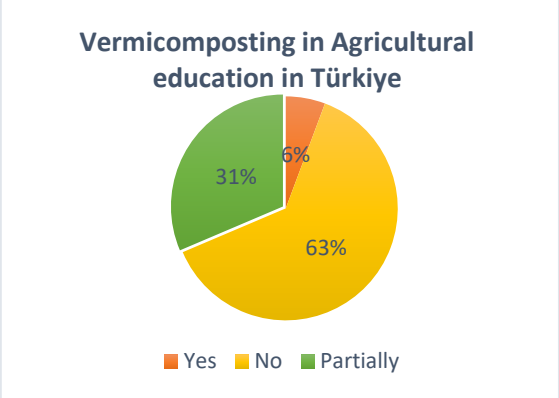
- A safe way of disposing of waste with a minimum emission of harmful gases towards sustainable agriculture and the application of environmental protection practices.
- Production of quality food
- Education of the young population on the selection of waste of organic origin
- Utilization of waste during agricultural production (plant and livestock) for the production of fertilizers and biogas.
- Utilization of all arable land for agricultural production and return of young people to rural settlements (to create infrastructural conditions there - roads, drinking water, etc.).
- Raising of environmental awareness among the young generations to learn about a healthy and clean ecological environment, application of organic agricultural production in agriculture and to give a special aspect to vermicomposting.
- To reduce food waste and irrational use of natural resources.
- Activating rural areas and encouraging agricultural production.

IO.2.1.3. Vermicomposting in the Agricultural education in Türkiye , North Macedonia, Greece, Spain and the Netherlands

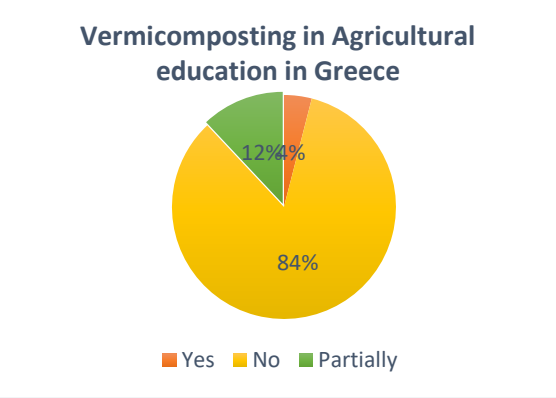
From the results received, **vermicomposting is not fully included in the Agricultural curricula or education programmes in the respective countries**, meaning it is included as part of some teaching subjects or partially mentioned in some materials. In North Macedonia vermicomposting is partially included in the subject contents in the Fertilization section and in the subjects Microbiology, Horticulture and Organic Horticulture. In the curricula for the secondary VET agricultural education, vermicomposting is included as part of some professional teaching subjects such as Horticultural production for the third year sector Agriculture, fisheries and veterinary medicine, Organic Agricultural Production, Agro-chemistry (with a short content - one lesson in each of the two subjects), Crop production, Pedology and Practical learning and learning through work.



In Türkiye, vermicomposting is included partially in the subjects Organic plant production, in the Fertilization section of Soil Sciences and as part of different subjects in the university programme for Agricultural engineers.

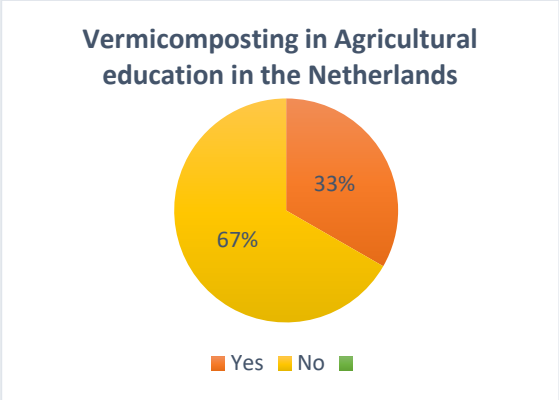


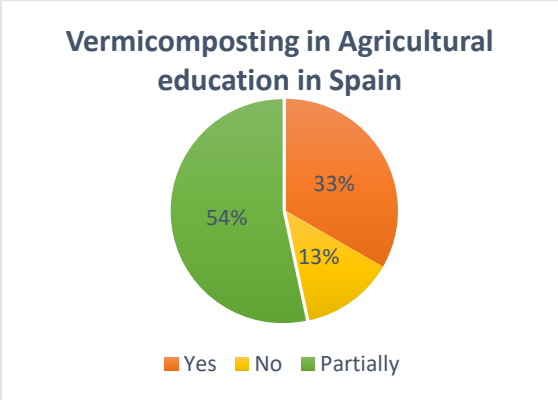
In Greece, the reference to the technique is made on the sidelines of dealing with the subject of composting. In some cases, teachers design environmental education programmes on vermicomposting or composting in general to motivate students to look for the effect of adopting such practices on the environmental footprint of agriculture. Vermicomposting is also included as a part of environmental education



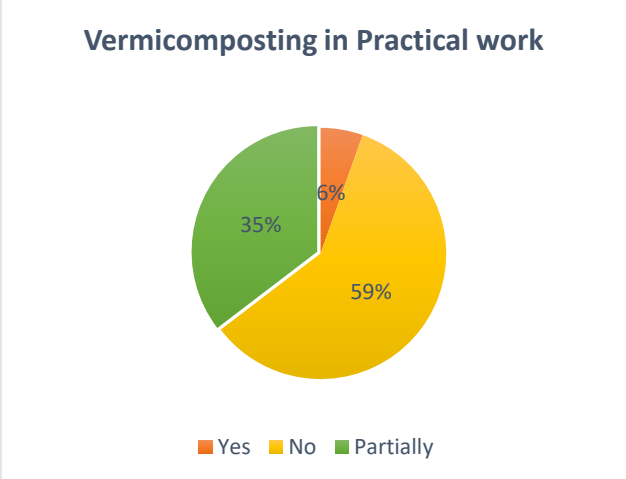
programmes on composting, visits to businesses that apply the vermicomposting technique are included.

In the Netherlands, vermicomposting is also included as part of the Soil Sciences and in the Plant and Environmental sciences. While in Spain, based on the results, vermicomposting is imparted in some subjects, courses and practices. However, the respondents were not familiar in which.

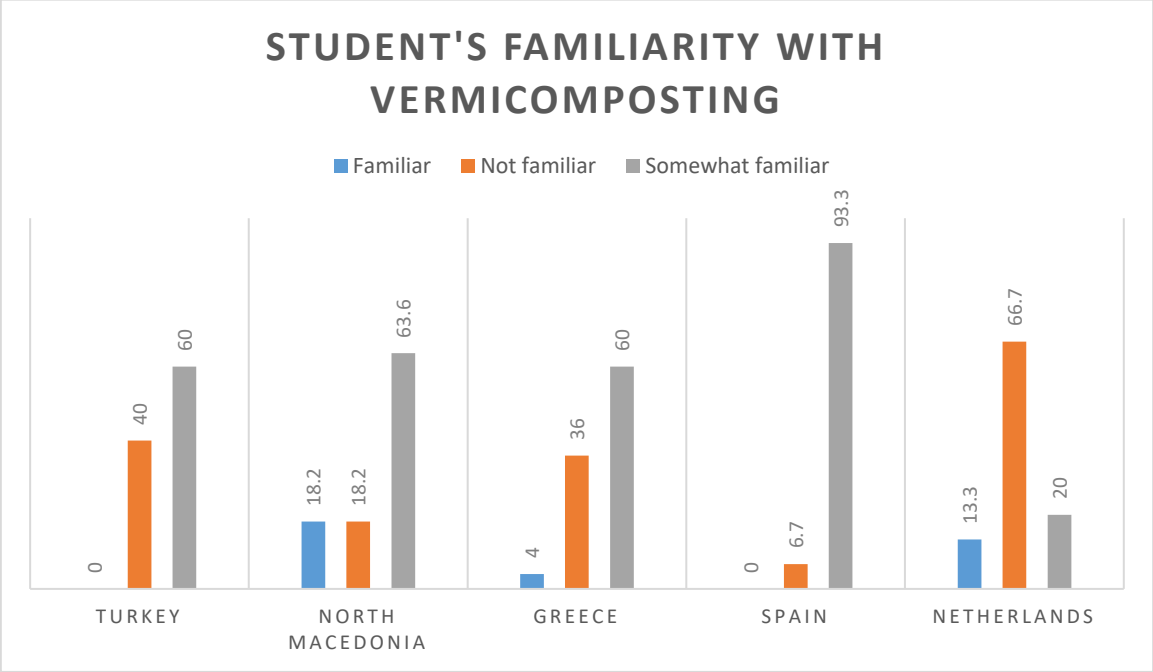




The results shown that this also applies to the involvement of vermicomposting in the practical work of the students. In most cases, vermicomposting is not at all included in the practical activities. However, in some cases, the educational institutions partially included some aspects of vermicomposting.



The results shown that the respondents believe that the students are either not familiar with the term vermicomposting or are somewhat familiar. Very small percentage believe that the students are familiar with the term.



In regards to the educational materials that the teachers/trainers use to train/teach staff, community members, students, and families on vermicomposting, the most common means are **Printed and electronic textbooks, Manuals, Teachers Guides and Lesson plans, Workbooks and Video lessons.** Below are shown the strengths and the weaknesses of those materials by country according to the results from the survey.

Türkiye

strenghts

- Inclusive
- Implementation Tips
- Offering rich vissuals
- Technical documents
- Rich technical content

weaknesses

- Low awerness
- Difficult access
- Need to be paid and are expensive
- Not consistent

North Macedonia

strenghts

- Availability
- Good theoretical basis
- No significant strengths - just rudimentary information
- Age appropriate
- Excellent quite educational
- What has been described about the importance of organic matter in agriculture and the importance of vericomposting for the quality of agricultural products, the quality of the soil, etc.
- Explanation and presentation of methods of vermicomposting
- The theoretical part is well explained
- Well explained method and procedure
- Visual acquisition of experiences
- Visual experience
- Easy availability of electronic materials
- They provide the latest information
- Obtaining organic fertilizer and then obtaining healthy food

weaknesses

- According to the curriculum, only one hour is dedicated to this issue. Textbooks are a basic tool for students to acquire certain theoretical knowledge. In order to deepen the knowledge, it is necessary for the schools to have certain resources in order to be able to receive fertilizer from California worms (perhaps several beds). In this way, the students will master the technique for producing this type of fertilizer, but they will also learn to select the waste that contains organic matter.
- They are not complete materials, because there is no separate subject, nor a subject teacher who would organize the materials and update the content
- Not comprehensive enough
- They do not contain a lot of practical advices on the practical application of vericomposting.
- Not available in schools
- Lack of photos and videos
- Lack of materias in Macedonian language
- Certain details are not explained

Greece

strenghts

- Easy to study and understand
- You can find them on internet
- They are very didactic
- They are detailed and analytic
- They have enough penetration in the community
- Significant
- They are very interesting to the students
- Trainee students or professional farmers, attending agricultural education, regardless of age, are activated by the image and lay the foundation for the application of new knowledge.

weaknesses

- Not easily accessible by students
- They are not very detailed
- They are not many
- There is not big bibliography
- They have technical knowledge that is not familiar to the trainees
- They take a lot of time
- The video itself is fascinating, however, it requires good preparation by the teacher, which includes encouraging and bonding the group of learners. Also important is its duration and finally, what will be presented is not considered by the group to be idealized enough and not applicable in real conditions, with the result that the group gives up and does not give it the required importance and attention

Spain

strenghts

- Good diagrams and images
- Easily adaptable to compliment the classes
- Contain a lot of information
- Easy to read

weaknesses

- Not up to date
- Poor quality of the content
- Not very practical
- Repetitive

Netherlands

strenghts

- Comprehensive coverage
- Glossary and index
- Clear explanations
- Interactive Features
- Quality best practices
- Structured and organised information
- Variety of resources
- Assessments and evaluation tools
- Up-to-date information
- Review questions and exercises
- In-depth information
- Step-by-step instructions
- Illustrations, photos, and diagrams
- Relevancy of content for a variety of farmers
- Practical applications

weaknesses

- Outdated information
- Lack of multilingual content
- Limited scope
- Mention unaffordable chemicals and inputs for farming
- Limited interactive features
- Lack of diversity
- Unaffordable prices
- Too technical or complicated
- Not considering the local context of farming
- Limited customisation
- Lack of practical application
- Inaccessibility

The respondents also shared some of the topics they know that are covered by the available materials they know. The topics are listed below by country:

Türkiye	Compost Plant nutrition Soil sciences
North Macedonia	General information, Production technology, Organic production, the importance of organic production, the importance of organic matter for soil fertility and many others, Organic fertilizers, Fertilizing with vermicompost and its composition, Fertilizer production from California worms, Conditions for vermicomposting, method of operation, application and benefits, Compost production technology.
Spain	Worm biology Final product characteristics Agronomical consequences Basic techniques to develop vermicomposting projects Soil characteristics
Netherlands	Overview of vermicomposting Benefits of vermicomposting Care for the worms Using vermicompost in the garden or on indoor plants Dealing with worms dying, pests, or bad odors Choice of the right worms Setting up a suitable bin How to keep the bin moist and temperature levels Setting up a vermicomposting system Feeding and watering the worms Harvesting the vermicompost Vermicomposting for small businesses Case studies and best practices
Greece	Data not available

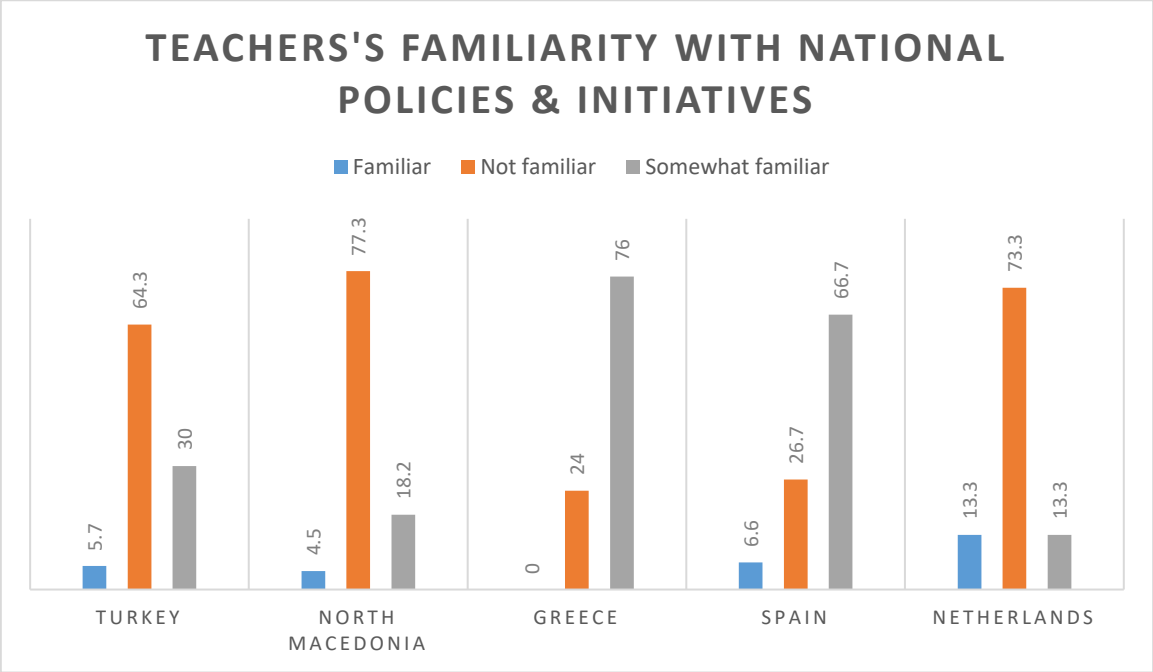
The most common barriers that the teachers/trainers face in the process of teaching on vermicomposting are:

Türkiye	Lack of application opportunity No specific training materials Insufficient educational materials
North Macedonia	Limited information and need for additional training There is no specific instruction for composting, let alone vermicomposting. There not enough material resources and demonstration beds in our school so that the students can be familiar with the whole compost production process in more detail

	The process of vermicomposting cannot be shown practically to the students. Lack of skills for practical performance There are no concrete practical examples
Spain	Difficulty to do practices Getting used to the techniques (rejection of "dirty" labour) Not very appealing to people Lack of time
Netherlands	Many people are unaware of the benefits of vermicomposting and its process. Vermicomposting requires specific equipment and materials. Some universities may not provide a dedicated area for the worms and their bin. It requires ongoing maintenance and attention. It may not be possible to commit to this level of care. Disgust factor: Some students may be put off by the idea of handling worms and dealing with composting materials. Lack of cooperation with universities and private companies for practical learning. There is no necessary equipment and infrastructure in the school. There is a lack of space in the school to maintain a learning environment for students There are few expert trainers and teachers who know about vermicomposting There are few job opportunities for vermicomposting to attract students There is a Lack of access to resources because of a lack of multilingual and diverse learning material Limited knowledge and experience because it is a specialized field Limited access to experts in the field Limited funding to invest in the necessary equipment and materials
Greece	Not enough educational material available Need for designation of a teacher for this topic. The ignorance and fear of the trainees as they consider the application of such methods Technologically inferior and with potential losses from use, in production. Lack of specific knowledge No laboratories are available Lack of students educational background The ignorance of the trainees and the downgrading of the benefits from the application as they consider the application of such methods less technologically advanced and a setback in the evolution of agriculture which will bring them to a situation where production will be limited or it cannot be adequately protected. It is difficult for the students to understand worms job in vermicomposting The ignorance of the trainees and their disbelief regarding the merits of this method Not enough time

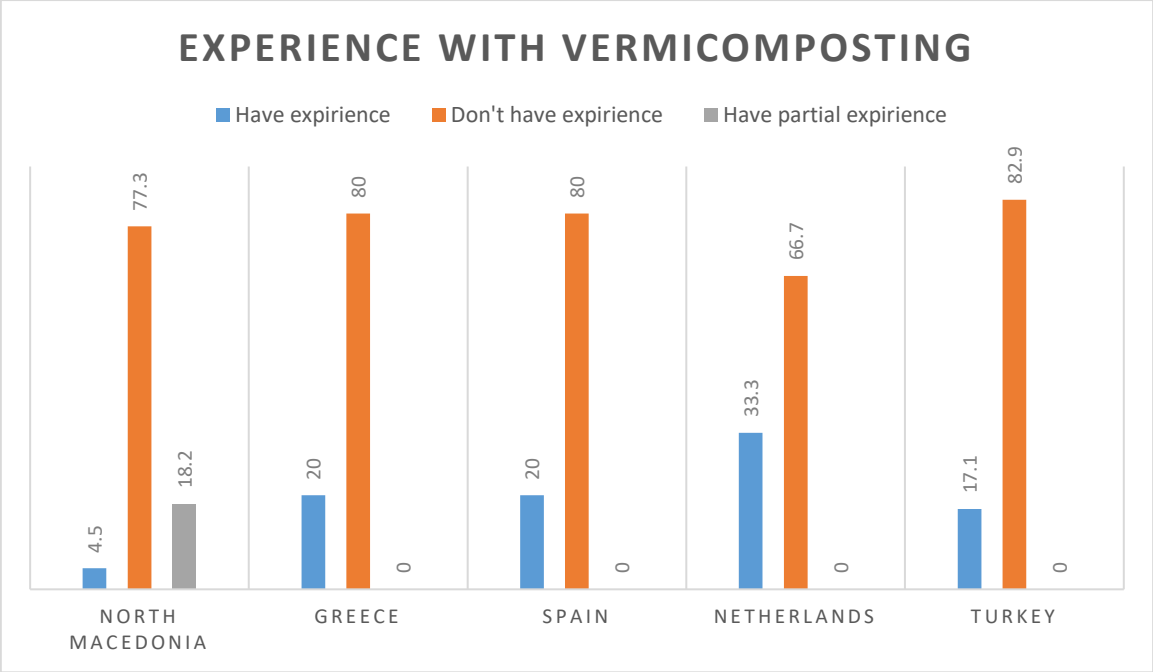
For implementing some activities in regards to vermicomposting, in North Macedonia, the teachers/trainers usually cooperate with Agricultural centers, NGOs, Private companies and other Secondary schools. In Spain, they cooperate the most with Public bodies, then Private companies and NGOs or Universities. In Greece, the teachers also mostly cooperate with Agricultural centers, NGOs, Private companies, Universities and other Secondary schools, however a great number from the respondents stated that there is no cooperation at all in regards to this topic. In Netherlands, they usually cooperate with Public bodies, Universities, Private companies and other entities.

Great number of the teachers/trainers are not aware or familiar with any National Policies & Initiatives which are aimed to promoting the concepts/benefits of vermicomposting and fostering support in implementing vermicomposting in North Macedonia, Türkiye and the Netherlands. However in Greece and Spain, great number are somewhat familiar.



IO.2.1.4. Experience with vermicomposting

Most of the respondents do not have any experience with vermicomposting and also very few of the respondents were able to identify some positive examples of vermicomposting in their communities.



72.7% of the participants are not familiar with any positive examples of farmers that practice vermicomposting in North Macedonia, and 27.3% know a positive example. Some of the positive examples stated are:

- Production of organic baby salads.
- Application of organic bird manure by inteoduction in the soil in order to enrich it with macro and micro elements
- Selling fertilizer as a way of self-financing
- Varomil in Novo Selo – Strumica

In Türkiye 80% from the respondents are not familiar, and the other 20% identified positive examples of producing of walnut, strawberries, artemisia, cotton, apricot with the use of vermicompost as fertilizer. In the Netherlands, only 33.3% from the respondents were familiar and gave with some examples:

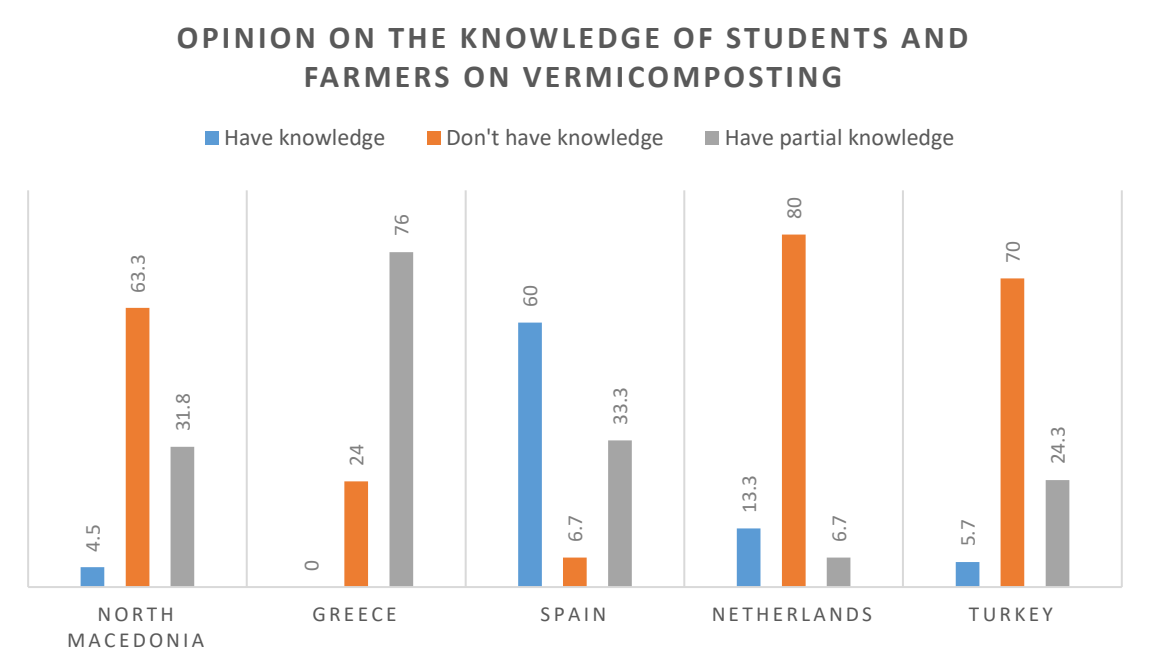
- StadsWormerij helps farmers to develop their small-scale worm farms. They welcome farmers in their compost yards and get acquainted with various compost systems.
- The Compostier enterprise in Diemen processes raw vegetable and fruit residues and small garden waste into rich food for the soil, the worm compost. Rowin Snijder is the founder of The Compostier and a pioneer in the local and circular processing of green waste in cities. Since 2014 he has been working on solutions for processing GFT waste using compost worms.
- De Vrije Boer in Zutphen is a biodynamic farm that uses vermicomposting to produce compost for its crops and also sells worms and vermicomposting systems to other farmers.

In Greece, only one responded replied positively and the example was an agricultural company producing organic fertilizers. In Spain the number is also small and only 26.7% were familiar with some positive examples. The examples given are: HumusFertil en La Roda, Albacete and farmers from their area.

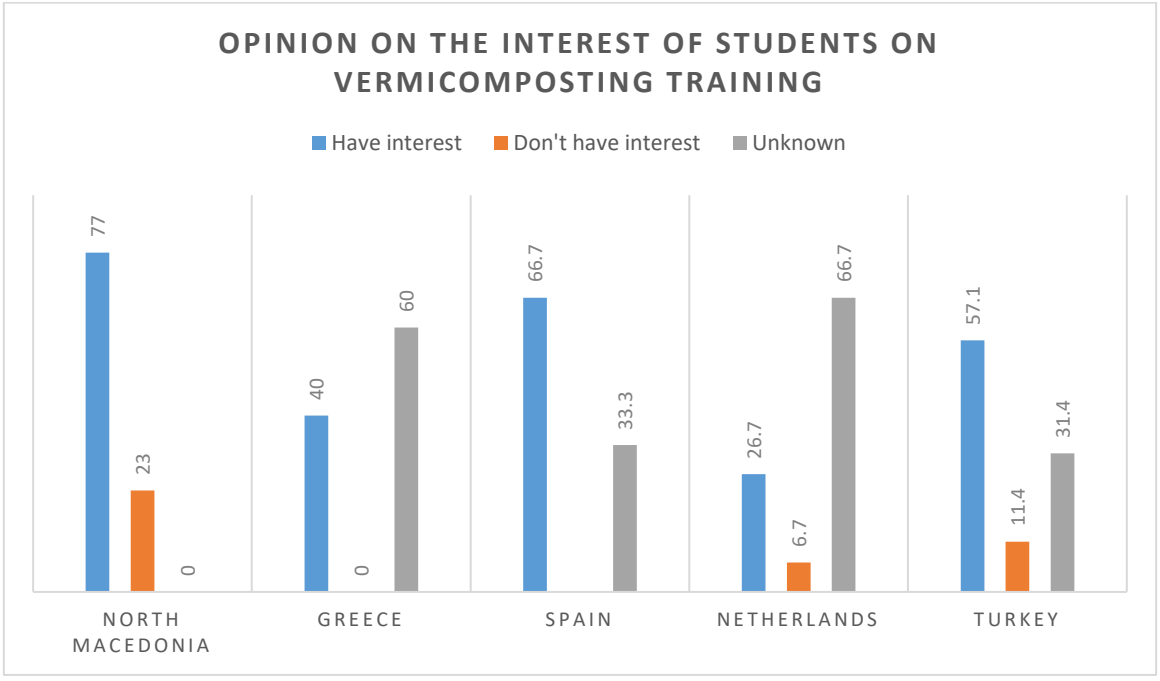
The respondents were also asked on their opinions for what is missing in the education system for vermicomposting. The answers are stated below by country:

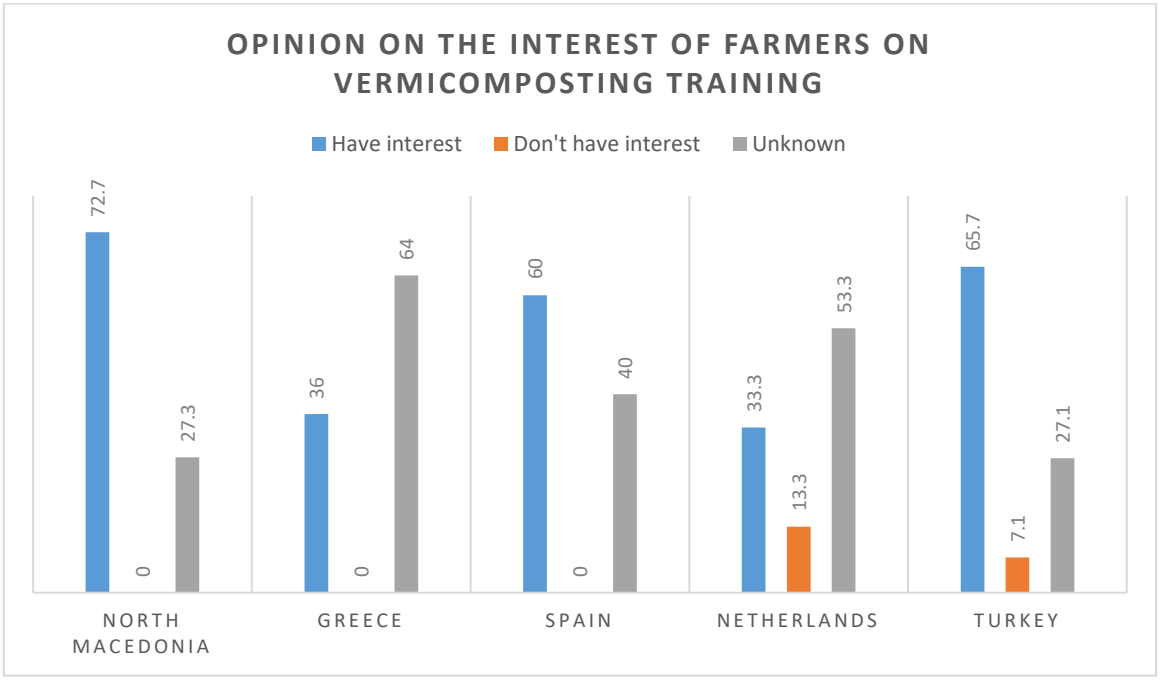
North Macedonia	Emphasis on socially useful topics. Practical implementation of the vermicomposting process. Practical training. Own demo beds. More expert practical examples and good practices for vermicomposting. More involvement in professional subjects and in practical teaching. To be included in the curricula for secondary vocational education or to make a curriculum. Insufficient engagement in practical activities. Educational materials, manuals, videos
Türkiye	Insufficient educational materials Limited experience sharing Conciseness No awareness of the importance
Greece	Specialized lessons Practical exercise Specialized curriculum developed Using vermicompost to classroom plants Detailed curriculum time and materials update on benefits

	There is no provision for this method in the official syllabus of educational institutions. There is no provision for the method in the official syllabus. It is left to the discretion of the teacher to organize activities which will help the trainees to get to know the method and evaluate its effect on the production process. It should occupy a place in the syllabus so that specific courses are provided and both the knowledge and skills required for its production and use are acquired. The detailed program does not include this method; everything depends on the knowledge, awareness and willingness of the teacher to refer to this method and its benefits in increasing the production of products and their contribution to the health of consumers. Well informed teachers, adequate scientific data, support by the government
Spain	More dedication in the official curriculum Teachers should show more interest and take part on vermicomposting More practices Watching the whole vermicomposting cycle
Netherlands	Information is not accessible to all. Giving information is not always applicable. The education system does not create awareness of the benefit of vermicomposting, such as reducing waste and improving soil health. Course books do not cover all the necessary information in the literature. Modern techniques and technologies are missing. Lack of practical support for young farmers. Lack of experience in academics and researchers in the field. Lack of university and private farm cooperation. There are few sources for data collection. Limited funding opportunities to create physical learning environments.



The major number of the respondents in North Macedonia, Türkiye and the Netherlands believe that the students and famers do not have the necessary knowledge on vermicomposting. In Greece, the majority believe that they have so partial knowledge, and in Spain the majority believe that the farmers and the students have the necessary knowledge. The respondents were also asked on their opinion whether the students and the farmers would be interested in participation in vermicomposting training.





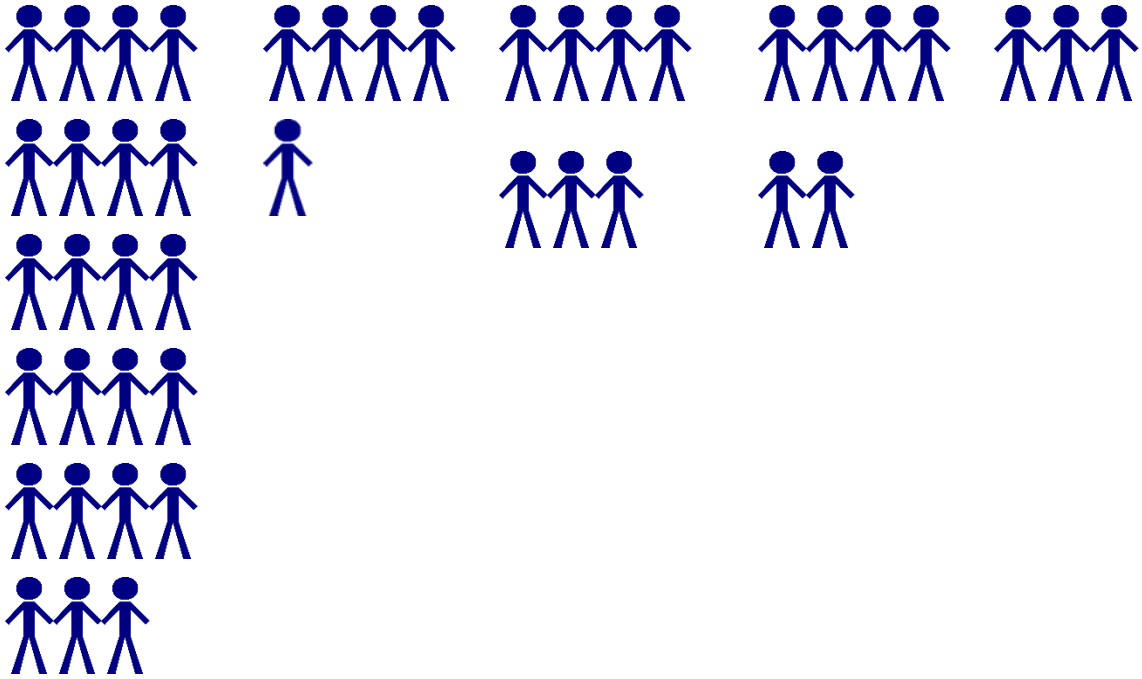
The respondents were asked if they are familiar with any Information and Communication Technology (ICT) solutions for vermicomposting cultivation, however only a very small percentage of them were familiar and examples were only stated from the respondents from the Netherlands. They are as follow:

- Temperature, Moisture, pH, Carbon-to-nitrogen ratio and product quality must be controlled and monitored. A microcontroller, Soil moisture sensor, Ultrasonic sensor, Humidity sensor, temperature sensor and Soil test kit are used to collect data in vermicomposting. “Rapitest” is one of the digital kits used in the field.
- With a small R&D grant awarded from the Dutch government, Jo Ploumen of the Netherlands is using microBIOMETER® to determine fungal to bacterial ratios in vermicompost filled in a Johnson-Su Bioreactor versus residence time. Jo also uses microBIOMETER® to measure microbes and F:B ratio in select soil samples.
- There are online learning tools. www.best4soil.eu www.wormcompostinghq.com, and www.urbanwormcompany.com portals are among these learning tools.

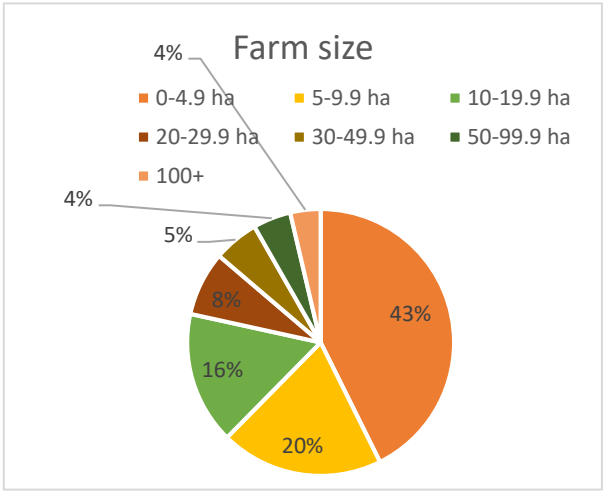
IO.2.2.1. Participants profile

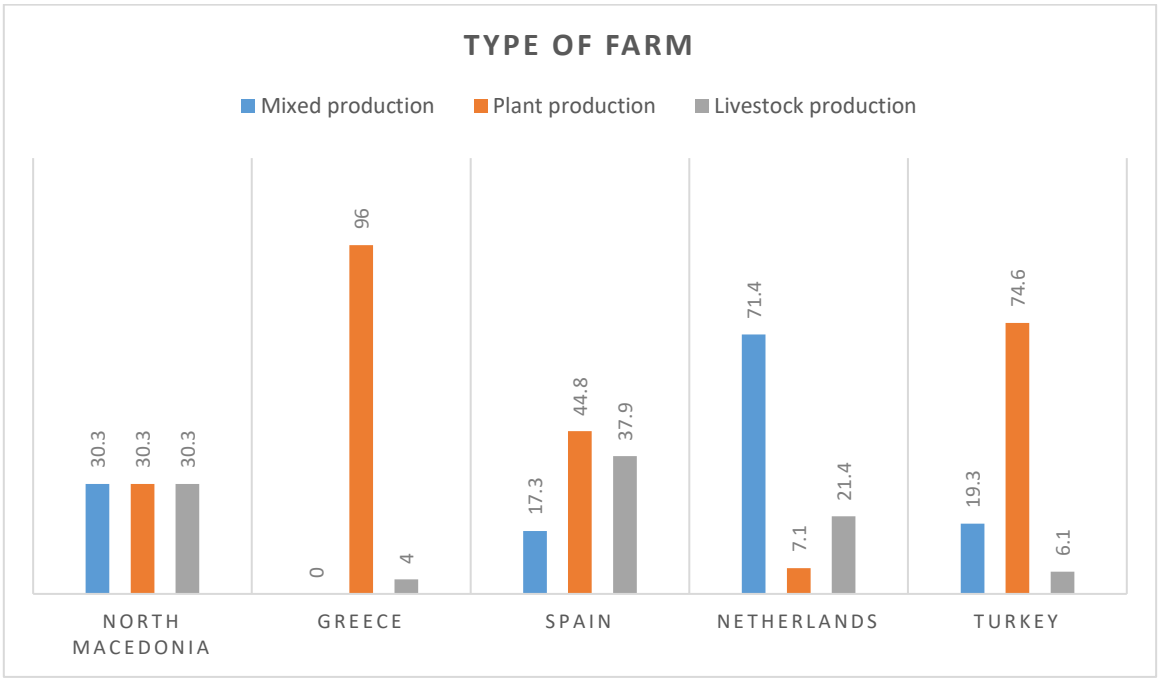
The Data collection questionnaire for VET Professionals and Farmers was implemented with the participation of 218 respondents.

Türkiye	Greece	North Macedonia	Spain	Netherlands
114 Respondents	27 Respondents	33 Respondents	29 Respondents	15 Respondents

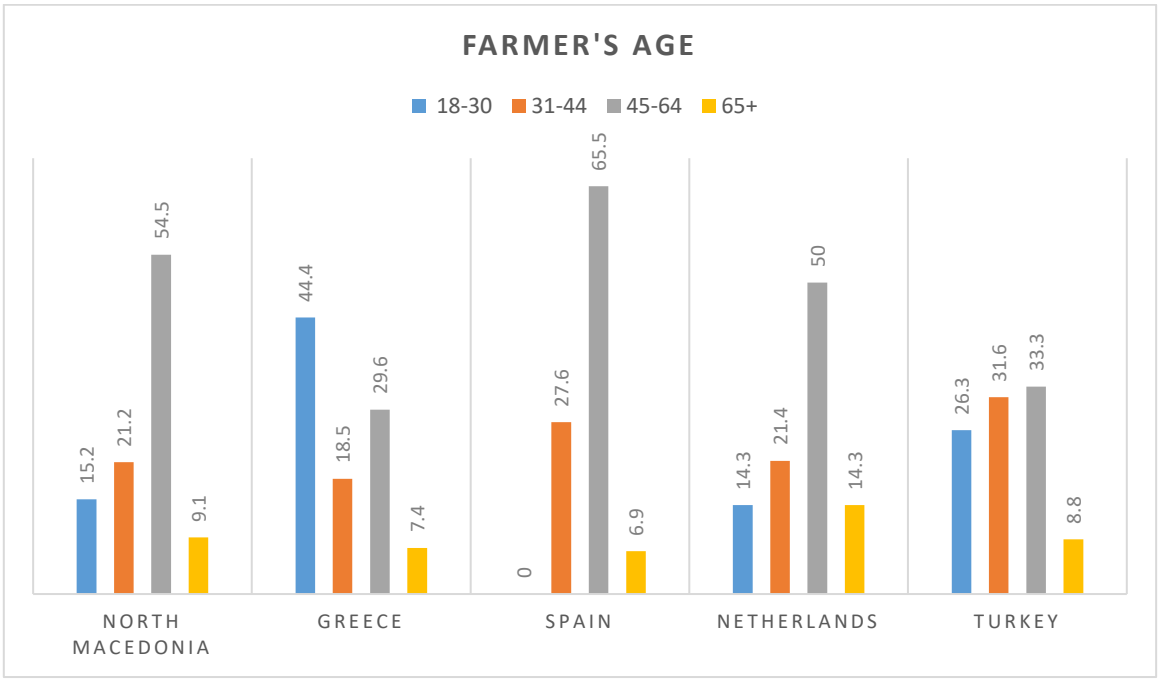


The composition of the respondents was various with farmers that have Mixed production, Crop production and Livestock production. In North Macedonian there was a small percentage of farmers that produce exclusively bio humus (9.1%). In this survey, we also have respondents with different size of farms, however the major number of the respondents are small farm owners.





The age of the participants is combined and varies from 18 years old to 65+ years old participants. The most common age group is from 45 to 64 years old.



The majority of the respondents are family owned farms in each country:

78.8% in North Macedonia

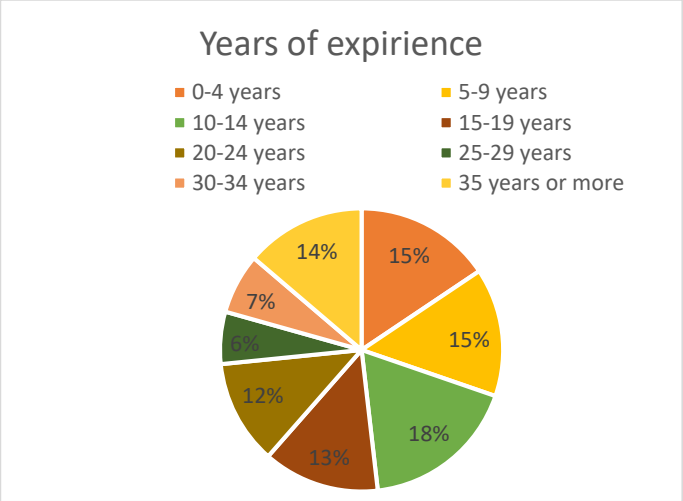
62.3% in Türkiye

92.9% in the Netherlands

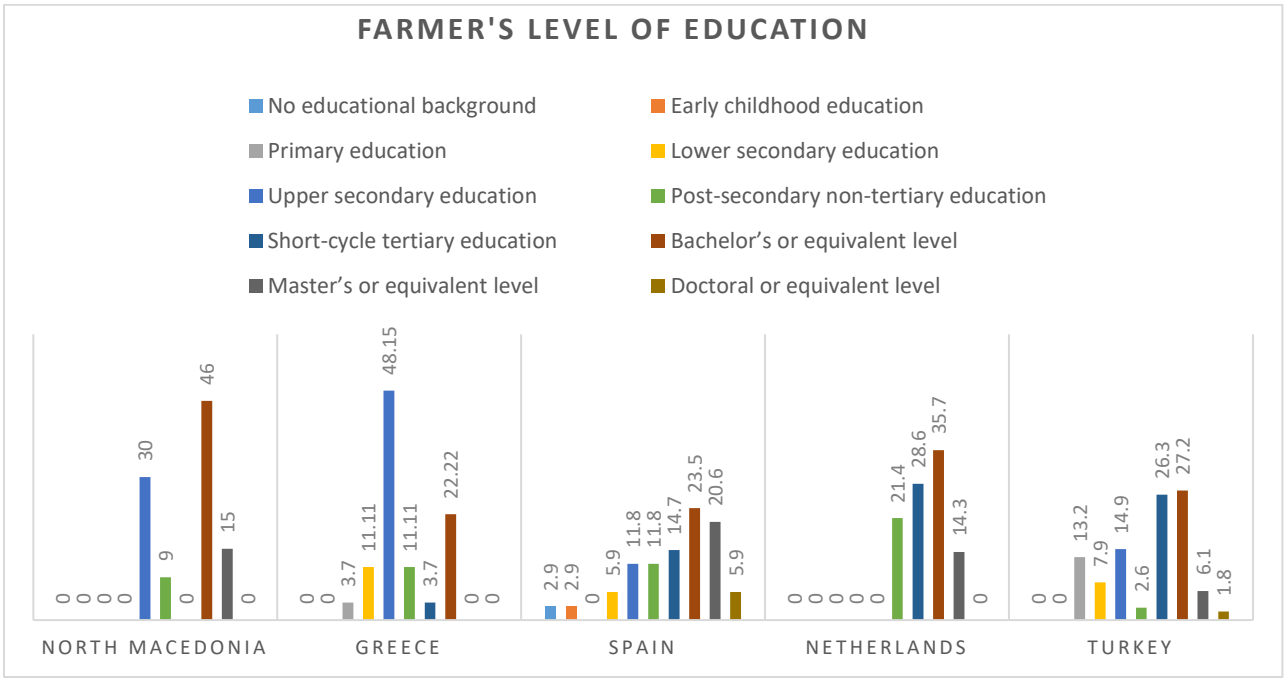
92.6% in Greece

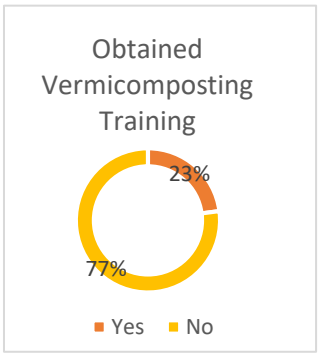
86.2% in Spain.

The years of experience of the respondents differs and we have respondents that worked in agriculture from less than 4 years to more than 35 years.

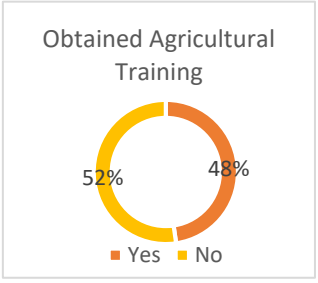


The majority of the respondents have finished some educational level, except for a very small number from Spain, 2.9% which stated that they do not have any educational background, and 2.9% which have only early childhood education.





Almost half of the respondents have never participated in some agricultural training and 77% have never participated in Vermicomposting training.



IO.2.2.2. Participants knowledge on vermicomposting

69.63% from the participants are familiar with the term vermicomposting.[1]

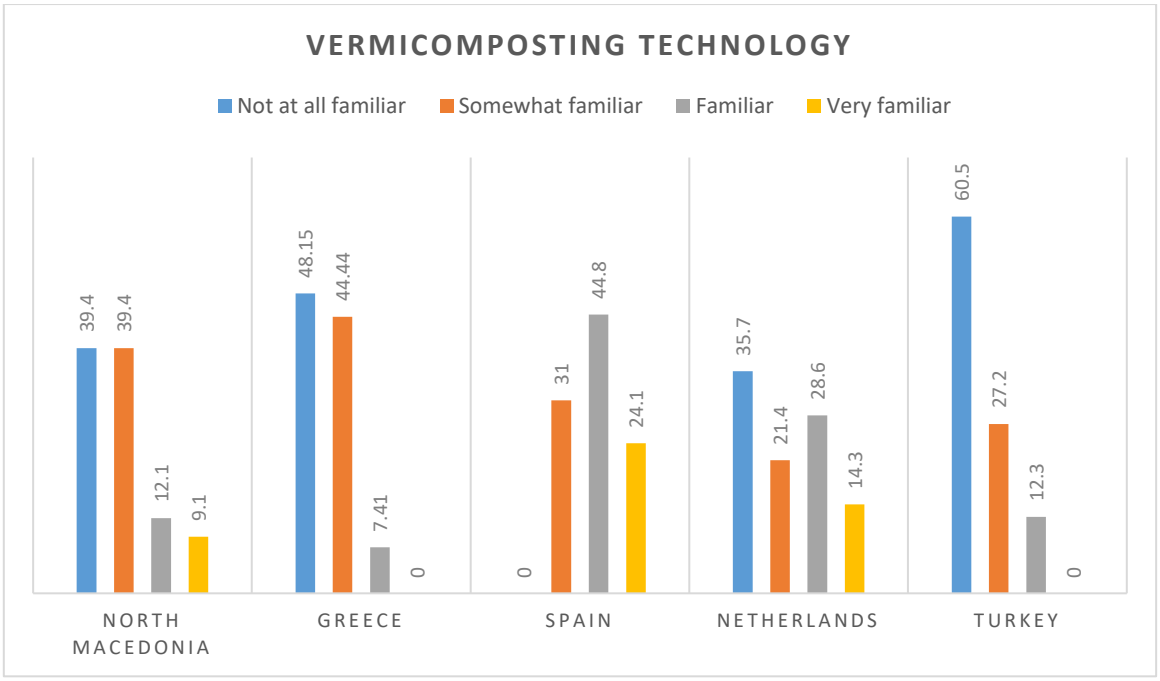
Familiar

69.63%

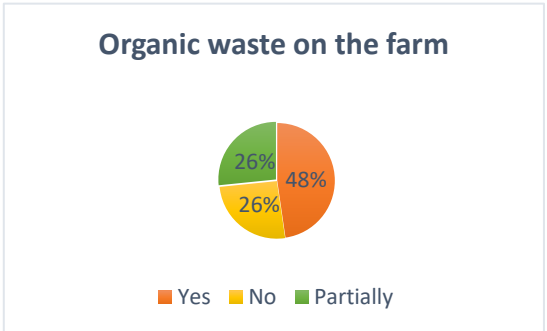
Not familiar

30.37 %

However, the results shown that the respondents are not so familiar with the vermicomposting technology, except in Spain, where the major number of the respondents are familiar or very familiar with the technology.



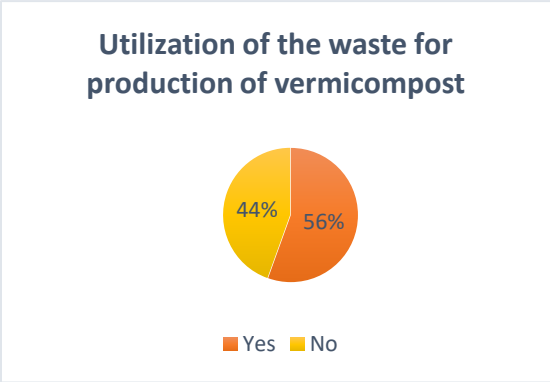
48% from the respondents have organic waste accumulating from their farming activities, and 26% of the respondents have some partial organic waste.



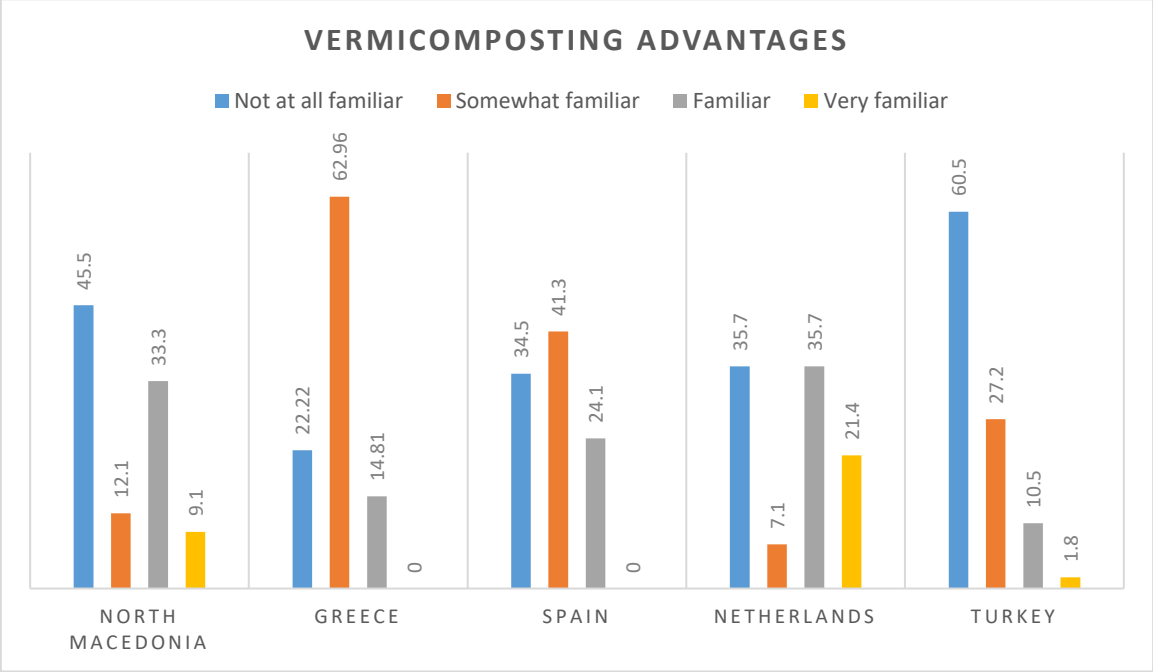
[1] These numbers refer to data obtained from North Macedonia, Türkiye , Spain and the Netherlands for 191 respondents. Data from Greece was not available.

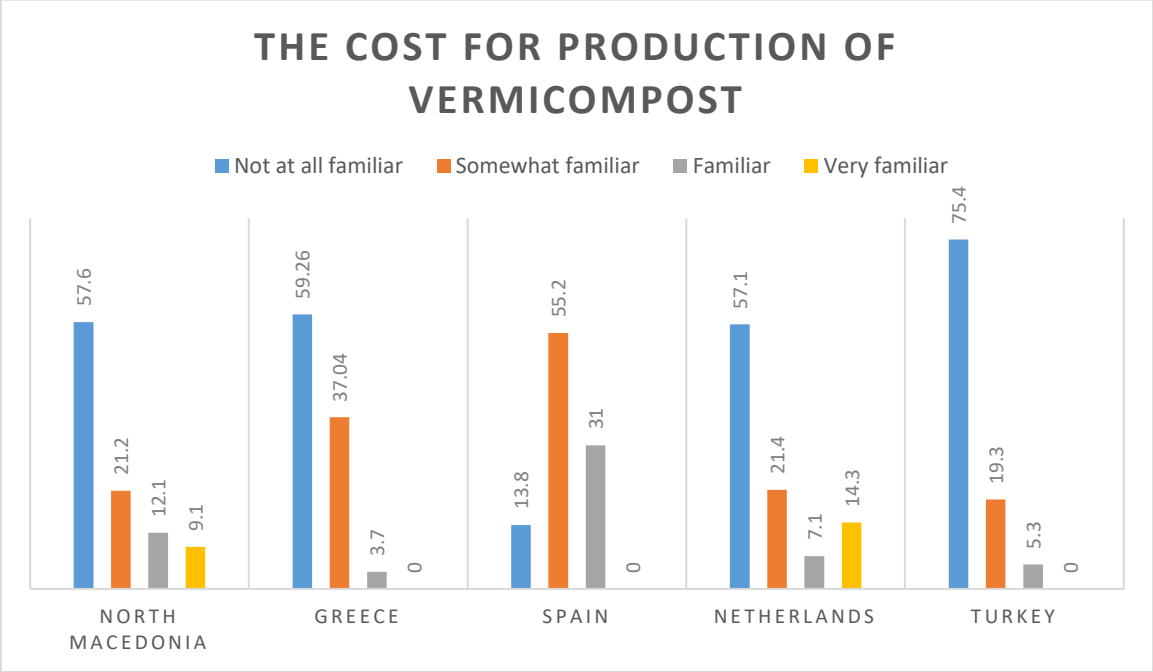
The participants were asked how they handle the organic waste accumulated on their farms and only 22.48% of the participants responded that they compost the waste.

55.5% of the respondents think that farmers can produce vermicompost very shortly by themselves through utilization of that waste.

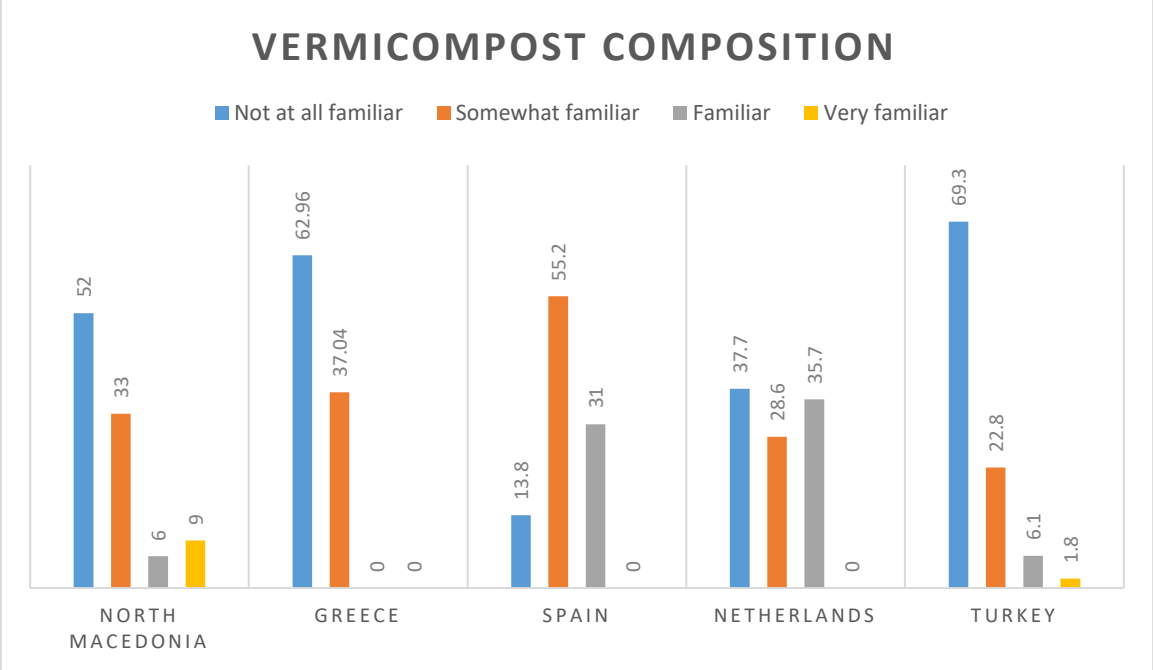


The majority of the respondents are not familiar with the advantages of vermicomposting, and a good portion of the respondents is familiar and somewhat familiar and very small percentage are very familiar with the advantages of vermicomposting.



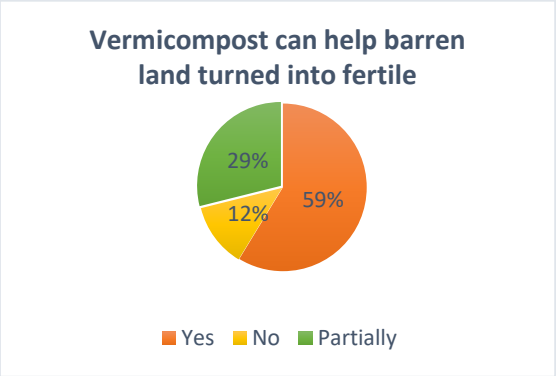


The majority of the respondents is also not so familiar with the cost for production of vermicompost or are somewhat familiar with the costs.



The results show that the respondents are also not so familiar with the composition of vermicompost or are somewhat familiar.

On the other hand, the majority of the respondents (72.7%) agree that vermicompost can help barren land turned into fertile.



The respondents were asked to list the barriers which they face in the process of practicing vermicomposting:

North Macedonia	Vermicompost weeds Insufficient equipment for vermicomposting. Crab infestation (they eat the worms) Protection from moles Poor infrastructure Required time, labor and necessary finances for compositing Lack of placement for sale of the final product Laws Education
Greece	Lack of knowledge and skills Lack of information about the production cost of vermicomposting. Low understanding how to compost and what can be composted. Technology performance Insufficient quantity Technical problems, odors The notion of vermicomposting is time-consuming, the lack of an established system to collect scraps Concerns about pests or unwanted odors. Lack of farmers' cooperation with educational agriculture experts. Lack of local leaders to promote the use of modern techniques. There is no understanding of the importance of composting. Lack of awareness of the relative advantages of biofertilizers . Lack of successful farmers' impact on the other farmers on executive plans. Low priority for composting
Türkiye	Storage constrains Difficulty of use

Netherlands	Lack of infrastructure Financial limitations or difficulties Limited land or space available Pest and diseases management Limited market demand Regulatory barriers
Spain	Time management Lack of knowledge of how to use vermicomposting techniques Maintaining a good environment for the compost (temperature, humidity…) Infrastructure issues Obtaining organic matter Finding good quality worms Watering

A huge number of the respondents are aware of the ecological advantages from vermicomposting. The ecological advantages that vermicomposting has over the environment, listed by the respondents, by country are:

North Macedonia	Waste management, fertilizer improvement Clean environment, improvement of soil quality, sustainable agriculture without bio waste. A large part of organic waste is thrown away by farmers in places where it can be harmful to the environment, it can be used in vermicomposting and thus returned to natural processes. Vermicomposting is the transformation of organic waste into a slow-release organic fertilizer. It is also a good alternative to standard chemical fertilizers, which are known for releasing a large amount of CO2 emissions to produce them..... It enriches the composition of the soil, improves the immunity of plants, does not imitate harmful gases, increases the organic part in the soil, enriches the soil with oxygen, etc. The structure and fertility of the soil is improved, and the environment is not polluted Production of humus, it is good for mixing soil in flowers, for feeding vegetable products and so on Organic substances are not as toxic to the environment as inorganic substances, but scattered or thrown away, they look unsanitary and cause a sense of neglect... Reduction of environmental pollution and improvement of soil structure

	Reduced use of chemical means for soil nutrition, reduction of acidification of cultivated areas Reducing waste disposal costs, reducing harmful gas emissions, improving soil fertility and biodiversity Reduction of CO2 emission and production of healthy food We eliminate artificial waste that is a big polluter of nature. With organic fertilizers, we reduce the protective means that are massively used in agriculture (Insecticides, fungicides and herbicides). Artificial fertilizers and protective means degrade several million hectares of fertile soil and turn them into deserts. If worms are raised in pig and cow farms, there will be no pollution of the underground water. From one mini farm of 10 cows, 100 tons of waste are obtained. If worms are processed (casting), 100 tons will yield 50-60 tons of biohumus. 50-60 tons of biohumus when sold (I have an export company) the farmer can earn around 20,000 euros annually. Cows, calves and milk are only losses and that's why the farms are closing. The soil is not polluted with various chemical means.
Greece	Vermicomposting reduces and eventually eradicates the need for chemical fertilizers. It attends to social issues and recycles waste. Vermicomposting contributes to many environmental benefits, including waste recycling. Less chemicals It recycles waste. Bio fertilizer Less chemicals Less use of chemicals less chemicals and less energy less chemicals for protection and nourishment Waste reduction, pollution reduction Waste recycling, so, it is good for the environment. Less use of chemicals. Protection of sensitive ecosystems Reduced use of chemicals in plant protection and nutrition
Spain	Soil replenishment Getting products with better quality Improves soil biodiversity Less use of chemicals Better waste management
Türkiye	Yield increases Turning waste into fertilizer The need for irrigation is reduced

	Reduces chemical pollution of the soil
Netherlands	Enables sustainable agriculture Reduces the use of chemical additives and energy inputs Sequesters carbon from the atmosphere Reduces pollution Ensure food security Enhance soil health Healthier plants and more diverse ecosystem Reduce the carbon footprint of organic waste Promotes biodiversity Ensure water efficiency and conserve irrigation water Reduces greenhouse gas emissions Diverts waste from landfills Reduces waste

The respondents were given several statements in regards to vermicomposting, where they stated whether they agree or disagree with them. The results are shown below:

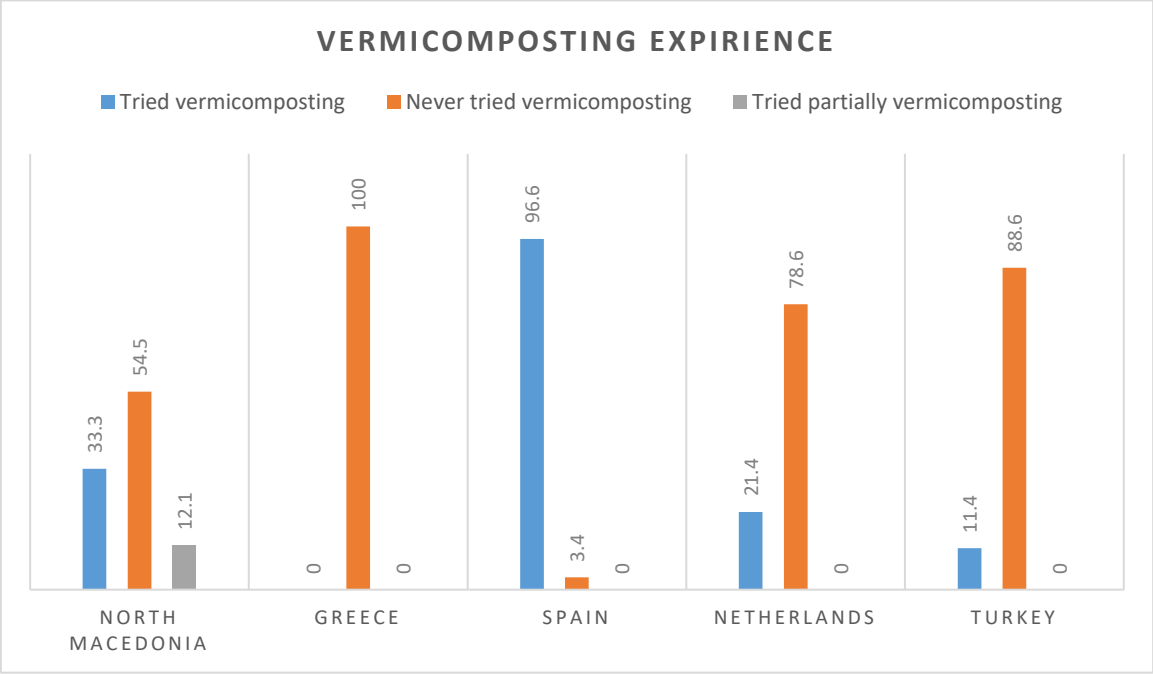
	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
Introducing earthworms into soil from vermicomposting is one of the most natural, ancient and perhaps the best among all sustainable agriculture practice.	4.93%	12.11%	29.6%	38.57%	14.35%
Vermicomposting means less reliance on purchased inputs leading to low cost of production	2.69%	8.07%	29.6%	43.05%	16.59%
Enhancement of soil productivity.	3.14%	4.04%	18.39%	43.95%	30.49%
With vermicompost the produce will be with better taste, luster and keeping qualities without toxic residues	3.14%	8.52%	23.77%	43.95%	20.63%
Vermicompost is rich in nutrients content and this may be good asset for sustainable agriculture.	3.14%	4.48%	20.63%	43.95%	27.8%

Wastes become valuable raw material for the soil biotechnological processes.	2.24%	4.48%	20.63%	42.6%	30.04%
More ground water recharge and less groundwater depletion.	2.69%	7.62%	27.35%	43.05%	18.83%
Soil salinization is reduced with low soil erosion and runoff.	3.59%	2.69%	30.49%	45.47%	17.49%
Vermicomposting can boost up rural economy.	2.69%	4.93%	26.01%	44.39%	21.97%
Reduced wasteland formation.	3.59%	10.31%	27.8%	39.46%	12.11%

The results above give us a clear picture of the understanding of the respondents in regards to the advantages of vermicomposting. The results shown that the majority of the respondents are aware of the advantages. These results give us great starting point for the further development of the project results.

IO.2.1.3. Participants experience with vermicomposting[2]

The majority of the respondents (73%) never tried to start composting the waste from their own farms, 25% of the respondents tried and 2% of the respondents tried partially.



The respondents that tried vermicomposting on their farms, listed the vermicomposting system they used or are still using:

North Macedonia	Worm house of 8m2 Composting with bio waste from own farm first with California worms and then with earthworms from own farm. Barn litter Plastic box Worms and waste from sheep Animal waste Used animal manure that was processed by California worms. Beds for California worms
Türkiye	Cold compost
Netherlands	Bin system Compost piles
Spain	Bocashi In old bathtubs Vermicomposting piles Piling up waste

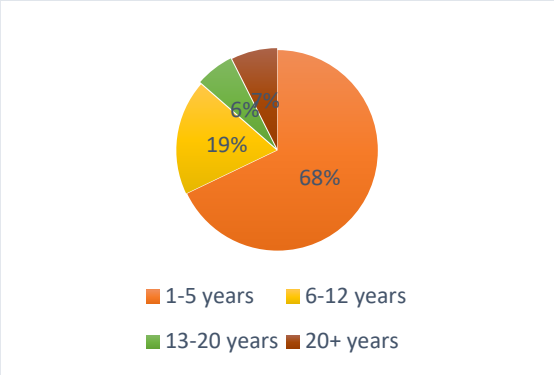
[2] The following questions do not contain responses from Greece, as none of the respondents in Greece ever tried vermicomposting.

	Heap and flip Hot compost

The respondents were asked how they colonized the compost systems. The answers of the respondents on the colonization of the compost system are:

North Macedonia	At first, I collected them from my farm and the stream of the nearby river, and then I propagated them myself. I added earthworms that were doing the composting and I got them from other people The same in groups or families multiplying and processing the material gradually keeping in the wet areas. If it is a product of animal origin, only worms are used. If it's about plant residues, then composting can be done with worms and they should be helped with soil bacteria (humifiers) which are in our product ORGALIFE TECNO for faster decomposition of organic matter and creation of CRN ZREL HUMUS
Tukey	Regeneration
Netherlands	Earthworms can reproduce in a compost system, which can help to establish a population of worms in the compost over time. They colonise a compost system by introducing organic matter containing earthworm eggs. Earthworms colonise the system under proper moisture and temperature levels, providing a diverse mix of organic materials for the worms to consume. They can colonise a compost system by introducing earthworms from a different location, either by adding them directly to the compost or by allowing them to migrate into the compost from the surrounding soil.
Spain	From the soil (by themselves, without any human help) Im not sure I added them myself They were given to me I purchased them

Half of the respondents have a composting system that they have been using for different periods. The majority (68%) of those composition systems are relatively young from 1-5 years old.

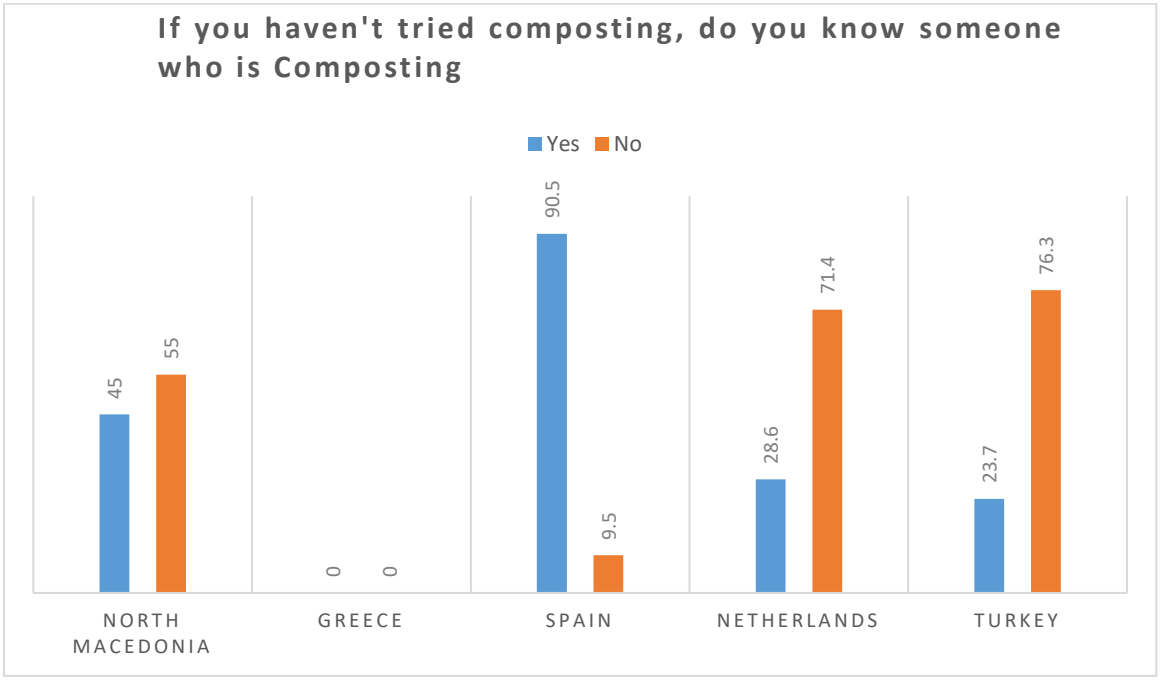


The respondents were also asked what components they put in their compost system:

North Macedonia	Sheep waste Waste from plant production and agricultural waste Bio-waste from the farm and domestic bio-waste, with the occasional addition of aged stable manure. Green manure Apples, grass, sheep waste Barn litter Organic vegetable waste, compost manure, used mushroom compost Cow manure, straw, fodder residues such as silage and haulage, various fruits and vegetables. Used mushroom substrate Leaves, food waste
Türkiye	Animal manure Carbon source Nitrogen source Plant residues
Netherlands	Branches Stems Straws Food and vegetable scarps Grass clippings
Sapain	Coffee grounds Manure Vegetable waste Organic matter Woody debris

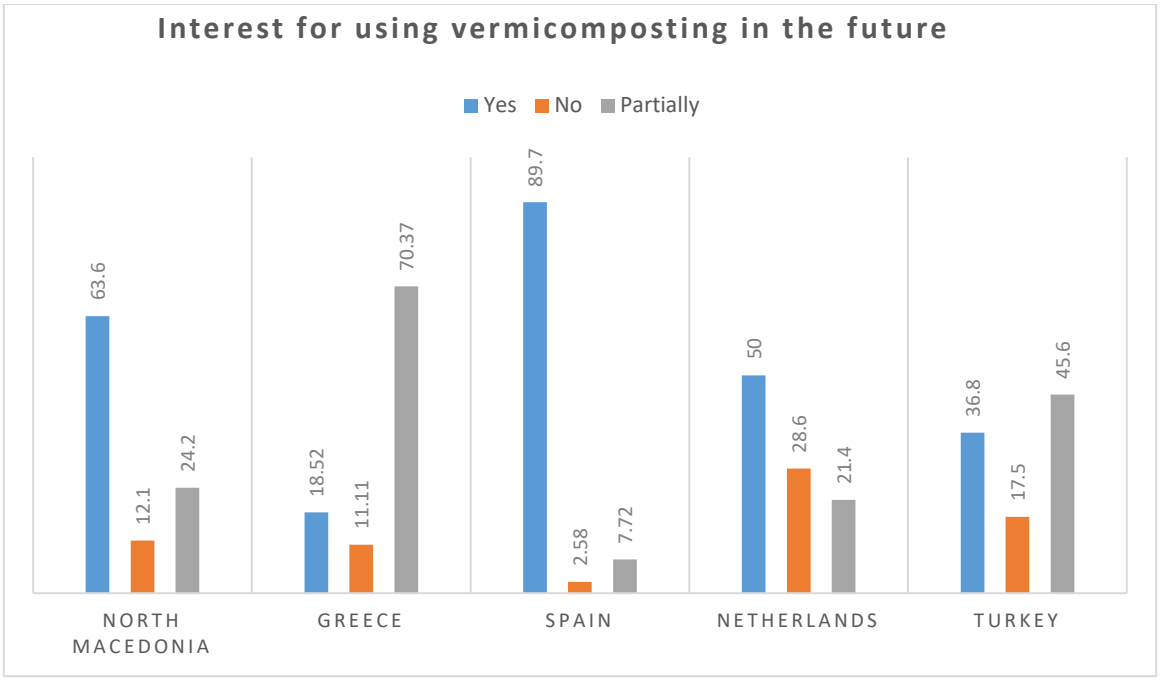
	Eggshells Straw Certain food leftovers Paper/cardboard Water Soil Urine

The majority of the participants in North Macedonia, Türkiye and the Netherlands are not familiar with anyone that is composting in their area. The majority of the participants is Spain are familiar. For Greece there was no data available for this question.

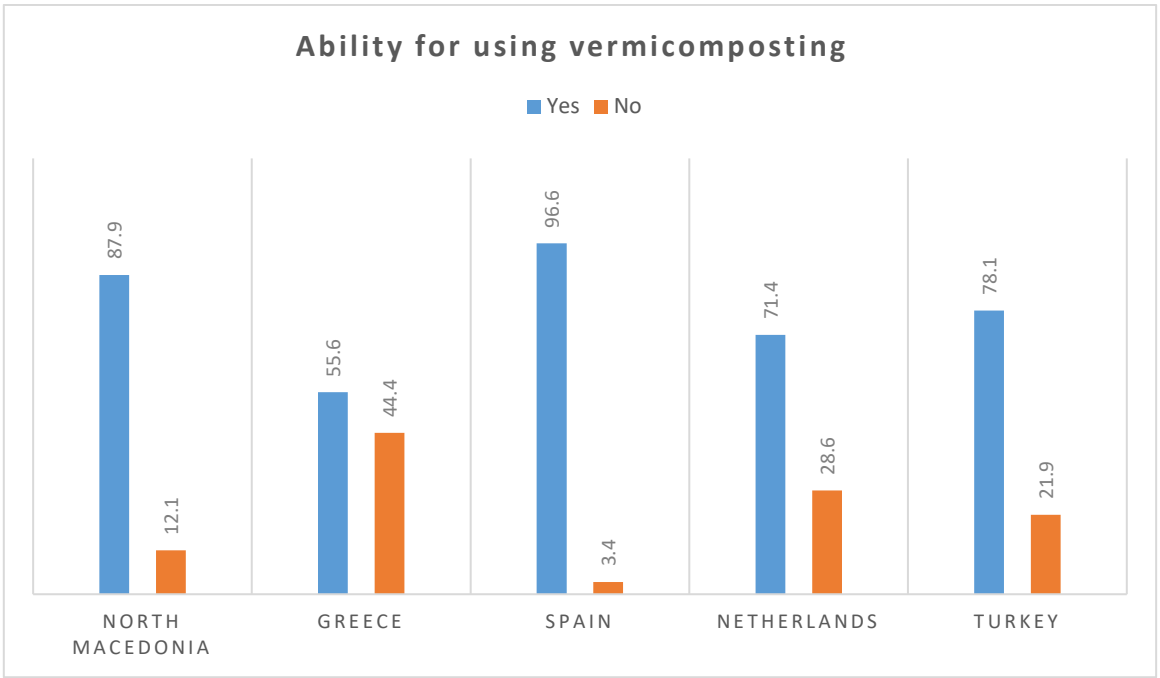


IO.2.1.1. Participants interest in practicing vermicomposting

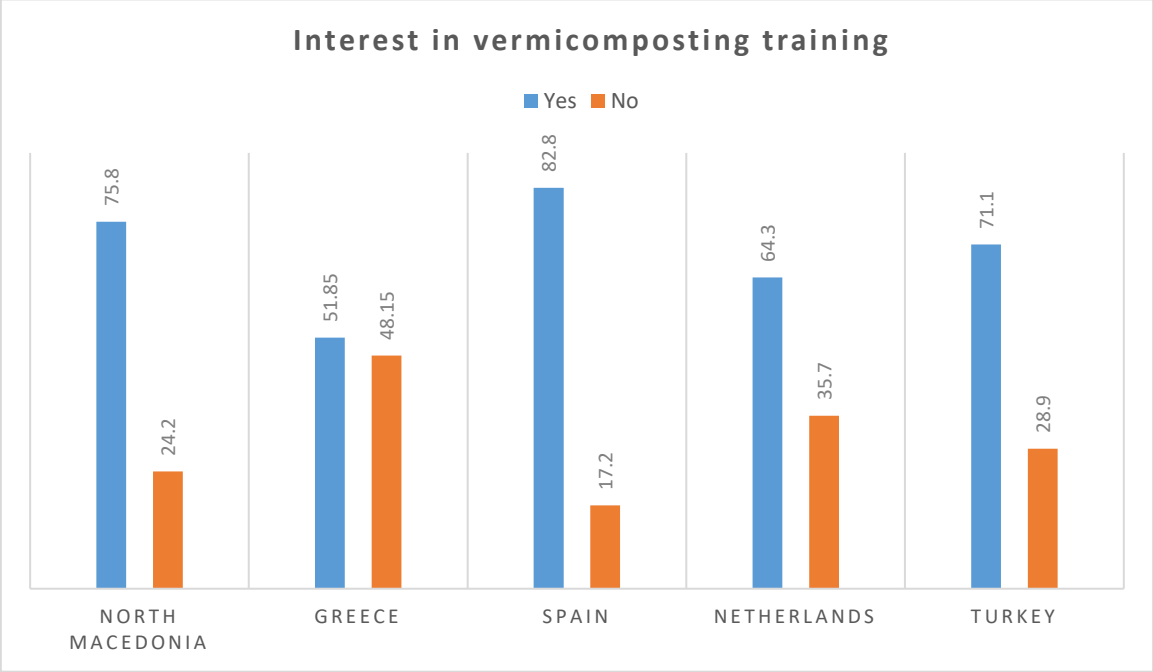
The interest of the respondents in practicing vermicomposting is different in each country. Spain has the greatest interest and the lowest interest is in Greece, where the majority of the respondents would only practice vermicomposting partially.



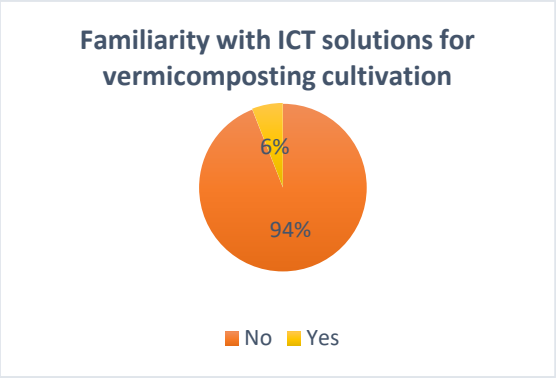
However, we also asked the respondents on their abilities to practice vermicomposting in the future, and the majority of them stated that they believe that they will be able to practice vermicomposting on their farms.



The results from the survey shows that the majority of the participants are interested in participation in training on vermicomposting.



The respondents were also asked if they are familiar with any kind of Information and Communication Technology (ICT) solutions for vermicomposting cultivation. The majority of them were not familiar.



Only 6% of the respondents are familiar with Information and Communication Technology (ICT) solutions for vermicomposting cultivation and several examples are given:

- Automation of the process itself through sensors for moisture of the material, automatic moistening, automated addition of new material to the compost, execution through a mobile application for the state in which the compost is located, etc.
- I took part in the Soil Food Web training
- We used sensors to monitor the temperature and moisture levels to optimise the conditions for the worms and facilitate the decomposition process. Vermimeal and Compostify are beneficial applications to connect with actors in the field. Users can

sign up for a vermicomposting service or find a community composting initiative to join.

- I tried mobile applications to get information on techniques, guidance and how to set up and maintain a vermicomposting system.
- We used data management systems to store and analyse data on the performance of the vermicomposting system. We also used monitoring systems to remotely monitor and receive alerts if any issues needed to be addressed. Compooster and VermiPro were two beneficial applications in our process.

6. RECOMMENDATIONS

From the results shown above, we can conclude that the research was implemented successfully for both of the questionnaires.

The results show that the profile of the participants perfectly fits the purpose of this research. We have included a great combination of the target groups. The majority of the respondents in the Survey for VET Schools, Agricultural Centers, and HEIs are quite experienced in their line of work, are qualified in the agricultural sector, and have previously participated in agricultural trainings. Therefore the results received in this research are relevant to the purpose of the research.

The conclusion from the Survey for VET Schools, Agricultural Centers, and HEIs show that:

- The knowledge of the respondents on Vermicomposting is very weak;
- The majority of the respondents have not obtained any non-formal learning so far on vermicomposting;
- The respondents are not so familiar with terminologies and the range of vermicomposting technologies that are used in Farming, Agricultural activities;
- The respondents are quite aware and familiar with the most common challenges in the agricultural sector in their own country;
- The respondents are not familiar with National Policies & Initiatives which are aimed to promoting the concepts/benefits of vermicomposting and fostering support in implementing vermicomposting;
- Most of the respondents do not have any experience with vermicomposting and also very few of the respondents were able to identify some positive examples of vermicomposting in their communities;
- The respondents know very small number of positive examples of farmers that practice vermicomposting;
- The majority of the respondents are not familiar with any Information and Communication Technology (ICT) solutions for vermicomposting cultivation.

In regards to the involvement of Vermicomposting in the educational curricula and programmes in the Agricultural education in the respective countries, the conclusions are:

- Vermicomposting is not fully included in the Agricultural curricula or education programmes in the respective countries, meaning it is included as part of some teaching subjects or partially mentioned in some materials;

- Vermicomposting is not at all included in the practical activities of the students in the respective countries;

- Educators lack of proper educational materials for vermicomposting, since most of them are not complete and the educators identify and find them on their own;

- Most of the educational institutions lack of opportunity for practical application of vermicomposting;

- There is lack of cooperation between the educational institutions for practical learning;

- There is lack of specific knowledge on vermicomposting of the educators;

- The major number of the respondents believe that the students and famers do not have the necessary knowledge on vermicomposting.

From the results of the survey on local VET Professionals and Farmers we can conclude that we covered the target groups in the respective countries successfully and we have good composition of the respondents with farmers that have Mixed production, Crop production and Livestock production, and the results from the research are relevant for the purpose.

The conclusion from the Survey for local VET Professionals and Farmers show that:

- The majority of the respondents are not so familiar with the vermicomposting technology;

- The majority of the respondents have not obtained any non-formal learning so far on vermicomposting;

- The majority of the respondents are not familiar with the advantages of vermicomposting;

- The majority of the respondents is also not so familiar with the cost for production of vermicompost;

- The respondents lack of knowledge and skills for vermicomposting;

- The respondents are aware of the ecological advantages from vermicomposting;

- The majority of the respondents do not have experience in vermicomposting;

- There is interest in the respondents in practicing vermicomposting;

- The majority of the participants are interested in participation in training on vermicomposting;

- The majority of the respondents are not familiar with any Information and Communication Technology (ICT) solutions for vermicomposting cultivation.

Based on the results from both surveys the training materials produced in this project should include:

- Detailed information about the vermicomposting technique by steps and the utilization of vermicompost;
- Nutrient composition of vermicompost;
- Detailed information for Earthworms for Vermicomposting;
- Detailed information for needed investments for vermicomposting;
- Good practice examples of farmers that are practicing vermicomposting;
- Detailed information about the economic returns of vermicomposting;
- Detailed information of the benefits of vermicomposting;
- Detailed Information and Communication Technology (ICT) solutions for vermicomposting cultivation;
- Detailed information for Practical implementation of the vermicomposting process;
- Detailed market related information for vermicompost;
- Detailed information for improvement of cooperation between farmers and the educational institutions in regards to vermicomposting;

The training materials should be produced with more visual aspects and should be available in all languages of the project.

Annexes

Annex 1 National reports from North Macedonia, Türkiye, Greece, Spain and the Netherlands

Annex 2 PowerWORMS Questionnaire for local VET Professionals and Farmers (Responses) from North Macedonia, Türkiye, Spain, Greece and the Netherlands

Annex 3 PowerWORMS Questionnaire for the VET Schools, Agricultural Centers, and HEIs (Responses) from North Macedonia, Türkiye, Greece, Spain and the Netherlands