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D 5.3. DEVELOPMENT OF EXPERIMENTS/SIMULATIONS AND TRAINING MATERIAL

WP5 - DEVELOPMENT OF INFRASTRUCTURES



Deliverable 5.3. Development of experiments/simulations and training material

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Author(s):	<i>Emir Mujić, Alma Bosnić</i>
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Table of Contents

EXECUTIVE SUMMARY	5
1 GUIDELINES	5
2 INTRODUCTION.....	5
2.1 Aims and objectives of STEPS project.....	5
3 DEVELOPMENT OF EXPERIMENTS/SIMULATIONS AND TRAINING MATERIAL IN PARTNER COUNTRIES HEIS	6
4 DEVELOPMENT OF EXPERIMENTS/SIMULATIONS AND TRAINING MATERIAL IN ALBANIA.....	7
4.1 Development of experiments/simulations and training material at Agricultural University of Tirana (AUT-P1).....	7
4.1.1. Progress of the task	8
4.1.2. Collected data on the level of satisfaction regarding the STEPS equipment	8
4.2 Development of experiments/simulations and training material at European University of Tirana (EUT-P2).....	8
4.2.1. Progress of the task	9
4.2.2. Collected data on the level of satisfaction regarding the STEPS equipment.....	9
5 DEVELOPMENT OF EXPERIMENTS/SIMULATIONS AND TRAINING MATERIAL IN KOSOVO.....	10
5.1 Development of experiments/simulations and training material at University Haxhi Zeka (UHZ-P3)	10
5.1.1 Progress of the tasks.....	11
5.1.2. Collected data on the level of satisfaction regarding the STEPS equipment	11
5.2 Development of experiments/simulations and training material at Universum College (UC-P4).....	12
6 DEVELOPMENT OF EXPERIMENTS/SIMULATIONS AND TRAINING MATERIAL IN BOSNIA AND HERZEGOVINA	12
6.1 Development of experiments/simulations and training material at University of Bihać (UNBI-P5)	12
6.1.1 Progress of the tasks.....	14
6.1.2. Collected data on the level of satisfaction regarding the STEPS equipment	14
6.2 Development of experiments/simulations and training material at University of Sarajevo (UNSA-P6)	14
6.2.1 Progress of the tasks.....	17
6.2.2. Collected data on the level of satisfaction regarding the STEPS equipment.....	18
7 DOCUMENTS RELATED TO THE DEVELOPMENT OF EXPERIMENTS/SIMULATIONS AND TRAINING MATERIAL IN PARTNER COUNTRIES HEIS	18
8 CONCLUSIONS	18
9 RECOMMENDATIONS	18
10 REFERENCES	18

EXECUTIVE SUMMARY

Educational material that supports the laboratory, software-based exercises and projects designed for the students of the MSc STEPS programme at the Partner Countries HEIs has been developed. The material provides learning outcomes at experiment/simulation level, detailed description of experiments/simulations, guidance and description of STEPS, i.e. measurement protocols, tutorials, sample reports and scenarios for additional exercises and further research activities. For each of the experiments and simulations from the MSc STEPS syllabus, training material was developed by scientific staff involved in the development of the two laboratories, “Food Quality Control Lab” and “Food Production Systems Management Lab”.

1 GUIDELINES

- Briefly describe the **development of experiments/simulations and training material** at your University,
- When developing **experiments/ simulations and training material**, make sure it is in accordance with the syllabi of the MSc STEPS program,
- Developed experiments/simulations and training material for the MSc STEPS program syllabus should be based on the learning outcomes (at the level of experiments/simulations). Educational material need to be aligned with the theoretical part of the courses (*task 4.2*).
- Briefly describe relationship between developed **experiments/simulations and training material**, MSc STEPS program Courses and purchased STEPS equipment.
- Please provide all documents related to the development of experiments/simulations and training material (scanned PDF file), depending on your internal procedures, with translation of the document or document title. Supporting documents for development experiments/simulations and training material (**example-documents**):
 - ✓ Documents (e.g. Request), Request to the HEIs council to write **experiments/simulations and training material** (*original documents and English version*),
 - ✓ Documents (e.g. Decision), Decision of HEIs to adopt writing **experiments/simulations and training material** (*original documents and English version*),
 - ✓ Documents (e.g. Request; Registration/Procurement process) of purchased and installed software licenses.

2 INTRODUCTION

2.1 Aims and objectives of STEPS project

The main objective of the project is the implementation of a modern MSc programme on “Sustainable food production systems”, compliant with the Bologna convention. Food culture and sociology, agriculture and rural development, food engineering, quality and safety, environmental footprints, economics, management and governance will be combined in a flexible and modular educational programme, designed and developed in the light of the European initiative for the transition to circular economy. Partner countries HEIs will be supported in order to help them provide an education aligned to the needs of the labour market and society. Laboratories will be equipped with experimental devices, computers and software. Scientific staff of the HEIs involved in the consortium will have the opportunity to enrich their scientific background and be familiarized with modern educational methodologies and ICT tools, in order to practice student-based approaches, and provide teaching based on learning outcomes.

3 DEVELOPMENT OF EXPERIMENTS/SIMULATIONS AND TRAINING MATERIAL IN PARTNER COUNTRIES HEIs

Scientific staff of HEIs partner countries (AUT, EUT, UHZ, UC, UNSA and UNBI) supervised and mentored by the scientific staff from the program countries (USAMVB, CULS, TEISTE and ReadLab) designed Educational material - laboratory and software-based exercises and projects, with the aim of ultimately exploiting the purchased STEPS equipment and further improving the level of knowledge and the relevance of a variety of courses.

For each of the experiments and simulations from the MSc STEPS syllabus, educational and training material was developed by scientific staff involved in the development of the two laboratory types, “*Food Quality Control Lab*” and “*Food Production Systems Management Lab*”.

Scientific and technical staff of AUT, UHZ and UNBI, mentored and supervised by scientific staff of USAMVB and ReadLab developed experiments and training material related to the exercises/projects designed for the *Food Quality Control Lab*. Scientific and technical staff of UET, UHZ, UC and UNSA, mentored and supervised by scientific staff of CULS, TEISTE and ReadLab developed simulations and training material for exercises/projects designed for the *Food Production Systems Management Lab*.

Assisted by UNSA, UNBI provided guidance to align educational material with the theoretical part of the courses (*task 4.2*). Developed training material is based on learning outcomes at the experiment/simulation level and they include detailed description of the experiments/simulations, guidance and description of steps towards the successful implementation of the activity, samples as well as samples of the results and scenarios for additional exercises and research.

Task progress monitoring

The progress of the tasks was monitored based on the below listed indicators:

- ✓ *the number of facilities/software licenses purchased and installed,*
- ✓ *the number of laboratory experiments and software simulations designed,*
- ✓ *the number of training/manuals developed.*

For the purpose of impartial collection and satisfaction level data analysis regarding the STEPS equipment, UNBI designed an online survey for all HEIs partner countries ([link](#)).

The survey was conducted by scientific staff of Partner Countries HEIs and MSc students/attendees during the implementation of the MSc programme. In the surveys, the participants were inquired about the level of satisfaction regarding the equipment installed, its number and the level at which the equipment supports the courses, its relevance with respect to modern approaches and applications, as well as the level at which they provide significant benefits compared to the previously existing laboratory equipment. Also, they were also asked if the equipment can simulate industrial applications or can be directly used by private companies during common projects and research activities.

The data, collected via surveys, were analyzed and presented separately for each Partner Country HEI in in the chapters below

4 DEVELOPMENT OF EXPERIMENTS/SIMULATIONS AND TRAINING MATERIAL IN ALBANIA

4.1 *Development of experiments/simulations and training material at Agricultural University of Tirana (AUT-P1)*

Under the task WP5 and the activities 5.3 Development of experiment /simulation and training material, which include the practical part of the syllabus, all the academic staff that will be part of this Master of Science has started to prepare material in written and demonstrative form. All the material are being collected and will be placed in the website, under each module.

The curricula of the MSc program “Sustainable Food Production System “(STEPS), has been approved by both the two Universities, Agricultural University of Tirana and European University of Tirana.

Each professor responsible for their module, has prepared a syllabus according to the requirement presented in the VKM 41, date 24.01.2018, which describes all the requirements necessary to better describe the curriculum of a course.

Some Training for the laboratory devices has taken place and they have helped the academic and specialized staff, to create and to produce better written and demonstrative material.

Advanced Food Science and Technology, 1st semester compulsory course. In the practical part, the student will have the possibility to design new technology in the production of the products based on the sustainable technology. Some materials are being prepared and will be ready for the students as soon as the Master will begin. For example the dry of the apples using different technologies, oil extraction, grain milling etc. In this course 12 laboratory exercise are being prepared. Hurdle technology applications, new emerging preservation technologies; main characteristics and importance of the use of new technologies in the food industry, storing food quality with a low-cost processing, and studying trends in food processing are topic which will be concretised in the practice with ideas of food design using an integrated approach comprising hurdle technology, applications for food preservation.

Development of new products, 3rd semester, elective course. This course will help the students with some great practical ideas in order to produce new product that will have nutritional value added and accepted by the consumer. They will also help reduce waste in the food industry, using some of their waste in the production of new products. An example would be the production of bread or biscuits with pomegranate skin flour, etc. In this course 10 laboratory exercise and practical material are being prepared.

Development and management of quality systems and evaluation of shelf life of food products, 2nd semester, compulsory course. In this course, the professors are preparing some experimental material, where with the determination of some chemical, physical and sensorial properties, the evaluation of the shelf life for the food production will take place.

Traceability Systems of Food products: Elective course, planned for the first year, second semester. In the last decades the safety and quality of food has become a very important issue because the number of diseases originating from food, food allergies and the production of genetically modified products has increased significantly. Therefore, in order to protect the health of the consumer and also to meet the demands for trade between countries, it is important to implement a traceability system throughout the food chain or the so-called "From farm to fork".

The course "Traceability systems of Food products" is design for students of the Scientific Master "Sustainable food production Systems". The first part of the module introduces students to the concept of traceability, objectives and relevant legislation and regulations in Albania and EU countries. The second part of the module gives the student information about new techniques based on DNA molecule, immunological technique (ELISA) etc. and their application in different food products to realize the traceability and authentication of these products. The third part of the module analyze the use of analytic technique such as ICP-MC in food traceability. The theoretical script was prepared from the responsible lecture of the module. In accordance with the theoretical part of this course, a detailed description of the experiment/simulation is prepared e.g., using ELISA technique (ELISA reader was purchased with the STEPS project budget) for the identification of allergen in food, PCR technique for the determination of bacterial pathogens in food etc.

Environmental chemistry. Elective course, planned for the first year, second semester. This course aims to acquaint students with the risk assessment of pollutants in the chain of food production, main properties and characteristics of chemical and biological pollutants, techniques chemical and biological methods used to investigate and prevent these pollutants. Particular attention will be paid to general scientific principles and methods as well as special professional knowledge needed to understand the potential sources of these pollutants within the food production chain as well as on the ways of their management. This course will also cover aspects on environmental chemistry and environmental pollution, assessment the risk of contaminants and food waste, organic pollutants, agricultural waste, heavy metals and metalloids, microbiological pollutants, mucotoxins, phytotoxins and pollutants of plant origin, some of them with experimental evaluation, in a qualitative and quantitative method.

4.1.1. Progress of the task

4.1.2. Collected data on the level of satisfaction regarding the STEPS equipment

4.2 Development of experiments/simulations and training material at European University of Tirana (EUT-P2)

European University of Tirana has started the design and development of experiments/ simulations and training materials, for some of the courses that will be delivered after the opening of the study program. Below are listed some short examples of this task:

Quality Management in the Agro-Food Sector - In the topic Techniques and Methods of MCT - students will develop a practical project for a certain quality problem in a business company. They will use some of the techniques and methods of MCT, including the Pareto diagram, cause-effect diagram, etc. to identify the main causes and to build procedures for their solution. In the topic Tracking and Hygiene Systems - students will work in groups of practical tasks related to the ISO 22000 Standard, focusing mainly on the general requirements that must be met by the Food Safety Management System of an agro-food business, risk control through pre-programs, HACCP plan and continuous improvement.

Marketing of Sustainable Agro-Food Products – topic 9 addresses the various objectives of pricing, and then proceeds with the theory of pricing. It goes further with the factors that influence the setting of prices, as well as with the methods that are mostly used in setting prices. It also shows the different strategies used by companies, using pricing as a basis. Pricing methods are based on three main factors which are Demand, Cost, and Competition. Here, all three methods will use analytical techniques, and mathematical equations to find the right price for food companies. At the same time, it is foreseen to have guests in the auditorium, from a food company in our country, and a site visit to such a company as well.

Innovation and Entrepreneurship for Sustainable Food Production – elective course in the 3ed semester. The practical part of the course refers to developing a business plan where the students will outline management and organization, provide logistics and operations actions, staffing, taxes, and government regulations (all necessary for protecting their businesses). Students then will move into marketing, investigating how to persuade others to buy their products and services and learning how to manage an existing business.

Data Analysis and Decision-Making - a) Based on historical data on the production performance of one of the business products over the years, evaluate the central trend with statistical methods for time series analysis. **b)** Referring to a product (milk, cheese, etc) for a period of three years, evaluate the seasonal ingredients according to statistical analysis. In the role of decision maker define the business perspective.

Sustainable Management of Supply Chain - For selected business from students, define the supply chain referring to the modelling, design, execution, control, and monitoring of the respective activities with the aim of establishing the successful supply chain. Calculate the respective cost of the chain.

Sustainable Management of Value Chain of Food - For a specific business, define: supply and value chain, determine the impact of the present competition, determine the impact of potential competition, what are the possibilities of your indication as a manager to minimize impact and competition, make an assessment of your decision-making.

4.2.1. Progress of the task

4.2.2. Collected data on the level of satisfaction regarding the STEPS equipment

5 DEVELOPMENT OF EXPERIMENTS/SIMULATIONS AND TRAINING MATERIAL IN KOSOVO

5.1 *Development of experiments/simulations and training material at University Haxhi Zeka (UHZ-P3)*

Considering the activities related to WP5 (Development of experiments/simulations and training material) UHZ teaching and research staff has developed teaching material and instruction materials for laboratory classes as well as software stimulations. All these activities were prepared immediately after accreditation of the study program MSc Sustainable Food Production Systems/STEPS. Training, open lectures and seminars organized as foreseen in WP3 (D3.2.) have a great impact on the development of material and practical work of the students. The UHZ staff attended seminars and HEIs staff from the program countries (USAMVB, ReadLab, CULS, TEISTE/AUA) conducted lectures on different subjects. The experience and know-how gained from these lectures as well as from open lectures trainings presented in Peja, Sarajevo and Bihac were very useful for UHZ staff in improving teaching techniques and laboratory exercises. Experiments/simulations and training material were designed before the beginning of the teaching process, and are completely in accordance with the compulsory and elective subjects in the syllabi. The material was developed for those subjects that have a practical part in their teaching content-syllabus, including practical, computational or laboratory exercises in the field of Food Quality Control Lab as well as software simulations in the field of Food Production Systems and Management Lab.

Students use laboratory equipment and computers, which UHZ benefited from the STEPS project. Apart from teaching and laboratory activities, since October 2021, the teaching staff emphasized very much in developing and implementation of the practical part of the syllabi especially for those subjects where practical classes in laboratory and production facilities are necessary. Staff responsible for both compulsory and elective courses organized collaboration through working visits to specific public and private institutions in the 1st and 2nd semesters.

MSc students from UHZ attending the study program “Sustainable food production systems” are already using experiments/simulations and training material for the following compulsory and elective courses in the 1st and 2nd semesters, as follows:

Fundamentals of Sustainable Agri-Food Systems – 1st-semester compulsory subject.

Based on the theoretical part of this course educational material was created which includes a detailed description of the experiment/simulation guidance for successful implementation of exercises and research related to Life-cycle Assessment. This material includes also information about collecting, analysing and monitoring the sustainability efficiency data of the company’s products and services, decision-making, changing products’ life cycles for the better, and improving the company's positive impact.

Agricultural and Food Industry Waste Management - 1st - semester compulsory course.

Training material in the form of an authorized script for laboratory exercises entitled Waste Management in Agriculture and Food Industry was prepared. Apart from general guidelines, this material includes detailed laboratory exercises in to be used by students during practical work.

Advanced Food Science and Technology - 1st - semester compulsory course.

A script entitled “Achievements in Food Science and Technology” was developed based on the syllabi of this course. This script includes 20 detailed laboratory exercises for practical training of students and also a guidelines in the field of food legislation and the latest information related to modern instrumental methods in this field

Research methodologies and tools compulsory -1st semester compulsory course

A script entitled “Research methodology” was developed based on the syllabi of this course. This script includes information for master students related to the application and access to different databases such as Web of Sciences, Scopus, PubMed, EBSCO, etc. The computers donated by the STEPS project have made it easier access to the field of scientific research and have enabled students’ access to areas of various research and the application of technology. The script is designed to help students of the master’s level realize the practical aspects of this course such as the design of project proposals, preparation of how to write a scientific paper, preparation of postcards for participation in conferences, seminars, etc.

Traceability systems of food products

This is a second-semester elective course. Apart from the theoretical part a training material was developed, which in addition to basic traceability information contains also practical exercises related to monitoring and control of traceability implementation for food products.

Development of experiments/simulations and training material at UHZ for the needs of MSc STEPS students is a continuous process in designing materials for all courses of the program. It is a dynamic process, which considers the development of new materials but also updating existing materials following trends, new achievements, and new equipment, and specific areas within sustainable food production systems.

Note: The process of developing the further experiments/simulations and training material at UHZ is continuing. MSc students use the currently developed material. Some records of practical implementation of certain courses are presented through photos and videos (attachment)

5.1.1 Progress of the tasks

For monitoring progress according to defined indicators, we say that staff and the MSc STEPS students in the field of Food Quality Control Lab already use the scripts for the courses in the first and the second semester.

5.1.2. Collected data on the level of satisfaction regarding the STEPS equipment

For collection and analysis of data on the level of satisfaction with STEPS equipment, UHZ is in the process of implementing of online surveys, which consist of two parts. The first part is related to „The level of satisfaction with the new equipment purchased within the Erasmus+ STEPS project (Scientific/Teaching/Technical staff) “, while the second part is related to the „Level of satisfaction with the new equipment purchased within the Erasmus+ STEPS project (students) “.

5.2 *Development of experiments/simulations and training material at Universum College (UC-P4)*

6 DEVELOPMENT OF EXPERIMENTS/SIMULATIONS AND TRAINING MATERIAL IN BOSNIA AND HERZEGOVINA

6.1 *Development of experiments/simulations and training material at University of Bihać (UNBI-P5)*

In accordance with the tasks within WP5 and activities 5.3 *Development of experiments/simulations and training material* which essentially include development of experiments, simulations and materials for practical - laboratory exercises and student training, UNBI teaching and research staff started designing and creating materials in a form of scripts/manuals with guidelines and instructions, as well as individual laboratory exercises and software simulations after approval and establishment of the study program [MSc Sustainable Food Production Systems/STEPS](#). Organized trainings and D3.2 Seminars and lectures intended for HEIs partner countries teaching/scientific staff have greatly contributed to the quality preparation and development of this material. As planned by the project, these trainings, seminars and lectures were organized and conducted by HEIs staff from the program countries (USAMVB, ReadLab, CULS, TEISTE / AUA). The trainings conducted during the Peja and Sarajevo meetings were especially important for the UNBI teaching and scientific staff. However, as the development of experiments/simulations and training material is a continuous and constantly open activity combined with the later conducted online and live trainings (Bihać, Pristina and Tirana meeting), they were important for the update of the existing materials and as a preparation ground for the creation of the new training material in the future. Experiments/simulations and training material were designed before the beginning of the teaching process, and are completely in accordance with the compulsory and elective subjects in the syllabi. It is important to point out that this material was developed for those subjects that have a practical part in their teaching content - syllabus, whether it is practical, computational or laboratory exercises in the field of *Food Quality Control Lab* or software simulations in the field of *Food Production Systems Management Lab*. Accordingly, for the purposes of training MSc STEPS students in UNBI, experiments/simulations and *training material* were developed for the following compulsory and elective courses in the 1st and 2nd semester, as follows:

Fundamentals of Sustainable Agri-Food Systems – 1st semester compulsory subject. In accordance with the theoretical part of this course, an unauthorized educational material was created - a manual for software exercises based on LCA software. This material include detailed description of the experiment/simulation LCA SimaPro project, (*SimaPro Faculty license; Release 9.1.1.1*) guidance and description (inputs and outputs) of steps towards the successful implementation of the activity, samples as well as scenarios for exercises and research of: Life-cycle Assessment (software-based exercises and projects); Life-cycle assessment (software-based exercises and projects) - collecting, analyses and monitoring the sustainability efficiency data of company's products and services; Life-cycle assessment (software-based exercises and projects) - decision-making, change products' life cycles for the better, and improve the company's positive impact.

Agricultural and Food Industry Waste Management - 1st semester compulsory course. Training material in the form of an authorized script for laboratory exercises entitled *Waste Management in Agriculture and Food Industry* was prepared and distributed. In addition to the introduction and general guidelines, the script included 34 individual, detailed laboratory exercises in this area intended for student training, following the syllabus of the subject.

Advanced Food Science and Technology - 1st semester compulsory course. As part of this course, which anticipates student practical - laboratory training in its curriculum, an authorized script entitled *Achievements in Food Science and Technology* has been designed and written, which in addition to 20 detailed laboratory exercises for practical training of students, includes guidelines in the field of food legislation and the latest information related to modern instrumental methods in this field

Harvesting and Post Harvesting Technologies – 2nd semester elective course. For practical training of students in this subject, training material was prepared in the form of an unauthorized script or manual entitled *Fruit Harvesting and Fruit Manipulation after Harvest*, which follows the theoretical part of the syllabus and is fully consistent with its content related to Practical–Laboratory and calculation exercise. In addition to 7 laboratory exercises, this material also contains chapters of instructions, guidelines and information related to fruit harvesting, handling, packaging and storing.

Animal Food Technology Science, Sustainable Technology of Meat Products and Sustainable Technology of Dairy Products - for these elective courses of the second semester, which anticipate laboratory exercises, UNBI teaching and scientific staff prepared an extensive script entitled *Quality of food of animal origin in sustainable food production systems of animal origin*, contains 29 elaborated laboratory exercises for sensory, chemical and microbiological analysis of animal origin food intended for practical education of students or as a control part in production.

Sustainable Animal Production, Sustainable Plant Production and Low Input Agriculture. Regarding the *training material* for software simulations (*LCA - software-based exercises and projects*) for these second semester elective courses, unauthorized training material was designed based on learning outcomes at the level of experiment or simulation. This material in the form of a manual is harmonized with the theoretical part and syllabus outcomes of these subjects, and in addition to instructions and guidelines contains a detailed description of the experiment - *simulation LCA SimaPro projects*: guidelines and description (inputs and outputs) of steps for successful analysis, samples and exercise scenarios and life cycle assessment research, LCA project design in low-input agriculture (crop and animal production), LCA project design in the areas of sustainable plant and animal production, environmental and resource impact analysis using LCA software.

Sustainable Land Management. For this second semester elective course, which anticipates a practical part in the form of laboratory exercises, material was designed in a form of an authorized script called *Sustainable Land Management*, which in addition to basic land information contains 18 laboratory exercises that give students the opportunity to acquire basic knowledge of soil as well as methods of soil study through theoretical knowledge, practical work in the field and in the laboratory easier and faster.

Finally, when it comes to the *development of experiments/simulations and training material at UNBI for the needs of MSc STEPS students*, it is important to emphasize that it is a continuous and constantly open process subject to designing new and updating existing materials following trends, new achievements and new equipment and specific areas within sustainable food production systems

Note: Due to the scope and amount of the developed experiments/simulations and training material at UNBI, and due to the copyright protection of certain scripts/manuals, it has not been updated on the GD STEPS project. However, as envisaged by the project, this training material was digitized and updated (D4.3) together with D4.2 educational material on the STEPS LMS platform (<https://mooc.steps-project.eu/>). MSc STEPS UNBI courses are created and run on the STEPS LMS platform. Also, all teachers and students of MSc STEPS at UNBI registered and started to use the platform. The part of the training material that has been authorized has passed the established procedure at UNBI, and the documentation related to these procedures is available on **Google Drive** and is linked in Chapter 7 of this report.

6.1.1. *Progress of the tasks*

For the purpose of monitoring progress according to defined indicators, we state that for the training of our MSc STEPS students in the field of Food Quality Control Lab, a total of 4 authorized and 1 unauthorized scripts were designed and written, which included 108 individual laboratory exercises from different fields, as well as great number of instructions, guidelines and information for students. One SimaPro LCA software license (Faculty license; Release 9.1.1.1) has been acquired within the Food Production Systems Management Lab and will be renewed every year. Based on this software, 6 manuals in the form of *unofficial training/teaching material* were designed and created. Each of these manuals, in addition to a brief guide, contains one detailed software simulation - scenario, or *LCA software - based exercises*.

6.1.2. *Collected data on the level of satisfaction regarding the STEPS equipment*

For the purpose of impartial collection and analysis of data on the level of satisfaction with STEPS equipment, UNBI conducted two online surveys. The first survey „[*Level of satisfaction with the new equipment purchased within the Erasmus+ STEPS project \(Scientific/Teaching/Technical staff\)*](#)“ was intended for teaching, scientific and technical staff of the Biotechnical Faculty of UNBI, while the second survey „[*Level of satisfaction with the new equipment purchased within the Erasmus+ STEPS project \(students\)*](#)“ was conducted using the MSc STEPS UNBI students as the target group.

Survey results (subsequently)

6.2 *Development of experiments/simulations and training material at University of Sarajevo (UNSA-P6)*

After the approval and establishment of the new MSc study program "Sustainable Food Production Systems" (STEPS) at the Faculty of Agriculture and Food Sciences in Sarajevo (first school/academic year 2020/2021), UNSA teaching staff began with a comprehensive approach and activities in designing and creating the necessary materials for theoretical and practical teaching of determined compulsory and elective courses/modules. In the context of fulfilling the tasks given within WP5 and defined activities (5.3. *Development of experiments / simulations and training material*), which refers to the development of experiments, simulations and materials for practical - laboratory exercises and student training, UNSA teaching staff has created and produced numerous materials for the needs of students, which consist of unauthorized exercises, scripts, manuals. In addition to the content and introductory notes, these materials contain the necessary guidelines and instructions, a description of laboratory exercises, software simulations and other forms of practical and experimental work of students.

A significant contribution to the development of quality teaching material in the form of the mentioned laboratory and other practical exercises came as a result of organized trainings based on WP2 (*D3.2 Seminars and lectures*) intended for teaching / scientific staff of HEIs partner countries, including UNSA. As planned by the project, these trainings, seminars and lectures were organized and conducted by HEIs staff from the program countries (USAMVB, ReadLab, CULS, and TEISTE/AUA). For UNSA teaching staff, trainings conducted during the Peja and Sarajevo meeting were of special importance for the creation of the mentioned materials. However, as the development of experiments / simulations and training material is about continuous and constantly open activities and later conducted online and live trainings during the project were important for updating existing (*Bihać meeting*), and preparation for creating new training material in future (*Prishtina and Tirana meetings*). Experiments / simulations and training material was designed before the beginning of the teaching process, and is completely in accordance with the required and elective subjects or their syllabi.

It is important to point out that this material was developed for those courses that have a practical part in their teaching content - syllabus, whether it is practical, computational or laboratory exercises in the field of Food Quality Control Lab or software simulations in the field of Food Production Systems Management Lab. Accordingly, for the purposes of training MSc STEPS students on UNSA experiments / simulations and training material was developed for the following compulsory (I semester) and elective courses (II and III semester):

Agricultural and Food Industry Waste Management - compulsory course of I semester. The course consists of three parts: waste management in primary agricultural production; waste management in the food industry of animal products; waste management in the food industry of plant products. For each of these three parts, exercise material was prepared as part of the learning material for each individual part of the subject. Exercise material includes: practical examples of calculation of gas emissions from agricultural production and examples of waste treatment from practice in B&H and the world (video materials, presentations and tours of farms and food plants). Based on this, students worked out their individual projects in all three parts of the course.

Advanced Food Science and Technology - compulsory course of I semester. Students are obligated to conduct Quantitative physical and chemical analysis of food products. Lab work include: gravimetric, volumetric, thermal, titration and spectrophotometric analyses, and the use of these techniques to analyze chemical substances and their reactions. Students get a lab procedure that highlights laboratory procedures for conducting the exercises. Students write an exercise report that includes recording their observations, results, and other data. After the lab work ended students had an oral colloquium exam.

Food Legislation – compulsory course of the first semester. The course is of theoretical-discussion type, without planned practical or laboratory exercises. Prepared teaching materials: Power Point presentation for teaching units distributed in 15 weeks of the semester. The Power Point presentation of each teaching unit is accompanied by a reading list, links to reference websites and portals and/or links to external video contents. Teaching materials were used on an LMS platform in the conditions of online teaching during the COVID-19 pandemic, so they can be easily transferred to the STEPS LMS platform.

Low Input Agriculture – elective course of the II semester. The training material in the form of unauthorized scripts or manuals under the title Low Input Agriculture, which accompanies the theoretical part of syllabus and its entitle is compliant with its content related to laboratory and calculation exercises. This material in addition to 10 laboratory and calculus exercises also contains chapters of the instructions, guidelines and information related to organic and integral plant and animal production.

Rural Development – elective course in II semester. The practical part of the course refers to the development of a local rural development plan for a particular area. Through 15 hours of practical work, students work on the situational analysis of the selected area, SWOT analysis, proposal of priorities and finally defining measures of local rural development of the selected area. Through various planning and programming tools, students acquire the necessary knowledge and skills in making local rural development plans.

Harvesting and Post Harvesting Technologies - elective courses in the II semester. For the practical training of students in this subject, training material was prepared in the form of the unauthorized power point presentations, which follows the theoretical part of the silaby and they are fully consistent with its content related to Practical-Laboratory and accounting exercises. In addition to 9 laboratory exercises, this material also contains chapters of instructions, guidelines and information related to harvesting, handling, packaging and storage of fruits, vegetables and field crops.

Sustainable land management and food production - elective courses in the II semester. A total of 15 hours of practical work are planned. The first part of the practical work (nine hours) is referring to pedological laboratory work. Students apply standard methods when it comes to the analysis of the physical, mechanical, and chemical properties of the soil. There is a total of seven thematic exercises. The second part of the exercise (six hours) refers to the application of the Geographic Information System (GIS). Within these exercises, students are getting familiar with GIS as a tool as well as the internationally recognized methods in land evaluation and agro-ecological zoning for purposes of agricultural production planning in relation to economic sustainability, quality of the environment, and social security. This part of practical work is developed jointly with students following their needs and interests. Exercises include creating thematic maps, performing spatial analyzes, trend analysis, etc. Students use a practicum in which standard soil analysis methods are being described. When it comes to GIS practical work, students have at disposal internal materials for exercises, as well as digital data from the faculty database. The ArcGIS Desktop software package (basic and academic license), purchased by the project, is used for exercises. For the realization of practical exercises and homework as well as analyzes for the preparation of seminar and master papers, students are provided with online access to software, which is undoubtedly a significant advantage when it comes to this part of the teaching process.

Sustainable technology in fruit and vegetable products - elective course of III semester. Since the syllabus of the course also envisages practical work with students, an unauthorized script called „Fruit and Vegetable Processing from the aspect of sustainability“ was prepared. The material describes in detail the technological lines of production of fruit and vegetable products with special emphasis on the critical points of water and energy consumption and waste generation (the pilot plant for fruit procesing). Also, the script describes 23 laboratory exercises for physico-chemical analysis of raw materials, semi-finished and finished products as well as waste generated from the processing of fruits and vegetables, which is a valuable source of bioactive components.

Sustainable Wine Production – Elective course in the third semester of the study Sustainable Food Production Systems at the University of Sarajevo – Faculty of Agriculture and Food Sciences. The subject is a combination of theoretical presentations of teachers and practical laboratory exercises related to wine quality control. Teaching units are distributed in 15 weeks of teaching. A teacher's Power Point presentation was prepared for each teaching unit. Along with the Power Point presentation of each teaching unit there is a reading list (chapters from books, articles, special thematic texts, etc.), and links to thematic portals and

websites with some teaching units. The entire teaching material was used in the implementation of online teaching in the conditions of the COVID-19 pandemic, so it can be easily transferred to the STEPS LMS platform. Laboratory equipment procured with the implementation of the STEPS project enabled the expansion of wine quality analysis through, eg detection of mycotoxins in wines using purchased equipment for *Elisa* testing or determining the chromatic properties of wine and other beverages using the purchased *spectrophotometer*. In addition to the realization of regular laboratory exercises, the purchased spectrophotometer is also used for research required for the master's thesis of a student of the first generation of STEPS study program at the University of Sarajevo. Through the planned innovation of the syllabus of the Sustainable Wine Production course, modeling of microfermentations using yeasts isolated from spontaneous populations is also envisaged. For these model fermentations, The *autoclave* purchased through the realization of the STEPS project will be of great help in the multiplication of yeasts from spontaneous populations necessary for such or similar experimental yeast fermentations.

Sustainable Technology of Dairy Products - elective course of III semester. As part of this elective course of the third semester, which includes laboratory exercises in its syllabus, practical exercises were held in the production of the most important dairy products (fermented milk, sour cream, butter, cheese) and physical and chemical analysis of these dairy products, paying special attention to sustainability. Written materials were prepared and distributed to students. Also, examples of dairies (presentations and videos) from different parts of the world are presented, where examples from practice are presented.

Sustainable Technology of Meat Products - elective course of III semester. The course in its syllabus contains laboratory exercises, prepared material in the form of an unauthorized script called Sustainable technology of meat products, which in addition to basic information about meat contains 14 laboratory exercises that give students the opportunity to easily and quickly adopt through theoretical knowledge and practical work in the laboratory basic knowledge of meat as well as methods of determining basic qualitative components.

Sustainable technology of cereal food - elective course of III semester. No exercises are planned within the module. The independent projects or seminars will be created according to the interests of students in the field of grain processing in selected industry plant and they will concern identification and classification of waste and by-products in cereal processing and recommendations of their reduction and eventually reutilization in a particular process. Projects would be carried out in a team of 3 to 5 members.

6.2.1. Progress of the tasks

In order to monitor progress according to defined indicators, we state that for the training of MSc STEPS UNSA students in the field of Food Quality Control Lab designed and written a number of scripts and unauthorized (usually PPT) materials, which included over 100 individual laboratory exercises from different areas, and a large number of chapters of instructions, guidelines and information for students. Within the Food Production Systems Management Lab, a 3x1 Year Term License was obtained for ArcGIS software (*ArcGIS DESKTOP BASIC PACKAGE*). ArcGIS Desktop (featuring ArcGIS Pro) is the foundational piece of the ArcGIS platform. GIS professionals can create, analyze, manage, and share geographic information so decision makers can make intelligent, informed decisions. It allows you to create maps, perform spatial analysis, and manage data. ArcGIS Desktop Basic provides the tools and environment for map creation and interactive visualization.

6.2.2. Collected data on the level of satisfaction regarding the STEPS equipment

For the purpose of impartial collection and analysis of satisfaction data on STEPS equipment, UNSA will conduct two online surveys. First survey „[Level of satisfaction with the new equipment purchased within the Erasmus+ STEPS project \(Scientific/Teaching/Technical staff\)](#)“ is intended for teaching, scientific and technical staff of the Faculty of Agriculture and Food Sciences of UNSA, while the second survey „[Level of satisfaction with the new equipment purchased within the Erasmus+ STEPS project \(students\)](#)“ will be conducted using the MSc STEPS UNSA students as the target group. **The results of the survey will be provided later in this report.**

7 DOCUMENTS RELATED TO THE DEVELOPMENT OF EXPERIMENTS/SIMULATIONS AND TRAINING MATERIAL IN PARTNER COUNTRIES HEIS

1. All the documents related to the development of experiments/simulations and training material at the **AUT** can be found on the following link:
2. All the documents related to the development of experiments/simulations and training material at the **EUT** can be found on the following link:
3. All the documents related to the development of experiments/simulations and training material at the **UC** can be found on the following link:
4. All the documents related to the development of experiments/simulations and training material at the **UHZ** can be found on the following link:
5. All the documents related to the development of experiments/simulations and training material at the **UNBI** can be found on the following link:
https://drive.google.com/drive/folders/19riWZ7Q81mz_8rWAMw_VQCfWYE8_NmcR?usp=sharing
6. All the documents related to the development of experiments/simulations and training material at the **UNSA** can be found on the following link:

8 CONCLUSIONS

9 RECOMMENDATIONS

10 REFERENCES

